

EHR Usability Test Report

Acuitas activEHR

Version 2.1



Report based on NISTIR 7741, Process approach for Improving the Usability of EHR's

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Executive Summary

Our client-driven philosophy and passion for technology within the optical world are the foundation of our success. We continue to strive to keep providing our clients with flexible and simple solutions that can be fully customized to meet the exact needs of their business size and requirements. Acuitas activEHR has been highly focused on solution usability. A core element of our agile based development cycles includes integration of client recommendations and requirements with a focus of usability centered design.

The User Centered Design process that Ocuco modeled after ISO/IEC 25062:2016. This modified process method includes the following steps:

1) description of the product areas, 2) goals of the test, 3) test participants, 4) processes the clients were asked to perform, 5) experimental design of the test, 6) the processing steps by which the test was conducted, 7) the usability metrics and collection methods, and 8) the numerical results. This process was used because it very closely aligns with the requirements set for Safety-Enhanced Design. In addition, it also provides the most clarity on the 'best practice' is for execution of each step.

Ocuco implemented this standard usability test in conjunction with Acuitas activEHR version 2.1 Ambulatory which was conducted by Janet L. Johnson between August 5th and August 17th, 2017 at the participant's offices thru a Go-to-Meeting session. The participants of varying experience levels completed the tasks which were reflective of rate of frequency used in the application, such as prescription ordering, recording patient problems and medication allergies, along with clearly viewing drug-drug and drug-allergy interactions.

The participants showed a 100% task completion rate, with a 2.25 minute average task time and an SUS score of 83.8. Based on their feedback voiced during the tests and the rate of errors/task times associated with certain tasks, there were a few notable improvements ideas. For example, a client brought up to offer a calendar view within the ePrescribing screen in lieu of offering a separate month, day and year field to increase efficiency in this area.

Introduction

The application offers a full patient journey thru all the necessary components of an optometric office and offerings of a full dispensing ophthalmic (lenses, frames and contact lens) module. Version 2.1 provides our clients with an efficient workflow to review, add and change medications, and laboratory orders as well as lab order results. Information such as allergies and hypersensitiveness, diagnoses and interactions are displayed to the client as they work with the various orders. The client can also review, add and change Problems, Patient Demographics and make active/inactive Implantable Devices associated to a Patient's chart.

Test Objectives

This test was to evaluate the usefulness, functionality and workflow for ease of use. The participated participants were both Optometrists and Pre-Test Technicians staff who used the application, for safety (avoid errors) and satisfaction (desirability level of application) of Acuitas activEHR version 2.1. The content of Acuitas activEHR version 2.1 was similar representation of what other clients would see in the production version. Separately from the 'test patients' in the application, all other features, functionality, tables and screens were the same as they would be in a production version.

The ultimate goal for this usability test for Acuitas activEHR version 2.1 were to test twelve (12) different areas being certified:

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



Methods

Participants

Ten participants were tested in this study. Our intended end-users are optometric assistant and optometrists within the ophthalmic industry. The selected participants are optometrists, pre-test technicians and other staff members within a practice with familiarity of the product and differing computer experience levels. These varying experience levels provided a 'real-world' setting to conduct the tests.

The participants chosen were compensated \$250.00, in appreciation of their time and willingness. These participants were not directly involved in the agile development cycles of the application.

	Occupation	Professional Experience	Age category	Sex	Education	Computer Experience	Product Experience
1	Office Coordinator	4 months	60 - 69	F	High School	Medium User 11 – 25 hrs. wk.	Minimal
2	Optometrist	11 yrs.	30 - 39	F	Doctorate degree	Heavy User 26+ hrs. wk.	2 yrs.
3	Optometrist	13 yrs.	40 - 49	M	Doctorate degree	Heavy User 26+ hrs. wk.	2 yrs.
4	Corp. Trainer	2 yrs.	40 - 49	M	Bachelor's Degree	Heavy User 26+ hrs. wk.	2 yrs.
5	District Mgr.	4 yrs.	40 - 49	M	Bachelor's Degree	Heavy User 26+ hrs. wk.	7 yrs.
6	Office Mgr.	12 yrs.	60 - 69	F	High School	Medium User 11 – 25 hrs. wk.	4 yrs.
7	Office Mgr./PTOP	32 yrs.	70 – 79	F	Trade training	Medium User 11 -25 hrs. wk.	5 yrs.
8	Optometrist	33 yrs.	70 - 79	M	Doctorate degree	Heavy User 26+ hrs. wk.	13 yrs.
9	Optician/Technician	9 yrs.	50 -59	F	Bachelor's Degree	Heavy User 26+ hrs. wk.	4 yrs.
10	Office Mgr.	18 yrs.	60 - 69	F	Associate Degree	Heavy User	4 yrs.

Participant Instructions

All participants were given a short explanation and overview of what the tests entail and were given the ability to ask question before the test commenced. The Test Moderator read the tasks/scenarios off to each participant and the participant then attempted/proceeded with the explained task. Participants had the opportunity to ask for clarification during the task processing steps. We measured the task completion rate, task time, error rate and satisfaction ratings. We also observed the participants behavior and documented verbalizations to determine any patterns across participants. The test criteria performed by participants were recorded remotely using GoToMeeting which recorded the users' screen, audio and mouse clicks/movements. This information was reviewed after each session to collect the metrics/count.

Experimental / Study Design

The objective of these tests were to measure the effectiveness, efficiency, workflow and end-user satisfaction. The participants' vocal feedback and reactions were recorded. Each participants' feedback was discussed and analyzed for patterns in their responses. This feedback was used to inform the design. Quantitative observations were made through the dependent variables below. The quantitative metrics measured were task success fate, task failure rate, task deviation rate, error rate, task time, and end-user satisfaction rating.

Tasks / Scenario's

The participant was given the set of tasks associated to each scenario. The tasks were chosen because of their functionality and frequency of use in the application. The participants were welcome to ask the moderator questions and refer back to the task sheet provided to them. Below are the scenarios that were given to each participant.

Scenario 1 – (170.315(a)(5))

Patient A – Task: Record Demographics (170.315(a)(5))

A new client comes in for an appointment. You want to check if they are in your system. Open the Search screen.

- Type in Last Name, First Name and Click enter

You see that there are no patients that matches your search, so click Create new patient.

- Select Gender.
- Enter in a birth date for the patient
- Enter phone number
- Fill out Ethnicity
- Fill out Race
- Fill out Preferred Language
- Fill out Sexual Orientation
- Fill out Gender Identity
- Exit patient file to save your changes.

Scenario 2 – (170.315(a)(5)), (170.315(a)(5))

Patient B - Tasks: View demographics (170.315(a)(5)), Change demographics (170.315(a)(5))

The client has told you that they have gotten divorced since the last visit.

- Update the client's marital status

Scenario 3 – (170.315(a)(1) & 170.315(a)(7)), (170.315(a)(8)), (170.315(a)(1) & 170.315(a)(7)), (170.315(a)(1) & 170.315(a)(7)), (170.315(b)(3))

Patient B - Tasks: View medications/medication list (170.315(a)(1) & 170.315(a)(7)), View medication allergy list (170.315(a)(8)), Change medication/medication list (170.315(a)(1) & 170.315(a)(7)), Record medication/medication list (170.315(a)(1) & 170.315(a)(7)), Electronically prescribe (170.315(b)(3))

As you talk with your patient/client during the appointment, they state that they continue to have trouble sleeping, you decide to prescribe Lunesta.

- Click 'New Visit' icon
- Open the "Examination", launch Examination screen.
- Navigate to 'Plan and Management'
- You review the EMR's active medication list and medication history list and realize the patient has been prescribed Ambien, 10 mg, as needed at bedtime.
- You also see the patient's "Medication & Allergies" tab you see they are allergic to Lunesta.

- >> Launch ePrescribing
- In order to prevent prescribing more than one sleep agent (e.g., same-class polypharmacy) and avoid an allergic reaction, you discontinue the Ambien 10mg [Reason for stopping: Adverse reaction] date - today
- And prescribe a new drug, trazodone, 150 mg tablet, as needed at bedtime.
- Amidst ordering new RX, enter SIG you want to make note that this was prescribed over Lunesta because of a drug allergy.
- Also advising the pharmacy with instructions 'Dispense as written'
- >> Return to EMR button

- Verify the order was made by reading back the new medication list.
- Access the Medications & Allergies tab to see the medication history screen. Click on the Trazodone record
- Close the chart

Scenario 4 – (170.315(a)(8)), (170.315(a)(8)), (170.315(a)(8)), (170.315(a)(2)), (170.315(a)(2)), (170.315(a)(1)), (170.315(a)(4)), (170.315(a)(4)), (170.315(a)(1)), (170.315(a)(4))

Patient B - Tasks: View medication allergies (170.315(a)(8)), Record medication allergy (170.315(a)(8)), Change medication allergy (170.315(a)(8)), View lab tests (170.315(a)(2)), Order lab test (170.315(a)(2)), Record

medication (170.315(a)(1)), View drug-allergy interactions (170.315(a)(4)), View drug-drug interactions (170.315(a)(4)), Change medication (170.315(a)(1)), Change the level of severity for drug-drug interactions (170.315(a)(4))

Your patient comes in for their regular appointment. You discuss the current symptoms they have been experiencing. They mention they are having a mild allergic reaction of swelling when taking their Abilify.

- Open the “Allergies and Hypersensitivities” form for patient and you notice this is currently not noted on the patient’s chart
- >> Launch ePrescribing
- Add Aripiprazole (medication name for Abilify brand) as an allergy to the chart, select reaction = ‘swelling’ and type in severity mild.
- The patient also indicates that their peanut allergy has gone away and they no longer have any reactions to eating peanuts. Highlight the peanut allergy and update action to ‘Inactivate’.
- While here, change ‘modify’ the severity of the Abilify allergy to severity moderate, because the patient indicated that their swelling gets pretty bad after taking their Abilify.
- >> Close ePrescribing returning to Acuitas activEHR

- Please view all allergies for the patient. Verify that the Aripiprazole allergy added in the EHR appears in the client’s known allergies list.
- The patient complains about being overly fatigued, achy and has trouble urinating. You suspect it’s a simple urinary tract infection from the symptoms described, but want to be sure.
- Open Plan and Management’ → Select the “Orders & Results” tab
- You plan to order a urinalysis, but you notice that a urinalysis has already been ordered for the patient. You decide to prescribe Bactrim for the suspected UTI.

- >> Launch ePrescribing
- You notice that on the order confirmation screen, you see both moderate and major interaction alerts. You would like to only see major interactions.
- Log into the Admin under 'Options'
- Go to the alerts page and select to change the "all warnings" to 'Severe and Contraindicated Only'
- Save the changes
- Click 'Prescribe' and proceed to prescribe 'Bactrim'.
- When you get to the interaction alerts on the order confirmation screen, you see that the alerts only appear for major drug-drug interactions. Complete the order.
- The patient reports they don't feel like the Flonase has been working, so you decide to discontinue Flonase as well as Abilify, since the client reported the allergic reaction.
- >> Close ePrescribing returning to Acuitas activEHR

- After you speak to your client more, you decide to add a Comprehensive Metabolic Panel test. Orders & Results tab LOINC 45065-0
- Close chart

Scenario 5 – (170.315(a)(14)), (170.315(a)(14)), (170.315(a)(14))

Patient B - Tasks: View implantable device list (170.315(a)(14)), Change implantable device list (170.315(a)(14)), Record implantable device list (170.315(a)(14))

The client tells you that they just had an implantable device removed.

- Open the "Implantable Device List" form found on the patient's history tab..
- Enter the client's name and the unique device identifier. Review the information that has been returned.
+B066000325011NS1/\$\$420020216LOT123456789012345/SXYZ456789012345678/16D20130202C1

- You see that the device has not been added to their record, so file the device to the client and set the status as inactive.
- Close chart

Scenario 6 – (170.315(a)(6)), (170.315(a)(6)), (170.315(a)(6))

Patient B - Tasks: View problem list (170.315(a)(6)), Record problem (170.315(a)(6)), Change problem (170.315(a)(6)) The patient has been complaining of a migraine.

The patient has been complaining of a migraine.

- Open the 'Medical Coding' tab → "Problem List" form, select 'Add Codes' within Problem List.
- Search by typing in Migraine, click 'Find'
- Add the problem "Migraine" [G43.001] to the patient's problem list.
- Upon saving to Problem list, add required fields (Date of onset and Status).
- The patient also tells you they no longer have the flu. Change the status of flu to "inactive".
- Save the changes.

Scenario 7 –170.315(a)(2)), (170.315(a)(2)), (170.315(a)(3)), (170.315(a)(3)), (170.315(a)(3)), (170.315(a)(1))

Patient C - Tasks: View lab test results (170.315(a)(2)), Change lab test (170.315(a)(2)), Add radiology order (170.315(a)(3)), Change radiology order (170.315(a)(3)), View radiology order (170.315(a)(3)), Change medication (170.315(a)(1))

- At the last visit you ordered a urinalysis lab test.
- Access "Orders & Results" form for "(patient name)"
- Review the lab test results for the order
- Change the status to clinically reviewed.
- To be thorough, you decide to order a CT scan LOINC 67292-3 to determine if the patient's symptoms could be related to a stroke.
- After placing the order, the patient tells you that they will be out of town for the next three days, so you will need to change

the order's start date to 3 days later. Discontinue the placed order and re-order the new order with the new start date. Confirm the order change by viewing the radiology list.

- Based on the discussion with the patient you decide to change the current medications to help with the immediate issues. Increase the medication RISPERDAL 2mg, 1 tablet, every night at bedtime to 3mg with the same directions.
- >> Launch ePrescribing
- Select Refill option, modify before signing to 3 mg with same directions
- Confirm the order change
- >> Close ePrescribing returning to Acuitas activEHR

Scenario 8 – (170.315(b)(2))

Patient Jones, Myra - Tasks: Clinical information reconciliation and incorporation (170.315(b)(2))

You have received a CCD from another practice and you need to reconcile the patient's data, thus importing pertinent data into the patient chart.

- Menu item EHR → Meaningful Use → Direct Messaging
- Click 'Receive'
- Review and assess inbound C-CD (Problems, Medications and Allergies)
- Click on each one to determine what you currently have in this patient's file and what is being offered to import
- Once satisfied, Click Reconcile

- Search for patient: Jones, Myra (practice: 005)
- Confirm patient's record has reconciled and data has been consumed?
- Close chart

Scenario 9 – (170.315(a)(9))

Patient A - Tasks: Clinical decision support (170.315 (a)(9))

With this patient being an Alaskan Native, Only certain staff members should be allowed to view 'clinical decision support' for any patient.

- Locate the patient with your current Provider credentials
- Confirm that within the patient's chart you as a Provider have rights to view 'Clinical Decision Support'
- Now, close the chart, using ▼(arrow) on Quit to logout
- Repeat this step with now selecting ▼(arrow) on Quit to re-login
- Locate same patient record with these current staff credentials
- Confirm patient's record no longer displays Clinical Decision Support alerts
- Close chart

Test Procedure

The test scenarios were moderated by an experienced usability specialist. The moderator gave each participant a brief explanation of what they could expect in the test, read through each task and scenario to the end-user and tracked comments and behavior during the session. Participants were instructed that they could ask for clarification along the way and were able to refer to a printed copy of the task. Task timing began at the point that the task had begun and ended once the participant had completed that task. Following the test scenario, the participant was asked the level of difficulty, task rating and for improvements and assessments. Metric information was recorded into a report following the testing.

Test Location

Testing was conducted virtually with remote participants using GoToMeeting application including session recording. The tests were completed in a quiet location with minimal background disturbance.

Test Environment

The intended facility would be an optometric practice where eye health examinations are recorded and used in a clinical setting. Testing was conducted on window desktops used with a standard keyboard and mouse for input. When Acuitas activEHR version 2.1 application was used, it was being accessed on Internet Explorer. Acuitas activEHR application being used was isolated environment via RDP access. The system performance during the testing is reflected of what would be experience in a day to day practice environment.

Test Forms and Tools

GoToMeeting application was used for all participants along with GoToMeeting's recording feature.

Usability Metrics

The usability metrics captured during the test were based on the NIST Guide to the Process Approach for Improving the Usability of Electronic Health Records. These metrics include effectiveness, efficiency and satisfaction. Effectiveness was measured by tracking success of task and error rates. Efficiency was measured through task time and deviations. Satisfaction was measured with feedback.

Effectiveness

Columns	Rational and Scoring
Task Success	When the user was able to complete the task
Task Failures	If the participant abandoned the task
Task Deviations	If deviated but ultimately accomplished the task, it was marked as success

Efficiency

Columns	Rational and Scoring
Task Time	Task time was measured with a stop watch for each task based on when the user first began a task to when the user finished the task. An average task time was measured at a task level. Task deviation was recorded to measure the amount of deviation from the optimal or quickest path through the task.

Satisfaction

Columns	Rational and Scoring
Task Rating	Participant's subjective impression of the ease of use of the application was measured by a post-task question. After the test the participant was asked to rate each task level of difficulty based on J. Sauro, Measuring Usability with the System Usability Scale (SUS).

Results

Data Analysis and Reporting

The usability testing results for Acuitas activEHR are detailed below. The results were measured based on the explanations in the 'Usability Metrics' section above.

Analysis (Task Averages)

Task	Success Rate	Number/Type of Errors	Task Time (seconds)	Standard Deviation (seconds)
Record demographics	100%	1: Had trouble using DOB calendar	224	+1.84
View demographics	100%	0	36	+0.05
Change demographics	100%	0	43	+3.0
View Medication	100%	0	55	+4.0
Record Medication	100%	2: Had trouble finding ePrescribing button 1: Returning to EMR option missed, hence inbound data trigger missed	168	+15.0
Change Medication	100%	0	49	+4
View Medication List (active and historical)	100%	0	55	+4.0
View lab orders	100%	0	30.5	+5.0
Record lab orders	100%	3: Accidentally selected Results instead of Orders	77.5	+10.0
Change lab orders	100%	0	16.5	+3.5
View lab results	100%	0	16	+4
View radiology order	100%	0	80	+4
Record radiology order	100%	0	72	+2
Change radiology order	100%	0	16	+1

View medication allergies (current and historical)	100%	0	55	+4.
Add Medication Allergy	100%	0	110	+5
Change Medication Allergy	100%	0	10	
Drug-Drug interaction checking	100%	0	35	+5
Drug-Allergy interaction checking	100%	0	35	+5
Changing Severity Level of Drug-Drug interaction shown	100%	7: Difficulty in finding Admin option button	300	+25.0
View Problem List	100%	0	12	0
Record Problem	100%	0	57	+2
Change Problem	100%	0	17	+1
Send prescription electronically and verify changes	100%	0	140	+7.0
View implantable device list	100%	0	34	0
Record implantable device	100%	1: Difficulty entering lengthy barcode	50	+10
Change implantable device	100%	0	5	+0.2
C-CDA reconciliation and incorporation	100%	1: Difficulty understanding reconcile process	168	+7
Clinical Decision Support	100%	0	70	+2.5

Analysis (Participant)

User ID	Success Rate	Number/Type of Errors	Verbalizations/Recommendations	Standard Deviation (seconds)	Avg Task Time (seconds)	SUS Rating
01_RB	100%	1: Had trouble using DOB calendar	Recommended to assess calendar offered	+20.5	224	87.5
02_KG	100%					87.5
03_TG	100%	1: Found consuming C-CDA a bit cumbersome	No recommendations, but felt it to be cumbersome	+33	168	82.5

04_JL	100%					87.5
05_BC	100%	1: Selected wrong button when attempting to prescribe a drug	No recommendations, commented on unfamiliarity with screen only	+15.0	168	87.5
06_BA	100%	2: Selected wrong button when logging into ePrescribing and returning to EMR	None	+5.0	140	75.0
07_EN	100%		No recommendations, commented on unfamiliarity with screens			87.5
08_ML	100%	1: Had trouble using within ePrescribing calendar	Instead of three distinct fields (MM, DD, CCYY) recommended a unified date calendar	+20.5	224	87.5
09_JL	100%	1: Accidentally selected Results instead of Orders	No recommendations, commented on unfamiliarity with screen only	+3.0	16	87.5
10_EJ	100%	1: Reconcile function displayed message that participant was in wrong practice	None, unfamiliarity with screens was main feedback	+7.0	168	67.5

Effectiveness

100% of the tasks were successfully completed by the participants. There were tasks that involved more effort than others, but even so, every tasks was successfully completed by all of the ten participants. There were no system errors. There was one system message to advising the participant they were in attempting to do a task in another practice other than the one they were logged into to. Eight end-user errors amongst all of the tasks and participants. Most of these end-user errors were due to unfamiliarity with screens, which were all easily noticed and reconciled without effecting the task complete rate.

Efficiency

The average task time for all tasks and all participants was just over 1 minute (69 seconds). The highest deviation from the average time, in regards to a less efficient time as an additional 25 seconds. In addition, the highest deviation in regards to a more efficient time, was a decrease in 15 seconds.

Satisfaction

We abided by the System Usability Scale (SUS) to gauge participant satisfaction. This is a 10 questions weighted scale that scores the application from 0 – 100 being the most usable. The above 'Usability Metrics' section above displays the score for each participant. Calculating the SUS score was performed based on items 1,3,5,7 and 9 contributions is the scale position minus 1. For items 2,4,6,8, and 10 the contribution is 5 minus the scale position, then the sum of the scores multiplied by 2.5, obtaining the overall value of the SUS. Common conventions find that a system with a rating of 68 or higher can be seen as easy to use. Each of our participants were given an SUS questionnaire after testing. The average SUS score amongst the participants was 83.8.

Major Findings

It can be assumed that with a 100% task completion rate, a less than 2.25 minute average task time, and an SUS score of 83.8, the applications are indeed end-user friendly based on the three criteria above that were measured. In addition, there were no critical safety concerns that presented themselves during the test with each participant.

Based on the rate of errors and task times recorded for each task, it can be determined that the most risk prone errors were during selecting a date from the calendar and accessing ePrescribing to prescribe drugs. These tasks had the largest amount of end-user errors and also had larger task times via Dr.First integrated portal. It can be inferred that based on that, those are the most risk prone tasks in the system. However, it is important to note that the errors that occurred during these tasks were all simple end-user errors that were easily and quickly reconcilable and didn't interfere with patient safety.

In all instances where specific safety/risk scenarios were presented, the participants were supplied with accurate guidance and were able to use that information to keep from risking the patient's safety. One example was then the participant was asked to place an order for Lunesta for a patient that had a Lunesta drug allergy. The system effectively displayed 'Allergies and Hypersensitive' list with the critical information and the participant was able to view and avoid a safety issue.

Areas for Improvement

Although the application measured well in regards to efficiency, effectiveness, and satisfaction of participants, there is always room for improving the workflow for the end-user. A few of the participants made recommendations throughout their recorded sessions. Some of these recommendations include improving the calendar offered to select a date.

That being said, the application overall performed very well in the three areas being measured: efficiency, effectiveness, and satisfaction. We at Ocuco take pride in these results and the user-centered design and safety-enhanced design that our application incorporates.

Dennis Ball, CTO Canada

Date 8/18/2017