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Version 14.1

Usability Test

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Open Dental Software

Produced by
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EHR Usability Test Report of Open Dental Software

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

Open Dental Software, version 14.1

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1 EXECUTIVE SUMMARY

A usability test for Open Dental Software, version 14.1, was conducted February 19 – 21, 2014 at Open Dental headquarters. 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, 6 dental healthcare professionals matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

This study collected performance data on tasks typically conducted on an EHR:

- Computerized Provider Order Entry (CPOE) orders
  - Recording, Accessing, and Changing CPOE Medication Orders
  - Recording, Accessing, and Changing CPOE Laboratory Orders
  - Recording, Accessing, and Changing CPOE Radiology Orders
- Drug-Drug and Drug-Allergy Interaction Checks
  - Adjusting Severity Levels
  - Encountering during CPOE
- Electronic Prescriptions: Creating
- Medication List: Recording, Accessing, and Changing
- Medication Allergy List: Recording, Accessing, and Changing
- Clinical Decision Support (CDS)
  - Configuring CDS intervention permissions by user role.
  - Setting up CDS Interventions based on a problems, medications, medication allergies, demographics, vital signs, and lab test results
  - Encountering CDS Interventions and identifying diagnostic and therapeutic reference information.
- Clinical Information Reconciliation
  - Reconcile Current Medications with another source
  - Reconcile Active Allergies with another source
  - Reconcile Active Problems with another source

During the 60 minute 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. Participants had prior experience with the EHRUT, but not with the version being tested. 20 minutes of training was provided before testing and a

simple user guide was provided for reference. These resources are similar to what a real end user would receive prior to using the software. 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 data logger timed the test and, along with the administrator, recorded user performance data on paper and electronically. The administrator did not give the participant assistance in how to complete the task.

Participant screens were recorded for subsequent analysis.

The following types of data were collected for each participant:

- Number of tasks successfully completed within the allotted time
- Time to complete the tasks
- Path deviations
- Errors
- 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. 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.

Measure / Task	N	Task Success	Path Deviations	Task Time		Task Ratings 5=Easy	Errors
	#	Mean	Deviations (Observed/ Optimal)	Mean (sec)	Deviations (Observed/ Optimal)	Mean	
CPOE 314.a.1 & Electronic Prescribing 314.b.3							
Record CPOE Medication Order / Encounter Drug Interaction Alert / Create Electronic Prescription	6	66%	1.04	151	1.4	2.8	2
Access/Change CPOE Medication Order in eRx	6	83%	1.25	31	.9	4.2	1
Record/Access/Change CPOE Laboratory Order	6	66%	1	58	.9	3.3	2
Import Lab Results/Encounter CDS Lab Intervention	6	100%	1	34	.6	3.3	
Record/Access/Change CPOE Radiology Order	6	66%	1.03	67	.9	3.8	2
Create CPOE Medication Order in Open Dental/Encounter Drug Interaction Check	6	100%	1	48	.9	4.2	
Access/Change CPOE Medication Order in Open Dental	6	83%	1	13	1	4.3	1
Drug-Drug and Drug-Allergy Interaction Checks 314.a.2							
Check/Adjust Drug Interaction Settings (eRx)	6	100%	1	26	.7	4.2	
Set up Drug Interaction Alert (Open Dental)	6	100%	1.07	66	1.4	3.5	
Check/Adjust Drug Interaction Settings (Open Dental)	6	83%	1.25	23	2.3	4	1
Medication List 314.a.6							
Record Medication in Medication List/Encounter CDS Medication Intervention	6	100%	1	19	.6	4.5	
Access/Change Medication in Medication List	6	100%	1	19	1.6	4.5	
Medication Allergy List 314.a.7							
Record Medication Allergy in Allergy List/Encounter CDS Allergy Intervention	6	100%	1	18	.8	4.7	
Access/Change Medication Allergy in Allergy List	6	100%	1	10	.7	4.5	

CDS Interventions 314.a.8							
Define CDS Intervention Permissions	5	80%	1.1	76	1.6	4	1
Setup CDS Problem Intervention	6	100%	1.1	64	1.4	3.7	
Setup CDS Medication Intervention	6	100%	1	32	1	4.2	
Setup CDS Medication Allergy Intervention	6	100%	1.2	35	1	4.3	
Setup CDS Age/Vital Signs Intervention	6	100%	1.1	47	.9	4.3	
Setup CDS Lab Results Intervention	6	100%	1.1	70	1.5	3.5	
Encounter CDS Demographic Intervention	6	100%	1	22	.6	5	
Encounter CDS Problem Intervention//Identify Diagnostic/Therapeutic References	6	100%	1	15	1.2	4.7	
Encounter Vital Signs Intervention/Identify Diagnostic/Therapeutic References	6	100%	1	18	.4	4.7	
Clinical Information Reconciliation 314.b.4							
Reconcile Patient's Active Medication List with Another Source	6	100%	1	24	.9	3.8	
Reconcile Patient's Active Problem List with Another Source	6	100%	1	15	1.25	4.3	
Reconcile Patient's Active Medication List with Another Source	6	83%	1	13	1.1	4.3	1

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be: 75.

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

- Major findings
  - Overall users found the system easy to use and quick to learn. As they became more familiar with the patterns of the system, their confidence increased and they worked more efficiently and effectively. Users commented

that information was displayed well and the point and click aspect simplified data entry and reduced user-error.

  - Several features were new to users in concept and/or functionality. These include Clinical Decision Support Interventions, CPOE Radiology and Laboratory Orders and Results, Drug-Drug and Drug-Allergy Interaction Checks, and Electronic Prescribing. Lack of confidence with information increased task times and path deviations. As one user verbalized, “The system was easy to use, but understanding the information was complex.”
  - Users expressed that they liked the CDS interventions encountered while entering patient data. They liked the drug-drug and drug-allergy interaction alerts that popped up when entering CPOE medication orders. They commented that these features were timely, relevant, informative, and useful.
  - Electronic Prescriptions and CPOE Medication Orders in eRx/NewCrop were unfamiliar to most users. The amount of data and options, coupled with unfamiliar terminology, led to some confusion of “where to click next.”

- Areas for improvement
  - Minor field and button label enhancements may increase usability.
  - As users became familiar with the system and content, their efficiency and satisfaction increased. Thus, training and documentation of the system should clearly and comprehensively address areas that are less familiar to dental providers. These areas specifically include Clinical Decision Support configuration and purpose and how to use the eRx/New Crop interface.

2 INTRODUCTION

The EHRUT tested for this study was Open Dental version 14.1. Designed for professionals in the dental healthcare industry (providers, dental assistants, office staff) the EHRUT is used to record

patient health information and dental treatment. 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 time on task, optimal path deviations, and participant task rating, were captured during the usability testing.

3 METHOD

3.1 PARTICIPANTS

A total of 6 participants were tested on the EHRUT(s). Participants in the test were professionals with dental and clinical experience. Participants were recruited by Arna Meyer and Ann Andrews and were not compensated for their time. In addition, participants had no direct connection to the development of the EHRUT(s). Participants were given the opportunity to have the same orientation and level of training as actual end users would receive.

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, professional experience, and computing experience. Participant names were replaced with Participant IDs so that an individual's data cannot be tied back to individual identities.

Part ID	Gender	Age	Occupational Role/ Professional Experience	Exp (Years)	Computer Experience
1	M	31-50	Dental EHR Specialist and Coordinator	1	high
2	M	18-30	Dental Office Manager, Front Desk	8+	high
3	F	31-50	Dental Assistant	13.5	high
4	F	31-50	Dental Administrative Staff	20+	high
5	F	31-50	Office Manager in medical industry	7	high
6	M	18-30	Clinical and dental practice mgmt software	2	high

6 participants were recruited and 6 participated in the usability test. 0 participants failed to show for the study.

Participants were scheduled for 60 minute sessions with 1 hour in between each session for debrief by the administrator(s) and data logger(s), and to reset systems to proper test conditions. A spreadsheet was used to keep track of the participant schedule, and included each participant's demographic characteristics as provided by the recruiting team.

3.2 STUDY DESIGN

Overall, the objective of this test was to uncover areas where the application performed well – that is, effectively, efficiently, and with satisfaction – and areas where the application failed to meet the needs of the participants. The data from this test may serve as a baseline for future tests with an updated version of the same EHR and/or comparison with other EHRs provided the same tasks are used. In short, this testing serves as both a means to record or benchmark current usability, but also to identify areas where improvements must be made.

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

- Number of tasks successfully completed without assistance
- Time to complete the tasks
- Path deviations
- Errors
- 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.

3.3 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. The 26 tasks mimicked a typical workflow for different user roles:

Administrative tasks:

1. Define Clinical Decision Support (CDS) intervention permissions.
2. Set up a CDS Intervention based on a problem.
3. Set up a CDS Intervention based on a medication
4. Set up a CDS Intervention based on a medication allergy
5. Set up a CDS Intervention based on age and vital signs (demographics).
6. Set up a CDS Intervention based on a lab results.
7. Check/Adjust Drug Interaction Settings in Electronic Prescriptions
8. Set Up Drug Interaction Alerts for Paper Prescription
9. Check/Adjust Drug Interaction Settings for Paper Prescriptions

Dental Assistant Tasks:

10. Enter Patient Demographics/Encounter CDS Intervention
11. Enter Current Medications/Encounter CDS Intervention
12. Enter Medication Allergies/Encounter CDS Intervention
13. Enter Problems/Encounter CDS Interventions

Dentist Tasks:

14. Create a CPOE Medication Order/Encounter Drug Interaction Alerts / Transmit Electronic Rx
15. Create/Access/Change CPOE Laboratory Order
16. Create/Access/Change a CPOE Order for Radiology Images
17. Access/Change a CPOE Medication Order
18. Create a CPOE Medication Order (Open Dental) /Encounter Drug Interaction Alerts/Write a Prescription
19. Access/Change the CPOE Medication Order (Open Dental)

Dental Assistant Tasks:

20. Enter Patient Vital Signs/Encounter CDS Intervention
21. Access/Change Medication List
22. Access/Change Allergy List
23. Import a Summary of Care and Reconcile Current Medications
24. Reconcile Active Allergies
25. Reconcile Active Problems/ Encounter CDS Intervention
26. Import Lab Results/Encounter CDS Intervention

Tasks were selected based on their frequency of use, criticality of function, and those that may be

most troublesome for users.

3.4 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. Both were experienced usability practitioners.

The administrator moderated the session including administering instructions and tasks. The administrator obtained post-task rating data and took notes on participant comments. A second person served as the data logger and monitored task times, took notes on task success, path deviations, number and type of errors, and comments.

Participants were instructed to perform the tasks:

- As quickly as possible making as few errors and deviations as possible.
- Without assistance; administrators were allowed to give immaterial guidance and clarification on tasks, but not instructions on use.
- Without using a think aloud technique.

For each task, the participants were given a written copy of the task. Task timing began once the administrator finished reading the question. The task time was stopped once the participant indicated they had successfully completed the task. Scoring is discussed below in Section 3.9.

Following the session, the administrator gave the participant the post-test questionnaire (System Usability Scale, see Appendix 5) and thanked each individual for their participation.

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

3.5 TEST LOCATION

The test facility included a waiting area and a quiet testing room with a table and a computer for the

participant. Only the participant and administrator were in the test room. The data logger worked from a separate location where she could see the participant's screen and face shot, and listen to the audio of the session. To ensure that the environment was comfortable for users, noise levels were kept to a minimum with the ambient temperature within a normal range. All of the safety instruction and evacuation procedures were valid, in place, and visible to the participants.

3.6 TEST ENVIRONMENT

The EHRUT would be typically be used in a dental practice. In this instance, the testing was conducted in a conference room at Open Dental headquarters. For testing, the computer used was Dell Optiplex 7010 running Windows 7 Professional. The participants used a mouse and keyboard when interacting with the EHRUT.

The EHRUT used a 27 inch monitor with 1920 x 1080 resolution. The application was set up by the Open Dental's IT Administrator according to the vendor's documentation describing the system set-up and preparation. The application itself was running on a Windows platform using a test database. Technically, the system performance 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.

3.7 TEST FORMS AND TOOLS

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

- Informed Consent
- Non-Disclosure Agreement
- Moderator's Guide
- Post-test Questionnaire

Examples of these documents can be found in Appendices 3-5 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 Go To Meeting on the test machine. A web camera captured each participant's facial expressions synced with the screen capture, and verbal comments were recorded with a microphone. The test sessions

were electronically transmitted to a nearby observation location where the data logger observed the test session.

3.8 PARTICIPANT INSTRUCTIONS

The administrator read the following instructions aloud to the each participant (also see the full Moderator's Guide in Appendix 4).

Thank you for participating in this study. Our session today will last 60 minutes. During that time you will take a look at an electronic health record system.

The product you will be using today is Open Dental version 14.1, and it is in its final stages of development. Some of the data may not make sense as it is placeholder data.

I will ask you to complete a few tasks using this system and answer some questions. You should complete the tasks as quickly as possible making as few errors as possible. Please try to complete the tasks on your own following the instructions very closely. Please note that we are not testing you; we are testing the system. 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. 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. 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 (1 minute) 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 for your impressions about the task once you are done.

Participants were then given 26 tasks that mimicked a typical workflow. Tasks are listed in the

Moderator's Guide in Appendix 4.

3.9 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:

- Effectiveness of Open Dental by measuring participant success rates and errors
- Efficiency of Open Dental by measuring the average task time and path deviations
- Satisfaction with Open Dental by measuring ease of use ratings

3.9.1 DATA SCORING

The following table (Table 1) details how tasks were scored, errors evaluated, and the time data analyzed.

Measures	Rationale and Scoring
Effectiveness: Task Success	A task was counted as a "Success" if the participant was able to achieve the correct outcome, without assistance, within the time allotted on a per task basis. The total number of successes were calculated for each task and then divided by the total number of times that task was attempted. The results are provided as a percentage. Task times were recorded for successes. Observed task times divided by the optimal time for each task is a measure of optimal efficiency. Optimal task performance time, as benchmarked by expert performance under realistic conditions, was recorded when constructing tasks. Target task times used for task times in the Moderator's Guide were operationally defined by taking multiple measures of optimal performance and multiplying by 1.25.
Effectiveness: Task Failures	If the participant abandoned the task, did not reach the correct answer or performed it incorrectly, the task was counted as a "Failure." No task times were taken for errors.
Efficiency: Task Deviations	The participant's path (i.e., steps) through the application was recorded. Deviations were counted when participant 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.
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.
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 EHRUT 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 1: Details of how observed data were scored

4 RESULTS

4.1 DATA ANALYSIS AND REPORTING

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above. Participants who failed to follow session and task instructions had their data excluded from the analyses. In task 1 (Define CDS Intervention Permissions), one participant failed to follow instructions, so that participant's data is excluded from task 1 metrics only.

The usability testing results for the EHRUT are detailed below (see Table 2). The results should be seen in light of the objectives and goals outlined in Section 3.2 Study Design.

Measure / Task	N	Task Success	Path Deviations	Task Time		Task Ratings 5=Easy	Errors
	#	Mean	Deviations (Observed/ Optimal)	Mean (sec)	Deviations (Observed/ Optimal)	Mean	
CPOE 314.a.1 & Electronic Prescribing 314.b.3							
Record CPOE Medication Order / Encounter Drug Interaction Alert / Create Electronic Prescription	6	66%	1.04	151	1.4	2.8	2
Access/Change CPOE Medication Order in eRx	6	83%	1.25	31	.9	4.2	1
Record/Access/Change CPOE Laboratory Order	6	66%	1	58	.9	3.3	2
Import Lab Results/Encounter CDS Lab Intervention	6	100%	1	34	.6	3.3	
Record/Access/Change CPOE Radiology Order	6	66%	1.03	67	.9	3.8	2
Create CPOE Medication Order in Open Dental/Encounter Drug Interaction Check	6	100%	1	48	.9	4.2	
Access/Change CPOE Medication Order in Open Dental	6	83%	1	13	1	4.3	1
Drug-Drug and Drug-Allergy Interaction Checks 314.a.2							
Check/Adjust Drug Interaction Settings (eRx)	6	100%	1	26	.7	4.2	
Set up Drug Interaction Alert (Open Dental)	6	100%	1.07	66	1.4	3.5	

Check/Adjust Drug Interaction Settings (Open Dental)	6	83%	1.25	23	2.3	4	1
Medication List 314.a.6							
Record Medication in Medication List/Encounter CDS Medication Intervention	6	100%	1	19	.6	4.5	
Access/Change Medication in Medication List	6	100%	1	19	1.6	4.5	
Medication Allergy List 314.a.7							
Record Medication Allergy in Allergy List/Encounter CDS Allergy Intervention	6	100%	1	18	.8	4.7	
Access/Change Medication Allergy in Allergy List	6	100%	1	10	.7	4.5	
CDS Interventions 314.a.8							
Define CDS Intervention Permissions	5	80%	1.1	76	1.6	4	1
Setup CDS Problem Intervention	6	100%	1.1	64	1.4	3.7	
Setup CDS Medication Intervention	6	100%	1	32	1	4.2	
Setup CDS Medication Allergy Intervention	6	100%	1.2	35	1	4.3	
Setup CDS Age/Vital Signs Intervention	6	100%	1.1	47	.9	4.3	
Setup CDS Lab Results Intervention	6	100%	1.1	70	1.5	3.5	
Encounter CDS Demographic Intervention	6	100%	1	22	.6	5	
Encounter CDS Problem Intervention//Identify Diagnostic/Therapeutic References	6	100%	1	15	1.2	4.7	
Encounter Vital Signs Intervention/Identify Diagnostic/Therapeutic References	6	100%	1	18	.4	4.7	
Clinical Information Reconciliation 314.b.4							
Reconcile Patient's Active Medication List with Another Source	6	100%	1	24	.9	3.8	
Reconcile Patient's Active Problem List with Another Source	6	100%	1	15	1.25	4.3	
Reconcile Patient's Active Medication List with Another Source	6	83%	1	13	1.1	4.3	1

The results from the SUS (System Usability Scale, Appendix 5) scored the subjective satisfaction with the system based on performance with these tasks to be: 75. Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

4.2 DISCUSSION OF THE FINDINGS

The sections below discuss the usability test results for each criteria.

4.2.1 Risk Analysis of Use

Each criteria was analyzed for serious use errors and issues. A risk score was assigned to errors to evaluate likelihood and severity level of consequence. To determine the score, the following equation was used: Likelihood x Severity = Risk.

Likelihood	**Severity:**
5 = very likely	10 = affects patient safety
3 = possible	3 = affects workflow or reporting calculations
1 = unlikely	1 = cosmetic

Risk Score
High: 30 - 50 Moderate: 10 - 29 Low: 0 - 9

High risk errors have a higher likelihood of occurring and affect patient safety, such as accidentally ordering or prescribing a medication that a patient is allergic to or that interacts negatively with a current medication. While two participants failed a high risk task (task 14 - Recording CPOE Medication Order/Creating Electronic Prescription), it was because they did not complete it. They were unable to determine how to delete the medication orders that indicated a severe drug-allergy interaction. The system clearly alerted the users at the time of CPOE and requested additional action. However, the interface did not intuitively guide users to the next steps. A high risk error also occurred when a user selected the wrong medication frequency while editing an order; they could not determine how to select the correct frequency. This was a data entry error, though increased education about how to use the system will reduce error likelihood.

Moderate risk errors occurred in CPOE Radiology Orders and CPOE Laboratory Orders when users

entered dates in the wrong field or failed to flag an order as radiology, thus affecting measure calculations and CQM reporting. An error while Configuring CDS Permissions (task 1) caused CDS interventions to not show for certain users. An error while Adjusting Severity Levels of Drug Interaction Alerts caused only high significance alerts to show instead of all alerts. An error occurred when a user clicked the wrong button (cancel instead of close), thus not saving the reconciliation and affecting measure calculations.

4.2.2 Computerized Provider Order Entry (CPOE) & Electronic Prescriptions

Users were tasked with creating, accessing, and changing CPOE medication, laboratory and radiology orders. For CPOE medication orders, drug-drug and drug-allergy interactions were encountered and acted upon. Users were tested using both eRx/NewCrop and Open Dental. When using eRx/NewCrop, users also transmitted the prescriptions electronically.

Related Tasks
Task 14: Create a CPOE Med Order/ Drug Interaction Check/Transmit Electronic Prescriptions
Task 15: Access/Edit a CPOE Medication Order in eRx
Task 16: Create/Access/Edit a CPOE Laboratory Order
Task 17: Create/Access/Edit a CPOE Radiology Order
Task 18: Create a CPOE Med Order/Drug Interaction Check/Write an Rx in Open Dental
Task 19: Access/Change the CPOE Medication Order

EFFECTIVENESS

CPOE Medication Orders & Electronic Prescriptions (eRx/NewCrop): Based on task success and path deviation data, the majority of users succeeded in creating, accessing, and editing CPOE medication orders in eRx/NewCrop, and in electronically transmitting the resulting prescription.

All users encountered drug interaction alerts when trying to enter CPOE orders. 4 users correctly interpreted the alert, canceled and deleted the medication order, and electronically prescribed a safe medication. Two users could not determine how to remove the unsafe medication, and abandoned the task. Users who did successfully create orders and transmit prescriptions did not always follow optimal paths.

One user failed “Editing a CPOE Medication Order” by selecting an incorrect frequency. User was unable to find the correct value because it was hidden higher in the scroll bar. Another user attempted to edit a prescription instead of a CPOE medication order, though eventually completed

the task successfully.

CPOE Medication Orders (Open Dental): Based on the task success and path deviation data, the majority of users succeeded in creating, accessing, and editing CPOE medication orders in Open Dental, and in identifying and acting on Open Dental drug interaction alerts. There were minimal path deviations. One user edited a completed prescription instead of a CPOE medication order, thus failing the task.

CPOE Laboratory Orders: Based on the task success and path deviation data, the majority of users succeeded in creating, editing, and accessing CPOE laboratory orders using optimal paths. Two users entered date information in the wrong field.

CPOE Radiology Orders: Based on the task success and path deviation data, the majority of users succeeded in creating, editing, and accessing CPOE radiology orders using optimal paths. Two users entered date information in the wrong field. One user did not flag the order as an image order, thus failing the task.

EFFICIENCY

CPOE Medication Orders & Electronic Prescriptions (eRx): Based on task time and deviation data, users did not use eRx/NewCrop as efficiently as we would have liked. They spent extra time navigating the interface, not knowing where to click next. While users carefully read drug interaction alerts they encountered, they did not immediately identify them as “severe” and reviewed the text several times before proceeding. The need to close the alert, cancel the medication order, then delete the medication order caused confusion and took extra time.

CPOE Medication Orders (Open Dental): Based on the observations of the task time and deviation data, users efficiently created, accessed, and edited CPOE medication orders in Open Dental.

CPOE Laboratory Orders: Based on the observations of the task time and deviation data, users efficiently created, accessed, and edited CPOE laboratory orders.

CPOE Radiology Orders: Based on the observations of the task time and deviation data, users

efficiently created, accessed, and edited CPOE radiology orders.

SATISFACTION

CPOE Medication Orders & Electronic Prescriptions (eRx): Based on task ratings, users rated "Creating Medication Orders and Transmitting Prescriptions" as average (2.8). *Changing/Accessing Medication Orders* was rated as easy (4.2). Users commented that buttons were "hard to find" and that they would need a couple of tries to get accustomed to the eRx/NewCrop interface.

CPOE Medication Orders (Open Dental): Based on task ratings, users found it easy to create, access, and edit CPOE medication orders in Open Dental (4.25).

CPOE Laboratory Orders: Users rated this task as average (3.8).

CPOE Radiology Orders: Users rated this task as average (3.8).

MAJOR FINDINGS

CPOE Medication Orders & Electronic Prescriptions (eRx): The eRx/NewCrop interface and CPOE terminology was new to all users. The users who failed to complete the task could not determine how to remove the medication order, but did identify that the medication order should be deleted and not prescribed. Users who completed the task successfully felt there were too many steps required to remove a medication after an interaction alert (close, cancel, and then delete), and that these steps were not intuitive. When selecting a medication frequency (e.g. 1 tablet) the need to scroll up/down to locate the correct value was not intuitive.

User comments regarding eRx:

- "There is a lot to look at; it is hard to find what is missing."
- "Hard to find some buttons and where to click next."
- "Hard to tell what is an 'order' and what is a 'prescription.'"
- "Scrollbar for frequency is confusing."

CPOE Medication Orders (Open Dental): The interaction alerts were clear and prompted the user to cancel the entire order when encountered. The user's unfamiliarity with CPOE medication orders versus prescriptions caused minor confusion.

CPOE Laboratory Orders: This feature was completely new to users. The data was unfamiliar to most since medical laboratory orders are usually not within the scope of a dental practice. There were many unfamiliar information fields, in addition to LOINC codes, which users had not previously encountered. The required date format was unusual. Because there were multiple date fields in the window, there were minor errors when entering the order date.

CPOE Radiology Orders: Similar to laboratory orders, this feature was completely new to users, and the data unfamiliar since medical radiology orders are usually not within the scope of a dental practice. However, since the process of creating/accessing/editing was similar to CPOE Laboratory Orders, users followed established patterns and more efficiently completed this task. Multiple date fields still caused some confusion. If a user entered the date in the wrong field for laboratory orders, they followed the same pattern and did the same for the radiology orders.

AREAS FOR IMPROVEMENT

CPOE Medication Orders & Electronic Prescriptions (eRx): To increase efficiency, Open Dental's documentation of eRx/NewCrop needs to clearly instruct and train providers on how to create a CPOE medication order, how to remove medication orders that trigger interactions, and how to successfully transmit the prescription. Education about terminology is also important. CPOE medication order versus prescription is confusing for dental providers, often because they are mistaken as the same.

CPOE Medication Orders (Open Dental): The single error was due to unfamiliarity with CPOE medication orders versus prescriptions. We feel this can be avoided with accurate documentation and training.

CPOE Radiology Orders: The errors were minor and due to unfamiliarity with radiology orders in general. We feel these can be avoided with accurate documentation and training.

CPOE Laboratory Orders: The errors were minor and due to unfamiliarity with radiology orders in general. We feel these can be avoided with accurate documentation and training.

4.2.3 Drug-Drug and Drug-Allergy Interaction Alerts

Users were tasked with adjusting severity levels of drug interaction alerts in eRx/NewCrop and Open Dental so that all interactions, regardless of severity, would show. They also set up alerts for drug-drug and drug-allergy interactions in Open Dental prior to CPOE. Alerts in eRx/NewCrop are pre-set so users did not need to create them. When creating CPOE medication orders, users were asked to not order or prescribe any medication that triggered a drug-drug or drug-allergy interaction alert.

Related Tasks
Task 7: Check/Adjust Drug Interaction Settings in Open Dental
Task 8: Check/Adjust Drug Interaction Settings in Electronic Prescriptions
Task 9: Set Up a Drug Interaction Alert in Open Dental
Task 14: Create a CPOE Med Order/ Drug Interaction Check/Transmit Electronic
Task 18: Create a CPOE Med Order/Drug Interaction Check/Write an Rx

EFFECTIVENESS

Based on the task success and path deviation data, most users successfully adjusted the severity levels of drug-drug and drug-allergy interactions in both eRx/NewCrop and Open Dental with minimal path deviation. In eRx/NewCrop, there was confusion for two users on how to save their settings because there were two save buttons (Save Prescriber and Save Account Settings). In Open Dental, one user misread the checkbox label and thus failed the task by selecting the incorrect option.

All users effectively and successfully set up alerts for drug-drug and drug-allergy interactions in Open Dental with minimal path deviation.

When creating a CPOE medication order, all users encountered and identified drug interaction alerts, both severe and less severe. Most users cancelled and/or deleted the order before proceeding. Two users acknowledged the alert, read it, but then were unable to determine how to cancel and remove the medication, thus failing the task.

EFFICIENCY

Based on task time and deviation data, users efficiently changed severity levels and set up alerts. Most users took the time to read the checkbox setting to ensure their selection was accurate.

When setting up drug-drug and drug-allergy interaction alerts in Open Dental, users quickly located and selected medications and allergies to trigger alerts. One user had trouble locating the checkbox for setting the interaction alert level, thus increasing task time.

Users took their time reviewing drug interactions they encountered. They did not immediately identify the alert's severity level, but rather took time to read and understand all text on the alerts before determining their next step. After receiving the alert in eRx/NewCrop, some users took less than optimal time and paths to cancel and delete the order. In Open Dental, users were quicker to identify and understand the alert text and act on it.

SATISFACTION

Based on the task ratings, most users expressed satisfaction. Users rated setting severity levels in eRx/NewCrop and Open Dental as "easy". Users rated setting up alerts in Open Dental as "average/easy" (3.5). Encountering drug interactions was part of CPOE Medication Orders and Electronic Prescribing, thus users did not individually rate the drug interactions. However, several users commented that they would prefer clearer language or stronger indication of contraindicated/severe interactions.

MAJOR FINDINGS

In both eRx/NewCrop and Open Dental, users found the wording of severity setting checkboxes confusing.

When setting up alerts in Open Dental, it was not intuitive to double click a medication or allergy to set it as "is high significance".

AREAS FOR IMPROVEMENT

Based on this feedback, we realize some errors were due to unfamiliarity with the eRx/NewCrop interface. Our training program and documentation will take this into consideration so that instructions and guidance are clear and comprehensive.

4.2.4 Medication List

Users were tasked with adding current medications to a patient's medication list, accessing the medication list (including discontinued medications), and changing medications in the list.

Related Tasks
Task 11: Enter Current Medications / CDS Medication Intervention
Task 21: Access/Change Medication List

EFFECTIVENESS

Based on the task success and path deviation data, all users successfully recorded, accessed, and changed medications in the Medication List using optimal paths.

EFFICIENCY

Based on task time and deviation data, all users efficiently recorded, accessed, and changed medications in the Medication List.

SATISFACTION

Based on the task ratings, all users expressed satisfaction by rating the tasks easy to very easy (4.5).

MAJOR FINDINGS

These tasks were familiar to most users since they were similar to steps required for Stage 1 Meaningful Use criteria in previous editions of Open Dental.

AREAS FOR IMPROVEMENT

One user noticed that while the medication list indicates an option to "Show Discontinued Medications," the medication itself is listed as "inactive". There is no other feedback for areas of improvement.

4.2.5 Medication Allergy List

Users were tasked with adding current medication allergies to a patient's Medication Allergy list, accessing the Medication Allergy list (including inactive allergies), and changing medication allergies in the list.

Related Tasks
Task 12: Enter Medication Allergy / CDS Allergy Intervention
Task 22: Access / Change Medication Allergy List

EFFECTIVENESS

Based on the task success and path deviation data, all users successfully recorded, accessed, and changed medications in the Medication Allergy List while following optimal paths.

EFFICIENCY

Based on task time and deviation data, all users efficiently recorded, accessed, and changed medications in the Medication Allergy List.

SATISFACTION

Based on the task ratings, users expressed satisfaction by rating the tasks easy to very easy (4.6).

MAJOR FINDINGS

These tasks were familiar to most users since they were similar to steps required for Stage 1 Meaningful Use criteria in previous editions of Open Dental.

AREAS FOR IMPROVEMENT

There is no other feedback for areas of improvement.

4.2.6 Clinical Decision Support (CDS)

Users were tasked with configuring CDS permissions and setting up CDS interventions based on problems, medications, medication allergies, vital signs, age/gender, and lab results. They also encountered CDS interventions, and diagnostic and therapeutic data, as they entered patient data in the EHRUT.

Related Tasks
Task 1: Define CDS intervention permissions
Task 2: Setup a CDS intervention based on a Problem
Task 3: Set up a CDS intervention based on a Medication
Task 4: Set up a CDS intervention based on a Medication Allergy
Task 5: Set up a CDS intervention based on Age and Vital Signs (COMBO)
Task 6: Set up a CDS intervention based on a Lab Test/Results
Task 10: Enter Demographics / CDS Demographic Intervention
Task 11: Enter Current Medications / CDS Medication Intervention

Task 12: Enter Medication Allergy / CDS Allergy Intervention
Task 13: Enter Patient Problems / CDS Problem Intervention
Task 20: Enter Vital Signs / CDS Vital Signs/Age Intervention
Task 26: Import CPOE Lab Results / CDS Lab Results Intervention

EFFECTIVENESS

Based on the task success and path deviation data, users completed these tasks effectively and found them relatively easy. Most users configured CDS permissions successfully with minimal path deviation. The one task failure was a caused by a combination of 1) not following task instructions, and 2) not noticing that some permissions were only visible by scrolling. There was minor confusion on which permissions to enable and the meaning of each.

All users successfully set up CDS interventions based on problems, medications, medication allergies, vital signs, age/gender, and lab results. Path deviation occurred when user was unfamiliar with terminology (e.g. didn't realize LOINC code pertains to Lab Results) or didn't immediately locate the correct button. One user added an incorrect "condition" by mistake and was unable to delete or edit the condition without deleting the entire intervention. This added additional paths.

All users successfully encountered CDS interventions and accessed diagnostic and therapeutic information.

EFFICIENCY

Based on task time and deviation data, users efficiently completed the tasks. Time per task when setting up CDS interventions decreased as users became familiar with the interface. Configuring CDS permissions by user role took longer because users lost their place among the rows and columns of the grid or didn't immediately realize they needed to horizontally scroll to see all permission options.

SATISFACTION

Based on the task ratings, users expressed satisfaction with CDS features. The lowest rating was given to CDS Lab Result interventions (3.5), although this may be due to unfamiliarity with medical labs since they are typically not within the scope of a dental practice. This CDS intervention also required more data selection.

MAJOR FINDINGS

The CDS feature is a new feature for Open Dental users. Three users commented that it was an aspect of the system they liked the most. They liked the interventions that occurred when entering patient data and the availability of diagnostic and therapeutic information. Configuring CDS permissions and interventions was unfamiliar but easy to learn.

AREAS FOR IMPROVEMENT

Users verbally mentioned the following as improvements they would like to see when configuring CDS permissions for user role:

- An option to “enable all” permissions for a user at once.
- Able to see/highlight which user they are currently configuring permissions for. The default window size did not display all permissions, and users did not realize the window could be resized by dragging. Thus, when scrolling, they had trouble tracking which row to click in and would “lose” their place.

Based on this feedback, we will discuss and consider updates. Additionally, we will ensure our documentation clearly instructs users on what CDS Permission allows and how to resize a window.

4.2.7 Clinical Information Reconciliation

Users were tasked with reconciling a patient’s current medications, allergies, and problems with a summary of care document (CCD) received and imported from another provider.

Related Tasks
Task 23: Reconcile Active Medications
Task 24: Reconcile Active Allergies
Task 25: Reconcile Active Problems / Encounter CDS Intervention

EFFECTIVENESS

Based on the task success and path deviation data, most users successfully reconciled all clinical information with minimal deviations. One user clicked Cancel instead of OK, thus canceling the reconciliation instead of saving.

EFFICIENCY

Based on the observations of the task time and deviation data, users efficiently reconciled clinical information. Some users took time comparing the actual summary of care document to current information instead of relying on the reconciliation tool, thus increasing task time.

SATISFACTION

Based on the task ratings, users expressed satisfaction by rating the tasks easy (4.1). Ratings increased as users became familiar with the steps of reconciling.

MAJOR FINDINGS

Clinical reconciliation is a relatively new feature for users. Some users had trouble identifying and locating the “reconciliation” buttons at the bottom of the summary of care window (labeled simply Medications, Allergies, and Problems). Others spent time comparing medications, allergies, and problems in the imported CCD before launching the tool, not knowing the reconciliation tool would automate the process.

AREAS FOR IMPROVEMENT

Based on these findings, we will discuss and consider updates. We will also provide clear training and instruction on the clinical reconciliation tool.

APPENDICES

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

1. Recruitment Screener
2. Participant demographics
3. Non-Disclosure Agreement (NDA) and Informed Consent Form
4. Moderator's Guide
5. System Usability Scale Questionnaire

APPENDIX 1: RECRUITMENT SCREENER

Hello, my name is _____from Open Dental Software. We are recruiting professionals with dental experience to participate in a usability study for dental electronic health record software. May I ask you a few questions to see if you qualify and would like to participate?

1. Are you male or female? ☐ Male ☐ Female
2. Which of the following best describes your age?
   ☐ 18 to 30 ☐ 31 to 50 ☐ 51 to 65 ☐ 65 +
3. Which of the following best describes your race or ethnic group?
   ☐ Caucasian ☐ Asian ☐ Latino/Hispanic ☐ Black/African American ☐ Other

Professional Demographics

4. Have you worked in the dental industry? If yes, in what capacity?
   - ☐ Dentist: Specialty _____
   - ☐ Hygienist: Specialty _____
   - ☐ Dental Assistant: Specialty _____
   - ☐ Dental Administrative Staff _____
   - ☐ Other _____
5. How many years of experience do you have in this occupation? _____

Computer Experience

6. About how many hours per week do you spend on the computer? ☐0 to 10 ☐11 to 25 ☐25+
7. How many years of experience do you have with EHR software? _____
8. What EHR software do you have experience with? _____
9. In the last month, how often have you used EHR software? _____
10. How does your work environment handle patient records?
    ☐ On paper ☐ Some paper, some electronic ☐ All electronic

Contact Information

Those are all the questions I have for you. Your experience matches the people we're looking for.

The test will occur February 19 - 21, 2014 and will require approximately 1 hour of your time.
Are you available? ☐ Yes ☐ No

What times are you available (PST)? ☐ 8am – 12 noon ☐1pm – 5 pm

Before your session starts, we will ask you to sign a release form allowing us to record your session. The recording will only be used internally for further study if needed. Will you consent to be recorded? ☐ Yes ☐ No

- Name of participant:
- Email address:

APPENDIX 2: PARTICIPANT DEMOGRAPHICS

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

Gender	Participants
Men	3
Women	3

Occupation/Role/Professional		Yrs Experience
Dental Admin Staff	1	20
Dental Office Manager/Front Desk	1	10
Medical Office Manager	1	7
Dental Assistant	1	13
Dental EHR Specialist	1	1
Medical/Dental Software Support	1	2.5

Age	
18 – 30	2
31 – 50	4

Experience	
Facility Use of EHR	
Some paper/some electronic	3
All electronic	3
Computer Experience	
30+ hrs per week	6
EHR Experience in Years	
0 – 5 yrs	2
6 – 10 yrs	2
11 - 15 yrs	1
16 – 20 yrs	1
Product Experience	
Dentrix	3
Eaglesoft	1
QSI	1
CPS	1
IPS	1
NextGen	1
Open Dental	6
Greenway Medical	1
First Pacific Corp	1
Easy Dental	1

APPENDIX 3: NON-DISCLOSURE AGREEMENT AND INFORMED CONSENT FORM

Non-Disclosure Agreement

THIS AGREEMENT is entered into as of ___March 3, 2014_____, between _____ (“the Participant”) and Open Dental Software (“the Testing Organization”) located at Suite 110, 3995 Fairview Industrial Dr. SE, Salem, OR 97302-1288.

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 Open Dental Software, 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 Open Dental Software and is being disclosed solely for the purposes of the Participant’s participation in today’s usability study. By signing this form the Participant agrees to not disclose this confidential information obtained today to anyone else or any other organizations.

Participant’s printed name: _____

Signature: _____ Date: _____

Informed Consent

Open Dental Software would like to thank you for participating in this study. The purpose of this study is to evaluate an electronic health records system. You will be asked to perform several tasks using the prototype and give your feedback. The study will last about 60 minutes.

Agreement

I understand and agree that as a voluntary participant in the present study conducted by Open Dental Software, I am free to withdraw consent or discontinue participation at any time. I understand and agree to participate in the study conducted and recorded by Open Dental Software.

I understand and consent to the use and release of the recording by Open Dental Software. I understand that the information and recording 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 recording and understand the recording may be copied and used by Open Dental Software 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 outside of Open Dental Software. 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

Moderator's Guide

Administrator _____

Data Logger _____

Date _____ Time _____

Participant # _____

Location: Open Dental Software
Suite 110
3995 Fairview Industrial Dr. SE
Salem, OR 97302-1288

Prior to testing

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

Prior to each participant:

- ☐ Reset application
- ☐ Start session recordings with tool

Prior to each task:

- ☐ Reset application to starting point for next task

After each participant:

- ☐ End session recordings with tool

After all testing

- ☐ Back up all video and data files

Orientation (2 minutes)

Thank you for participating in this study. Our session today will last 60 minutes. During that time you will take a look at an electronic health record system.

The product you will be using today is Open Dental version 14.1. It is in its final stages of development. Some of the data may not make sense as it is placeholder data.

We will be testing 7 features that have been identified as high risk in regards to patient safety.

- Computerized Provider Order Entry of Medication, Laboratory, and Radiology Orders
- Drug-drug and drug-allergy interaction checks
- Medication List
- Medication Allergy List
- Clinical Decision Support
- Electronic Prescribing
- Clinical Information Reconciliation

I will ask you to complete a few tasks using this system and answer some questions. You should complete the tasks as quickly as possible making as few errors as possible. Please try to complete the tasks on your own following the instructions very closely. Please note that we are not testing you; we are testing the system. 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. Please be honest with your opinions. 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. Should you feel it necessary you are able to withdraw at any time during the testing.

Do you have any questions or concerns?

Preliminary Questions (2 minutes)

Have you worked in the dental or medical industry? ☐ Yes ☐ No

If Yes, what was your role?

How long have you worked in this role?

What were/are some of your main responsibilities?

Tell me about your experience with electronic health records. (e.g. What have you used it for?)

First Impressions (1 minute)

This is the application version you will be working with. Please don't click on anything just yet.

What do you notice? What are you able to do here? Please be specific.

Notes / Comments:

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 for your impressions about the task once you are done.

Scenario A: Setup CDS, Drug Alerts, Drug Interaction severity levels (Admin)

You are the practice administrator. To enhance patient safety, you will set up parameters that alert and guide dentists and dental assistants as they make clinical decisions. This will include setting up clinical decision support interventions, drug interaction alerts for paper prescriptions, and setting the severity level of drug interaction alerts.

Task 1: Define CDS intervention permissions By User Role (48 seconds)

Take the participant to the starting point for the task: Electronic Health Record (EHR Setup)

As the Practice Administrator define the CDS permissions for two users. Use the information in your task sheet.

Success:

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

Comments:

Task Time:____ seconds

Optimal Path: Electronic Health Record (EHR) Setup → EHR Triggers → Click Setup (Clinical Decision Support Setup) → Click Save → EHR Triggers

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was:____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 2: Setup a CDS intervention based on a Problem (45 seconds)

Take the participant to the starting point for the task: EHR Triggers

Set up a Clinical Decision Support intervention for Heart Disease. Use the information in your task sheet.

Success:

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

Comments:

Task Time:_____ seconds

Optimal Path: EHR Triggers → Click Add (EHR Trigger Edit) → Problems → EHR Trigger Edit → EHR Triggers

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was:____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 3: Set up a CDS intervention based on a Medication (34 seconds)

Take the participant to the starting point for the task: EHR Triggers

Set up a Clinical Decision Support intervention for Coumadin. Use the information in your task sheet.

Success:

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

Comments:

Task Time:____ seconds

Optimal Path: EHR Triggers → Click Add (EHR Trigger Edit) → Select Medication → EHR Trigger Edit → EHR Triggers

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: ____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 4: Set up a CDS intervention based on a Medication Allergy (34 seconds)

Take the participant to the starting point for the task: EHR Triggers

Set up a Clinical Decision Support intervention for an allergy to Novocain. Use the information in your task sheet.

Success:

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

Comments:

Task Time:_____ seconds

Optimal Path: EHR Triggers → EHR Trigger Edit→ Allergy Setup → EHR Trigger Edit → EHR Triggers

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: ____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 5: Set up a CDS intervention based on Age and Vital Signs (55 seconds)

Take the participant to the starting point for the task: EHR Triggers

Set up a Clinical Decision Support intervention for patients older than 17 who are taller than 5 ‘1”to consider blood donation.

Success:

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

Comments:

Task Time:____ seconds

Optimal Path: EHR Triggers → EHR Trigger Edit→ Input (Age) → EHR Trigger → Input (Height) → EHR Trigger Edit → EHR Triggers

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was:____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 6: Set up a CDS intervention based on a Lab Test/Results (46 seconds)

Take the participant to the starting point for the task: EHR Triggers

Setup a Clinical Support Intervention for the Lab Results. Use the information in your task sheet.

Success:

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

Comments:

Task Time:_____seconds

Optimal Path: EHR Triggers → EHR Trigger Edit→ Clinical Decisions Support Lab → LOINC → EHR Triggers

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: ____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 7: Check/Adjust Drug Interaction Settings in Open Dental (10 seconds)

Take the participant to the starting point for the task: Electronic Health Record (EHR) Setup.

For paper prescriptions you want all drug interactions to show: high and low significance. High significance interactions show automatically. Check to see what the current setting is. Change if necessary.

Success:

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

Comments:

Task Time:____ seconds

Optimal Path: Electronic Health Record (EHR) Setup → EHR Settings → clear the Only show high significance Rx alerts box → Electronic Health Record (EHR) Setup

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: ____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 8: Check/Adjust Drug Interaction Settings in Electronic Prescriptions (35 seconds)

Take the participant to the starting point for the task: Chart module.

In eRx you want all drug interactions to show: severe and less severe. All severe interactions show automatically. Check to see what the setting for less severe interactions is and change if necessary.

Success:

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

Comments:

Task Time:____ seconds

Optimal Path: Chart → eRx (bring IE into focus)→ Admin tab → uncheck the 'Hide All Less Severe Drug Interaction' box → Save Prescriber Settings → Close IE

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was:____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 9: Set Up a Drug Interaction Alerts in Open Dental (46 seconds)

Take the participant to the starting point for the task: Chart module.

For paper prescriptions, set up drug-drug and drug-allergy interaction alerts using the information in your task sheet.

Success:

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

Comments:

Task Time:____ seconds

Optimal Path:
First Rx: Chart → Rx Setup → Edit Rx Template → Select Medication → Edit Rx Template → Rx Alert Edit (check 'Is High Significance box') → Edit Rx Template → Rx Setup

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Second Rx: Rx Setup → Edit Rx Template → Allergy Setup → Edit Rx Template → Rx Setup

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: ____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Scenario B: Enter information about a new patient (Dental Assistant)

You are a dental assistant. The practice has a new patient, ‘’. The initial record has been created. Enter additional demographic information and current medications, allergies, and problems.

Task 10: Enter Demographics / CDS Demographic Intervention (37 seconds)

Take the participant to the starting point for the task: Chart module

For patient “Trudy Smith”, enter birthdate and gender. Use the information in your task sheet. If you encounter clinical decision support interventions, review instructions and reference information before proceedings.

Success:

☐ Easily completed

☐ Completed with difficulty or help: Describe below

☐ Not completed

Comments:

Task Time:____ seconds

Optimal Path: Chart → Patient Edit → CDS Intervention → Chart

☐ Correct

☐ Minor Deviations/Cycles: Describe below

☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: ____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 11: Enter Current Medications / CDS Medication Intervention (31 seconds)

Take the participant to the starting point for the task: Chart module

The patient is currently taking a medication. Add it to his active medication list using the information in your task sheet. If you encounter clinical decision support interventions, review instructions and reference information before proceeding.

Success:

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

Comments:

Task Time:____ seconds

Optimal Path: Chart → Medical → Select Medication → CDS Intervention → Medication for Patient → Medical

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: ____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 12: Enter Medication Allergy / CDS Allergy Intervention (23 seconds)

Take the participant to the starting point for the task: Medical window

Add the patient's active medication allergies to his allergy list. Use the information in your task sheet. If you encounter clinical decision support interventions, review instructions and reference information before proceeding.

Success:

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

Comments:

Task Time:____seconds

Optimal Path: Medical → Allergy Edit → CDS Intervention → Medical

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was:____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 13: Enter Patient Problems / CDS Problem Intervention (13 seconds)

Take the participant to the starting point for the task: Medical window

The patient is pregnant. Add "pregnancy" to her to her Problem list. If you encounter clinical decision support interventions, review any instructions or reference information before proceeding.

Success:

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

Comments:

Task Time:_____seconds

Optimal Path: Medical → Problems → CDS Intervention → Medical

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: _____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Scenario C: Update and enter patient information and treatment (Dentist)

You are a dentist performing a routine checkup for a returning patient.

Task 14: Create a CPOE Med Order/ Drug Interaction Check/Transmit Electronic Rx (105 seconds)

Take the participant to the starting point for the task: eRx.

For patient 'George Johnson' you decide to prescribe an antibiotic. In eRx, create a CPOE medication order using the information on your task sheet. Use the system to check for drug interaction and DO NOT order or prescribe a medication with severe interactions. Transmit the prescription electronically.

Success:

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

Comments:

Task Time:____seconds

Optimal Path: eRx (Compose) → Drug Search → Drug Search Results → Encounter severe drug interaction alert /Close → Cancel Pending → DELETE AMOXIL→ new Drug Search → Select medication → Pending Rx → Save Rx → Take Complete Rx to Review Page → Transmit Rx → Transmit Rx/Add to Record

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: _____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 15: Access/Edit a CPOE Medication Order in eRx (34 seconds)

Take the participant to the starting point for the task: eRx.

After consideration, you decide to change the dosage of a CPOE medication order created in eRx.

Success:

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

Comments:

Task Time:_____seconds

Optimal Path: eRx (Compose Rx) → EDIT next to medication → Pending Rx (change dosage)→ Save Rx

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: _____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 16: Create/Access/Edit a CPOE Laboratory Order (63 seconds)

Take the participant to the starting point for the task: EHR dashboard.

You decide to order a medical lab test. Create a laboratory order using the information on your task sheet.

Success:

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

Comments:

Task Time:____seconds

Optimal Path: EHR Dashboard (click Edit Labs) → Lab Orders (Click Add) → Lab Order Edit → Providers → Lab Order Edit → LOINC → Lab Order Edit (click Save) → Lab Orders → Lab Order Edit (click Save) → Lab Orders

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: _____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 17: Create/Access/Edit a CPOE Radiology Order (79 seconds)

Take the participant to the starting point for the task: EHR dashboard.

You decide to take extra precautions and order a radiology image. Create a radiology order using the information on your task sheet.

Success:

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

Comments:

Task Time:____seconds

Optimal Path: Lab Orders (Click Add) → Lab Order Edit → Providers → Lab Order Edit → LOINC → Lab Order Edit (click Save) → Lab Orders → Lab Order Edit (click Manage Images) → Check Waiting for Images → Lab Order Edit → Lab Orders

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: _____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Scenario D: During a regular checkup, write a prescription in Open Dental (Dentist)

Task 18: Create a CPOE Med Order/Drug Interaction Check/Write an Rx (55 seconds)

Take the participant to the starting point for the task: Chart module, patient selected.

You are a dentist during a routine checkup for Susan Sparkle. Write a paper prescription using the information on your task sheet. Use the system to determine if there are any drug-drug or drug-allergy interactions. Do not prescribe any medications that indicate an allergy or drug interaction.

Success:

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

Comments:

Task Time:____seconds

Optimal Path: Chart → Select Prescription → Alert (cancel) → Select Prescription → Edit Rx → Chart

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: _____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 19: Access/Change the CPOE Medication Order (13 seconds)

Take the participant to the starting point for the task: Medical window

After consideration, change the medication order as indicated in on your task sheet.

Success:

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

Comments:

Task Time:____seconds

Optimal Path: Medical → Medication for Patient → Medical

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was:

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Scenario E: Update information for returning patients (Dental Assistant)

Task 20: Enter Vital Signs (48 seconds)

Take the participant to the starting point for the task: EHR Dashboard – Susan Sparkle

As a Dental Assistant, enter the patient's vital signs using the information in your task sheet. If you encounter clinical decision support interventions, review any instructions or reference information before proceeding.

Success:

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

Comments:

Task Time:____seconds

Optimal Path: EHR dashboard → Vital Signs → Edit Vitalsign → CDS Intervention → Vital Signs

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: _____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 21: Access/Change Medication List (12 seconds)

Take the participant to the starting point for the task: Medical window

She informs you she is no longer taking a medication. Make the changes as indicated on your task sheet. If you encounter clinical decision support interventions, review any instructions or reference information before proceeding.

Success:

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

Comments:

Task Time:____seconds

Optimal Path: Medical → Medication for Patient → Medical (Show Discontinued)

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: _____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 22: Access/Change Allergy List (15 seconds)

Take the participant to the starting point for the task: Medical window

She informs you that she is no longer allergic to Sulfasalazine. Update her allergy list as indicated on your task sheet.

Success:

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

Comments:

Task Time:____seconds

Optimal Path: Medical → Allergy Edit → Deselect 'is Active' checkbox → OK → Check 'Show Inactive Allergies'

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: _____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 23: Reconcile active Medications (32 seconds)

Take the participant to the starting point for the task: Summary of Care window – Eric English

You have received a summary of care (CCD.xml) from another provider for Eric English. Reconcile the medications with the current medication list. Use the information on your task sheet. If you receive a clinical decision support intervention, review any instructions or reference information before proceeding

Success:

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

Comments:

Task Time:____seconds

Optimal Path: Summary of Care → Open File → CCD window → Reconcile Meds → OK

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: _____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 24: Reconcile Active Allergies (12 seconds)

Take the participant to the starting point for the task: CCD window.

Reconcile the active medication allergies in the Allergy list with the allergies in the summary of care. If you encounter clinical decision support interventions, review any instructions or reference information before proceeding.

Success:

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

Comments:

Task Time:____seconds

Optimal Path: CCD window → Reconcile Allergies → OK

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: _____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 25: Reconcile Active Problems (12 seconds)

Take the participant to the starting point for the task: CCD window.

Reconcile the active problems in the Problem list with the problems in the summary of care. If you encounter clinical decision support interventions, review any instructions or reference information before proceeding.

Success:

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

Comments:

Task Time:____seconds

Optimal Path: CCD window → Reconcile Problems → OK

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: _____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Task 26: Import CPOE Lab Results /Encounter CDS Intervention (60 seconds)

Take the participant to the starting point for the task: EHR dashboard.

Import lab results. If you encounter clinical decision support interventions, review any diagnostic or therapeutic information before proceeding.

Success:

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

Comments:

Task Time:____seconds

Optimal Path: EHR Dashboard→ Edit Labs → Click Import → Paste the text → Click OK → Lab Orders → Save → CDS Intervention → Lab Orders window.

- ☐ Correct
- ☐ Minor Deviations/Cycles: Describe below
- ☐ Major Deviations/Cycles: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall this task was: _____

Show participant written scale: Very Easy (5) to Very Difficult (1)

Administrator / Notetaker Comments:

Final Questions (5 Minutes)

What was your overall impression of this system?

What aspects of the system did you like most?

What aspects of the system did you like least?

Were there any features that you were surprised to see?

What features did you expect to encounter but did not see? That is, is there anything that is missing in this application?

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).

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