

EHR Usability Test Report for Azalea EHR version 3.0

*Report based on NISTIR 7742 Customized Common Industry Format Template for Electronic Health
Record Usability Testing*

Product: Azalea EHR version 3.0

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Table of Contents

- 1 [EXECUTIVE SUMMARY](#)
- 2 [INTRODUCTION](#)
- 3 [METHOD](#)
 - 3.1 [Participants](#)
 - 3.2 [Study Design](#)
 - 3.3 [Tasks](#)
 - 3.4 [Procedures](#)
 - 3.5 [Test Location](#)
 - 3.6 [Test Environment](#)
 - 3.7 [Test Forms and Tools](#)
 - 3.8 [Participant Instructions](#)
 - 3.9 [Usability Metrics](#)
 - 3.10 [Data Scoring](#)
- 4 [RESULTS](#)
 - 4.1 [Data Analysis and Reporting](#)
 - 4.2 [Effectiveness](#)
 - 4.3 [Efficiency](#)
 - 4.4 [Satisfaction](#)
 - 4.5 [Major Findings](#)
 - 4.6 [Areas for Improvement](#)
- 5 [APPENDICES](#)
 - 5.1 [Sample recruiting screener](#)
 - 5.2 [Participant demographics](#)
 - 5.3 [Non-Disclosure Agreement and Consent](#)
 - 5.4 [Example Moderator's Guide](#)
 - 5.5 [System Usability Scale Questionnaire](#)

1. EXECUTIVE SUMMARY

A usability test of Azalea EHR, version 3.0, a ambulatory EHR, was conducted in October 2017 in Valdosta, GA by Azalea Health Innovations, Inc. The purpose of this test was to test and validate the usability of the current user interface, and provide evidence of usability in the EHR Under Test (EHRUT). During the usability test, 10 intended users matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

This study collected performance data on 43 tasks typically conducted on an EHR. The tasks were related to the following criteria:

- 170.315(a)(1) CPOE – Medications
- 170.315(a)(2) CPOE – Laboratory
- 170.315(a)(3) CPOE – Diagnostic Imaging
- 170.315(a)(4) Drug-drug, Drug-allergy Interaction Checks
- 170.315(a)(5) Demographics
- 170.315(a)(6) Problem List
- 170.315(a)(7) Medication List
- 170.315(a)(8) Medication Allergy List
- 170.315(a)(9) Clinical Decision Support
- 170.315(a)(14) Implantable Device List
- 170.315(b)(2) Clinical Information Reconciliation and Incorporation
- 170.315(b)(3) Electronic Prescribing

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. All participants in the study had prior experience with the EHR. The administrator introduced the test, and instructed participants to completed a series of tasks (given one at a time) using Azalea EHR. During the testing, the administrator timed the test and, along with the data logger, recorded user performance data on paper. The administrator did not give the participant assistance in how to complete the task.

The following types of data were collected for each participant:

- Number of tasks successfully completed within the allotted time without assistance

- Time to complete the tasks
- Number and type of errors
- Path deviations
- Participant’s verbalizations
- Participant’s satisfaction ratings of the system

All participant data was de-identified – no correspondence could be made from the identity of the participant to the data collected. Following the conclusion of the testing, participants were asked to complete a post-test questionnaire and were compensated for their time. Various recommended metrics, in accordance with the examples set forth in the *NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records*, were used to evaluate the usability of the EHRUT. The tables located under the section labeled “[4.1 Data Analysis and Reporting](#)” is a summary of the performance and rating data collected on the EHRUT. The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be 91% satisfaction rate.

In addition to the performance data, the following qualitative observations were made with more details about each under sections 4.2, 4.3, 4.4, 4.5 and 4.6.

- [4.2 Effectiveness](#)
- [4.3 Efficiency](#)
- [4.4 Satisfaction](#)
- [4.5 Major Findings](#)
- [4.6 Areas for Improvement](#)

2. INTRODUCTION

The e EHRUT tested for this study was Azalea EHR, version 3.0, a complete ambulatory EHR. Designed to present medical information to healthcare providers in ambulatory healthcare settings, across multiple specialties. 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. To this end, measures of effectiveness, efficiency, and user satisfaction such as task success, path deviation, task time, and errors and simplicity rating were captured during the test.

3. METHOD

3.1 Participants

A total of 10 participants were tested on the EHRUT. Participants included Physicians, Nurses and Certified Medical Assistants. Azalea’s client relations team assisted with recruiting the participants. In addition, participants had no direct connection to the development of or organization producing the EHRUT. Participants were not from the testing or supplier organization. Participants were given the opportunity to have the same orientation and level of training as the actual end users would have received.

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

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, computing experience and user needs for assistive technology. Participant names were replaced with Participant IDs so that an individual’s data cannot be tied back to individual identities.

Part ID	Gender	Age	Education	Occupation /Roll	Professional Experience (months)	Computer Experience (months)	Product Experience (months)
1	Male	40-49	Doctorate degree	Physician	264	420	60
2	Female	40-49	Doctorate degree	Physician	132	396	60
3	Female	40-49	Doctorate degree	Physician	180	348	60
4	Female	40-49	Master’s degree	Nurse	144	360	60
5	Male	50-59	Master’s degree	Nurse	180	204	60
6	Female	30-39	Master’s degree	Nurse	84	300	60
7	Female	30-39	Master’s degree	Nurse	30	180	24
8	Female	20-29	Master’s degree	Nurse	72	180	12
9	Female	30-39	Master’s degree	Nurse	120	252	36
10	Female	40-49	Master’s degree	Nurse	132	288	60

10 participants (matching the demographics in the section on Participants) were recruited and 10 participated in the usability test. Zero participants failed to show for the study. Participants were scheduled for 60 minute sessions with 30 minutes 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 personnel.

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 one 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 within the allotted time
- Without assistance
- Time to complete the tasks
- Number and types of errors
- Path deviations
- Participant’s verbalizations (comments)
- Participant’s satisfaction ratings of the system

Additional information about the various measures can be found in section 3.9 on Usability Metrics.

3.3 Tasks

A number of tasks were constructed based on the 2015 Edition Certification criteria that would be realistic and representative of the kinds of activities a user might do with this EHR, including:

- (a.1) CPOE –Meds
 - A1.1. Record medication via CPOE
 - A1.2. Change medication via CPOE
 - A1.3. Display changed CPOE medication order
- (a.2) CPOE – Lab
 - A2.1. Record Lab order via CPOE
 - A2.2. Change Lab order via CPOE
 - A2.3. Display changed CPOE Lab order

- (a.3) CPOE – Diagnostic Imaging
 - A3.1. Record Imaging order via CPOE
 - A3.2. Change Imaging order via CPOE
 - A3.3. Display changed CPOE Imaging order

- (a.4) Drug-drug, drug-allergy interaction checks for CPOE
 - A4.1. Using CPOE, trigger a drug-drug interaction by entering a new medication order
 - A4.2. Using CPOE, trigger a drug-allergy interaction by entering a new medication order
 - A4.3. Adjust the severity level of a displayed drug-drug interaction

- (a.5) Demographics
 - A5.1. Record a patient’s preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender and identity.
 - A5.2. Change the patient’s preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender and identity.
 - A5.3. Display the patient’s changed preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender and identity.

- (a.6) Problem List
 - A6.1. Record a problem to the problem list
 - A6.2. Change a problem on the problem list
 - A6.3. Display the active problem list
 - A6.4. Display the historical problem list

- (a.7) Medication list
 - A7.1. Record a medication to the medication list
 - A7.2. Change a medication on the medication list
 - A7.3. Display the active medication list
 - A7.4. Display the historical medication list

- (a.8) Medication allergy list
 - A8.1. Record a medication allergy
 - A8.2. Change a medication allergy
 - A8.3. Display the active medication allergy list
 - A8.4. Display the historical medication allergy list

- (a.9) Clinical Decision support
 - A9.1. Add a CDS intervention and/or reference resource for each of the required elements
 - Problem list
 - Medication list
 - Medication Allergy List
 - At least one Demographic
 - Laboratory Test
 - Vital Signs
 - And a combination of at least 2 of the elements listed above
 - A9.2. Trigger the CDS interventions/resources added using the applicable data elements from each of the required elements
 - A9.3. View the intervention/resource information using the Infobutton standard for data elements in the problem list, medication list, and demographics
 - A9.4. Trigger the CDS interventions/resources based on data elements in the problem list, medication list, and medication allergy list by incorporating patient information from a transition of care/referral summary
 - A9.5. Access the following attributes for one of the triggered CDS interventions/resources: bibliographic citation, developer, funding source, release/revision date
- (a.14) Implantable Device List
 - A14.1. Record UDI
 - A14.2. Change UDI Status
 - A14.3. Access UDI, device description, identifiers, and attributes
- (b.2) Clinical Information Reconciliation and Incorporation
 - B2.1. Incorporate a CCDA and conduct reconciliation of the medications, medication allergies, and problems in the CCDA with the information currently in the patient's record
 - B2.2. Generate a new CCDA with reconciled data
- (b.3) e-Prescribing
 - B3.1. Create new prescription

- B3.2. Change prescription (dosage or duration)
- B3.3. Cancel prescription
- B3.4. Refill prescription
- B3.5. Receive fill status notification
- B3.6. Request and receive medication history information

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 and their identity was verified and matched with the participant's name on the schedule. Participants were then assigned an identification number in order to de-identify results. Each participant was asked for verbal consent to record the testing session.

To ensure that the test ran smoothly, two Azalea staff members participated in the test, the usability administrator and the data logger. The test administrator provided the instructions for each test, and monitored task times, post-task rating data, and took notes on participant comments. A second person served as the data logger and took notes on task success, path deviations, number and type of errors, and comments.

Participants were instructed to perform the tasks:

- As quickly as possibly making as few errors and deviations as possible
- Without assistance; administrator was 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 instructions of the task and were also read out loud by the test administrator. Task timing began once the administrator finished speaking. The task time was stopped once the participant indicated that they were finished by saying, "Done." Scoring is discussed below in the below section labeled "Data Scoring"

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

Participants were thanked for their time and compensated. Participants signed a receipt and acknowledgement form (See Appendix 6) indicating that they had received the compensation

3.5 Test Location

The test was administered in a setting where participants were isolated from other participants while completing the tasks. Only the administrator and data logger were present and capable of seeing what the participant was doing at any time during the test.

3.6 Test Environment

The EHRUT would typically be used in an ambulatory healthcare setting. In this instance, the test was conducted on a PC in an office at the practice using the Google Chrome web browser, as Azalea EHR is a web-based solution. A mouse and keyboard were used by each participant for the completion of all tasks, and the PC connected to a high speed Internet connection.

Technically, the system performance (i.e., response time) was representative to what actual users would experience in a field implementation. Additionally, participants were instructed not to change any of the default system settings (such as control of font size).

3.7 Test Forms and Tools

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

- Informed consent
- Moderator's guide
- Post-test questionnaire
- Acknowledgment Form

Examples of each can be found in the Appendix section. The Moderator's Guide was devised so as to be able to

capture required data

3.8 Participant Instructions

The administrator read the following aloud to each participant in the study:

"Thank you for participating in this study. Your input is very important. Our session today will last about 60 minutes. During that time you will use an instance of an electronic health record. I will ask you to complete a few tasks using this system and answer some questions. You should complete the tasks as quickly as possible making as few errors as possible. Please try to complete the tasks on your own following the instructions very closely. Please note that we are not testing you we are testing the system, therefore if you have difficulty all this means is that something needs to be improved in the system. I will be here in case you need specific help, but I am not able to instruct you or provide help in how to use the application. Overall, we are interested in how easy (or how difficult) this system is to use, what in it

would be useful to you, and how we could improve it, so please be honest with your opinions. All of the information that you provide will be kept confidential and your name will not be associated with your comments at any time. Should you feel it necessary you are able to withdraw at any time during the testing.”

Following the procedural instructions, participants were shown the EHR and were given a couple minutes to explore the system and make comments. Once this task was complete, the administrator gave the following instructions:

For each task, I will read the description to you and say “Begin.” At that point, please perform the task and say “Done” once you believe you have successfully completed the task. I would like to request that you not talk aloud or verbalize while you are doing the tasks. I will ask you your impressions about the task once you are done.

Participants were then given 43 tasks to complete. Tasks are listed in section 3.3 Tasks.

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:

1. Effectiveness of Azalea EHR by measuring participant success rates and errors
2. Efficiency of Azalea EHR by measuring average task time and path deviations
3. Satisfaction with Azalea EHR by collecting users’ comments and ratings

3.10 Data Scoring

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

Measures	Rationale and Scoring
<p>Effectiveness:</p> <p>Task Success</p>	<p>A task was counted as a “Success” if the participant was able to achieve the correct outcome, without assistance, within the time allotted on a per task basis.</p> <p>The total number of successes were calculated for each task and then divided by the total number of times that task was attempted. The results are provided as a percentage.</p> <p>Task times were recorded for successes. Observed task times divided by the optimal time for each task is a measure of optimal efficiency. Optimal task performance time, as benchmarked by expert performance under realistic conditions, is recorded when constructing tasks. Target task times used for task times in the Moderator’s Guide must be operationally defined by taking multiple measures of optimal performance and multiplying by some factor of 1.25 which allows some time buffer because the participants are presumably not trained to expert performance. Thus, if expert, optimal performance on a task was [x] seconds then allotted task time performance was [x * 1.25] seconds. This ratio should be aggregated across tasks and reported with mean and variance scores.</p>
<p>Effectiveness:</p> <p>Task Failures</p>	<p>If the participant abandoned the task, did not reach the correct answer or performed it incorrectly, or reached the end of the allotted time before successful completion, the task was counted as an “Failures.” No task times were taken for errors.</p> <p>The total number of errors was calculated for each task and then divided by the total number of times that task was attempted. Not all deviations would be counted as errors. This should also be expressed as the mean number of failed tasks per participant.</p> <p>On a qualitative level, an enumeration of errors and error types should be collected.</p>
<p>Efficiency:</p> <p>Task Deviations</p>	<p>The participant’s path (i.e., steps) through the application was recorded. Deviations occur if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control. 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.</p>

	<p>It is strongly recommended that task deviations be reported. Optimal paths (i.e., procedural steps) should be recorded when constructing tasks.</p>
<p>Efficiency: Task Time</p>	<p>Each task was timed from when the administrator said “Begin” until the participant said, “Done.” If he or she failed to say “Done,” the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task. Variance measures (standard deviation and standard error) were also calculated.</p>
<p>Efficiency: Task Rating</p>	<p>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.</p> <p>Common convention is that average ratings for systems judged easy to use should be 3.3 or above.</p> <p>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.</p>

4. RESULTS

4.1 Data Analysis and Reporting

The results of the usability test were calculated according to the methods specified in section 3.9 Usability Metrics above.

The usability testing results for Azalea EHR are detailed in the below tables. The results should be seen in light of the objectives and goals outlined in Section 3.2 Study Design. The data should yield actionable results that, if corrected, yield material, positive impact on user performance.

170.315(a)(1) CPOE – Medications	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5 = Easy
	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
A1.1. Record medication via CPOE	10	100% (0%)	0 (70/70)	43.4 (6.15)	1.09 (434/400)	0% (0%)	4.3 (0.82)
A1.2. Change medication via CPOE	10	100% (0%)	0 (60/60)	16.7 (2.16)	1.11 (167/150)	0% (0%)	4.4 (0.69)
A1.3. Display changed CPOE medication order	10	100% (0%)	0 (20/20)	8.7 (1.63)	1.09 (87/80)	0% (0%)	5 (0)

170.315(a)(2) CPOE – Lab	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5 = Easy
	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
A2.1. Record Lab order via CPOE	10	100% (0%)	0 (50/50)	31.9 (1.91)	1.06 (319/300)	0% (0%)	5
A2.2. Change Lab order via CPOE	10	100% (0%)	0 (50/50)	22.1 (1.97)	1.11 (221/200)	0% (0%)	5
A2.3. Display changed CPOE Lab order	10	100% (0%)	0 (20/20)	8.9 (1.73)	1.11 (89/80)	0% (0%)	5

170.315(a)(3) CPOE – Diagnostic Imaging	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5 = Easy
	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
A3.1. Record Imaging order via CPOE	10	100% (0%)	0 (50/50)	31.5 (1.58)	1.05 (315/300)	0% (0%)	5
A3.2. Change Imaging order via CPOE	10	100% (0%)	0 (50/50)	16.7 (1.58)	1.11 (150/135)	0% (0%)	5
A3.3. Display changed CPOE Imaging order	10	100% (0%)	0 (20/20)	8.6 (0.53)	1.07 (77/72)	0% (0%)	5

170.315(a)(4) Drug-drug, drug-allergy interaction checks for CPOE	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5 = Easy
	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
A4.1. Using CPOE, trigger a drug-drug interaction by entering a new medication order	10	100% (0%)	0 (50/50)	15.6 (1.26)	1.04 (156/150)	0% (0%)	4.3 (0.82)
A4.2. Using CPOE, trigger a drug-allergy	10	100% (0%)	0 (50/50)	15.7 (1.25)	1.05 (157/150)	0% (0%)	3.9 (0.56)

interaction by entering a new medication order							
A4.3. Adjust the severity level of a displayed drug-drug interaction	10	60% (52%)	0.98 (78/80)	97.5 (78.79)	1.67 (585/350)	40% (52%)	2 (1.24)

170.315(a)(5) Demographics	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5 = Easy
	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
A5.1. Record Demographics	10	100% (0%)	0 (30/30)	51.9 (6.33)	1.30 (519/400)	0% (0%)	5 (0)
A5.2. Change Demographics	10	100% (0%)	0 (40/40)	18.3 (3.95)	1.31 (183/140)	0% (0%)	5 (0)
A5.3. Display Demographics	10	100% (0%)	0 (20/20)	6.1 (1.37)	1.02 (61/60)	0% (0%)	5 (0)

170.315(a)(6) Problem List	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5 = Easy
	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
A6.1. Record a problem to	10	100% (0%)	0 (40/40)	11.7 (1.89)	1.06 (117/110)	0% (0%)	5 (0)

the problem list							
A6.2. Change a problem on the problem list	10	100% (0%)	0 (50/50)	11.4 (1.51)	1.04 (114/110)	0% (0%)	5 (0)
A6.3. Display the active problem list	10	100% (0%)	0 (40/40)	7.4 (1.26)	1.06 (74/70)	0% (0%)	5 (0)
A6.4. Display the historical problem list		100% (0%)	0 (40/40)	7.4 (1.26)	1.06 (74/70)	0% (0%)	5 (0)

170.315(a)(7) Medication List	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5 = Easy
	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
A7.1. Record a medication to the medication list	10	100% (0%)	0 (70/70)	34.4 (5.93)	1.15 (344/300)	0% (0%)	4.1 (0.73)
A7.2. Change a medication on the medication list	10	100% (0%)	0 (60/60)	17.4 (2.63)	1.16 (174/150)	0% (0%)	4.3 (0.48)
A7.3. Display the active medication list	10	100% (0%)	0 (30/30)	6.8 (1.32)	(1.13) 68/60	0% (0%)	5 (0)
A7.4. Display the historical	10	100% (0%)	0 (30/30)	6.8 (1.32)	(1.13) 68/60	0% (0%)	5 (0)

medication list							
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170.315(a)(8) Medication Allergy List	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5 = Easy
	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
A8.1. Record a medication allergy	10	100% (0%)	0 (80/80)	33.5 (2.46)	1.12 (335/300)	0% (0%)	3.5 (0.42)
A8.2. Change a medication allergy	10	100% (0%)	0 (70/70)	19.4 (1.71)	1.08 (194/180)	0% (0%)	3.9 (0.31)
A8.3. Display the active medication allergy list	10	100% (0%)	0 (30/30)	6.9 (1.10)	1.15 (69/60)	0% (0%)	5 (0)
A8.4. Display the historical medication allergy list	10	100% (0%)	0 (30/30)	6.9 (1.10)	1.15 (69/60)	0% (0%)	5 (0)

170.315(a)(9) Clinical Decision support	N	Task Success	Path Deviation	Task Time	Errors	Task Ratings 5 = Easy

	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Mean (SD)
A9.1. Create CDS Intervention	10	100% (0%)	0 (50/50)	41.3 (4.27)	1.18 (413/350)	0% (0%)	5 (0)
A9.2. Trigger CDS Intervention	10	100% (0%)	0 (20/20)	6.4 (0.70)	1.07 (64/60)	0% (0%)	5 (0)
A9.3. View CDS intervention / resource info	10	100% (0%)	0 (30/30)	8.6 (0.97)	1.08 (86/80)	0% (0%)	5 (0)
A9.4. Trigger CDS intervention by incorporating CCDA file	10	100% (0%)	1.04 (125/120)	44.9 (7.31)	1.28 (449/350)	0% (0%)	3.9 (0.32)
A9.5. Access CDS intervention attributes	10	100% (0%)	0 (40/40)	8.6 (0.97)	1.08 (86/80)	0% (0%)	5 (0)

170.315(a)(14) Implantable Device List	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5 = Easy
	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Mean (SD)
A14.1. Record UDI	10	100% (0%)	0 (90/90)	20.3 (2.11)	1.13 (203/180)	0% (0%)	5 (0)
A14.2. Change UDI Status	10	100% (0%)	0 (70/70)	14.1 (0.99)	1.08 (141/130)	0% (0%)	5 (0)

A14.3. Access UDI	10	100% (0%)	0 (40/40)	11.5 (1.27)	1.15 (115/100)	0% (0%)	5 (0)
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170.315(b)(2) Implantable Device List	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5 = Easy
	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
B2.1. Incorporate a CCDA and reconcile	10	100% (0%)	1.04 (125/120)	44.9 (7.31)	1.28 (449/350)	0% (0%)	3.9 (0.32)
B2.2. Generate a new CCDA with reconciled data	10	100% (0%)	0 (40/40)	10.9 (1.66)	1.21 (109/90)	0% (0%)	5 (0)

170.315(b)(3) e-Prescribing	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5 = Easy
	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
B2.1. Create new prescription	10	100% (0%)	1.16 (116/100)	82.5 (19.21)	1.5 (825/550)	0% (0%)	3.4 (0.52)
B2.2. Change prescription	10	100% (0%)	1.06 (74/70)	24.5 (2.17)	1.11 (245/220)	0% (0%)	3.7 (0.48)

B2.3. Cancel prescription	10	100% (0%)	0 (60/60)	18.1 (1.37)	1.13 (181/160)	0% (0%)	4 (0)
B2.4. Refill prescription	10	100% (0%)	0 (40/40)	14.7 (1.34)	1.13 (147/130)	0% (0%)	4.6 (0.52)
B2.5. Receive fill status notification	10	100% (0%)	0 (60/60)	19.4 (2.17)	1.21 (194 /160)	0% (0%)	3.8 (0.42)
B2.6. Request and receive medication history information	10	100% (0%)	0 (60/60)	17.7 (1.50)	1.11 (177/160)	0% (0%)	4.1 (0.57)

4.2 Effectiveness

Only one error was observed out of all tasks performed. The error occurred during task number A4.3. CPOE Med - Adjust the severity level of a displayed drug-drug interaction. A minor issue we noticed was that the task for “A4.3. CPOE Med - Adjust the severity level of a displayed drug-drug interaction” gave users the hardest time. It seemed to take the users the longest to complete with the most path deviations (if even completed), and there were even some unsuccessful at completing as adjusting the severity level of drug-drug and drug-allergy interaction checks is an account-wide eRx Dr. First setting that is performed by the eRx account admin which is usually only a provider or a practice administration and is typically done at the time of the EHR account’s initial setup and not by individual users on a regular basis. Therefore, most users were confused as to where in the system they needed to go in order to make that adjustment and instead went to the Azalea EHR settings screen rather than the Dr. First settings screen. Some users couldn’t figure out at all where to make the adjustment and either ran out of time or abandoned the task all together and asked for assistance as they were unaware of how to get to the Dr. First settings screen since they were either never trained to go to that screen in the first place since they have no need to visit that screen. However, the 3 providers who were trained on the functionality were able to complete the task without error, so we don’t see it as a major issue.

4.3 Efficiency

The observed paths and task times were mostly in line with the optimal paths and task times that were calculated prior to testing as all users tested had been using our software for at least a year and were already very familiar with our system’s functionality prior to the study. The task times that were documented as being over the allotted time were in line with the categories listed above under

effectiveness.

4.4 Satisfaction

Overall the usability study participants were very satisfied with the workflow and usability of the Azalea EHR system. All of the study participants work at the same practice and the practice has been a client of ours for 5 years. Therefore all of the participants had quite a bit of experience using our system, most of which having 5 years experience, and were already quite knowledgeable of the system prior to the study. The practice tested is also one of our top revenue accounts and therefore majority of their feature and enhancement requests are taken into consideration as long with their design feedback when developing any new features and enhancements, which is a large contributor to their overall high satisfaction.

We did, however, find a trend that we received lower satisfaction scores for those tasks that required to the users to utilize the 3rd party eRx portal that is integrated in our software in order to complete the task. The practice under test has been pushing for us to develop our own eRx portal for a quite a while now. Since the portal we use is not developed by our inhouse developers we are unable to take into consideration any of their enhancement requests and design feedback and can only relay their requests to the 3rd party vendor on their behalf. The practice feels that if we were to develop and certify on our own eRx portal we would be able to adhere to their eRx, medication and allergy related feature and enhancement requests in a more timely manner.

4.5 Major Findings

There were no complaints or actionable comments made by the participants in the study and therefore no major findings discovered by the study. There was however a minor issue we noticed regarding task for "A4.3. CPOE Med - Adjust the severity level of a displayed drug-drug interaction". This task gave users the hardest time. It seemed to take the users the longest to complete with the most path deviations (when completed), and there were even some users who were unsuccessful at completing this task as adjusting the severity level of drug-drug and drug-allergy interaction checks is an account-wide eRx Dr. First setting that is performed either by the eRx account admin, typically a provider or a practice administrator, and done at the time of the EHR account's initial setup. Therefore some of the users tested were not aware of how to navigate to Dr. First's settings screen in the eRx portal.

4.6 Areas for Improvement

The overall recommendation for improvement that we received was that multiple users requested that we would develop our own electronic prescribing portal rather than embedding a 3rd party vendor's portal into our EHR. . The practice under test has been pushing for us to develop our own eRx portal for a quite a while now so this was not of a surprise to receive the request.

5 APPENDICES

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

1. Sample recruiting screener
2. Participant demographics
3. Non-Disclosure Agreement and Consent
4. Example Moderator's Guide
5. System Usability Scale Questionnaire

5.1 Appendix 1: Sample recruiting screener

Azalea EHR Usability Study Demographic Survey

1. Name of Practice:
2. Name of Participant:
3. Gender:
 - a. Male
 - b. Female
 - c. Other
 - d. Decline to specify
4. Credentials:
5. Highest Level of Education:
 - a. No high school degree
 - b. High school graduate, diploma or the equivalent (for example: GED)
 - c. Some college credit, no degree
 - d. Trade/technical/vocational training
 - e. Associate degree
 - f. Bachelor's degree
 - g. Master's degree
 - h. Doctorate degree (e.g., MD, DNP, DMD, PhD)"

6. What is your age bracket?
 - a. <20
 - b. 20-29
 - c. 30-39
 - d. 40-49
 - e. 50-59
 - f. 60-69
 - g. 70+

7. What is your occupation/role?
 - a. Physician
 - b. Nurse
 - c. Medical Assistant
 - d. Other _____

8. How many months of professional experience do you have in your current role?

9. How many months of computer experience do you have (all computer experience)?

10. How many months have you worked with Azalea EHR?

5.2 Appendix 2: Participant demographics

Gender	Count
Men	56
Women	116
Not Collected	
Total (participants)	

Age Range	Count
<20	
20-29	

30-39
 40-49
 50-59
 60-69
 70+
 Total (participants)

Education Range **Count**

High school graduate/GED
 Some college
 College graduate
 Postgraduate
 Total (participants)

Occupation/Role **Count**

Physician
 Nurse
 Medical Assistant
 Total (participants)

Years of Experience **Mean**

Professional Experience
 Computer Experience
 Azalea EHR Experience

Assistive Technology Needs **Count**

Yes
 No
 Not Collected

Total (participants)

5.3 Appendix 3: Non-Disclosure Agreement and Consent

Non-Disclosure Agreement

THIS AGREEMENT is entered into as of _____, 2017, between _____ ("the Participant") and the testing organization Azalea Health located at 107 W. Central Ave. Valdosta, GA 31601.

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 Azalea Health, 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 Azalea Health and is being disclosed solely for the purposes of the Participant's participation in today's usability study. By signing this form the Participant acknowledges that s/he will receive monetary compensation for feedback and will not disclose this confidential information obtained today to anyone else or any other organizations. Participant's printed name: Signature: D

Participant's printed name:

Signature: _____ **Date:** _____

Informed Consent

Azalea Health would like to thank you for participating in this study. The purpose of this study is to evaluate an electronic health records system. If you decide to participate, you will be asked to perform several tasks using the prototype and give your feedback. The study will last about 60 minutes. At the conclusion of the test, you will be compensated for your time.

Agreement

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

I understand and consent to the use for research purposes by Azalea Health and if ever required by the meaningful use certification body for auditing purposes. I understand that the information and recordings are 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 recordings and understand they may be copied and used by Azalea Health without further permission.

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

I understand and agree that the data collected from this study may be shared with outside of Azalea Health and Azalea Health's client. I understand and agree that data confidentiality is assured, because only deidentified 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:

Signature: _____ **Date:** _____

5.4 Appendix 4: Example Moderator's Guide

Administrator: _____

Data Logger: _____

Date: _____ Time: _____

Participant #: _____

Location: _____

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

Only 1 task is presented here for example:

170.315 (a)(1) - CPOE – Medications

During this test you will be asked to:

- Record medication via CPOE
- Change medication via CPOE

- Display changed CPOE medication order

Steps to complete task:

- Open patient record named Azalea Test
- Access eRx screen to place a medication order
- Order amoxicillin, 250 mg capsule
- Access medication orders to change an order
- Change order to amoxicillin, 500 mg capsule
- Display changed order

Success:

Easily Completed

Completed with difficulty or help :: Describe below

Not completed

Comments:

Task Time: _____ Seconds

Optimal Path:

- Open patient record
- Click Prescribe button in menu bar on left
- Dr. First will be launched directly to prescribe screen
- Search for amoxicillin in prescribe field
- Click Find button
- Click on amoxicillin 250mg to select
- Click Continue
- Click Ok
- Medication is displayed in pending prescription list
- Click Modify
- Change drug to amoxicillin 500 mg
- Click Continue
- Click Ok

- Changed medication is displayed in pending prescription list

Correct
 Minor Deviations / Cycles :: Describe below
 Major Deviations :: Describe below
Comments:

Observed Errors and Verbalizations:

Comments:

Rating:

Overall, this task was: _____

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

Administrator / Notetaker Comments:

5.5 Appendix 5: System Usability Scale Questionnaire

Please a 1 - 5 next to each statement below.

Strongly Agree = 5, Agree = 4, Neutral =3, Disagree =2, Strongly disagree =1

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

10. I needed to learn a lot of things before I could get going with this system _____