

Electronic Health Record (EHR) Usability Test Report of UroChartEHR Version 7.7

Report applies to:

- 170.315 (a)(1) Computerized provider order entry – medications
- 170.315 (a)(2) Computerized provider order entry – laboratory
- 170.315 (a)(3) Computerized provider order entry – 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

Report based on NIST 7741 Guide to the Processes Approach for Improving the Usability of Electronic Health Records.

UroChartEHR Version 7.7

Date of Usability Test: February 6th – March 1st

Date of Report: 3/13/2017

Report Prepared by: UroChartEHR Product Management and AmerisourceBergen Provider Solutions Group Customer Experience Teams
Mike Sullivan, Customer Experience Product Manager
Michael.sullivan@absg.com
3101 Gaylord Parkway
Frisco, TX 75034

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Executive Summary

Date of Usability Test: February 6th – March 1st

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Usability tests of UroChartEHR version 7.7 Urology electronic health record (EHR) were conducted from February 6th through March 1st 2017 in Frisco, Texas by the AmerisourceBergen Provider Solutions Customer Experience team. The purpose of these tests was to test and validate the usability of the current user interface and provide evidence of usability and learnability. During the usability test, 12 participants with varying backgrounds from physicians, nurses, clinical business coaches, and product quality specialists with and without prior experience used the UroChartEHR in simulated, but representative, tasks.

During the 60 to 90 minute one-on-one usability test, each participant was greeted by the moderator who introduced the test and instructed participants to complete a series of tasks provided through the Morae usability software. During the testing, the individual tasks were timed electronically through the usability software. The administrator did not give the participant assistance in how to complete the task, but did provide prompting to the user when deemed necessary to gain further knowledge in areas where the participant was struggling with a task. Participant screens, head shots (when available), and audio were recorded for subsequent analysis.

The following types of data were collected for each participant:

- Number of tasks successfully completed
- Number of tasks completed with prompting
- Number of tasks failed to complete
- Time to complete each task
- Participant's rating of each task from difficult to easy
- Participant's satisfaction ratings of the system (SUS)
- Participant's verbalizations

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 system usability scale (SUS) questionnaire. Various recommended metrics, in accordance with the examples set forth in the NIST 7741 Guide to the Processes Approach for Improving the Usability of Electronic Health Records, were used to evaluate the usability of UroChartEHR. (See the [Data Scoring section](#) of this report).

Introduction

The UroChartEHR System is a urology-specific EHR built to maximize efficiencies. Constructed as a solution to the shortfall of generic EHR solutions for urology practices, UroChartEHR, which was designed by a urologist, is based on the principle that urology-specific interfaces result in better patient care. Built around the workflow of a urology practice, UroChartEHR enables physicians and staff to avoid having to search through non-urology content or build content from scratch.

Method

Participants

A total of 12 participants were tested. Selected participants were physicians, nurses, practice administrator, clinical business coaches, and quality program specialists. Participants were recruited by the AmerisourceBergen Provider Solutions Customer Experience team. In addition, participants had no direct connection to the development of UroChartEHR. Specific emphasis was placed on inexperienced users to help understand the initial learnability and discoverability of the application to help reduce training and support calls, and to improve the overall usability of UroChartEHR.

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 the [Appendices](#).

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

ID	Gender	Age Range	Occupation/Role	Professional Experience	Product Experience*
101	Male	45-54	Urology Physician	10 or More Years	Intermediate
102	Male	45-54	Director	10 or more years	Novice
103	Female	45-54	Client Engagement Manager	1-3 years	Fundamental Awareness
104	Male	25-34	Client Engagement Manager	1-3 years	Fundamental Awareness
105	Female	45-54	Nurse/Customer Transition	10 or more years	None
106	Male	45-54	Oncology Nurse/Director	10 or more years	None
107	Female	45-54	Nurse/Product Owner Patient Engagement/Care Plans	4-6 Years	None
108	Male	45-54	Practice Administrator/Business Coach	1-3 Years	None
109	Female	25-34	Nurse Practitioner/Director of Quality Programs	less than 6 months	None
110	Male	55-64	Physician/VP Medical Affairs and Policy	1-3 Years	Novice
111	Female	45-54	Project Manager III/Scrum Master	1-3 years	None
112	Female	55-64	Nurse/Senior Director, Quality Programs	10 or more years	None

[*See Appendix 4: UroChartEHR Product Experience Definitions](#)

Twelve participants were recruited and participated in the usability test. Participants were scheduled for 90-minute sessions with 30 minutes in-between each session for the moderator 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.

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 UroChartEHR. This testing can serve as both a means to record or benchmark current usability, but also to identify areas where improvements can be made.

During the test, each participant accessed UroChartEHR through either a Web-meeting or a computer in our usability test lab with the same instructions provided by the usability software. 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
- Number of tasks completed with prompting by moderator
- Number of tasks failed to complete
- Time to complete the tasks
- Participant's verbalizations (comments)
- Individual task ratings from very difficult to very easy
- Participant's satisfaction ratings of the system (SUS)

Additional information about the various measures can be found in Usability Metrics Section

Procedures

Upon arrival or successful connection to the Web-meeting, participants were greeted by the moderator and assigned a patient for the test. The moderator gave each participant an introduction to the test and explained how the test would be performed. (See [Appendix 2 Moderator Guide](#)). A verbal ok was provided to record the audio and screen during the test. The moderator collected task times, post-task rating data, and system usability scale data through the usability software. Additional qualitative data was collected through review of the audio and screen capture of each test participant where comments, observations, enhancement recommendations, and video clips were taken to provide product managers and development teams with necessary data to determine and prioritize possible new features and enhancements. Without assistance, administrators were allowed to prompt and ask for clarification on tasks, but not provide instructions on use. Participants were instructed to perform the tasks (see task descriptions below).

Tasks

The following tasks were developed to be realistic and representative of the kinds of activities a user might perform in UroChartEHR:

Task 1:

- Find the patient and review their demographic information in the system.
 - Make the following updates to the patient's demographics.
 - **Ethnicity:** Change to "Panamanian."
 - **Race:** Add "Filipino" to existing Race.
 - **Preferred Language:** Add "Tagalog" as the patient's preferred language.

Task 2:

- Import the **CCDA "Continuity of Care"** file to the patient chart.
File Location - C:\CCDA xml\John Williams Discharge Summary.xml
- Reconcile the **"Continuity of Care"** information with the patient chart.
- Add the following to the patient chart:
 - **Problems**
 - Benign Essential hypertension
 - Family HX Malignancy Bladder
 - Incomplete Bladder Emptying
 - Urgency of Urination
 - **Allergies**
 - Peritoneal dialysis Soln 48...
 - **Medications**
 - Lipitor
 - Lotensin HCT

Task 3:

- View the **CCDA "Continuity or Care"** from the patient's chart.

Task 4:

- Find the patient's problem list and verify the list is properly updated:
 - Add diagnosis of **Overactive Bladder**.

- Discontinue the diagnosis of **Kidney Stone**.

Task 5:

- The patient has a surgically implanted device in their leg and has provided you with the unique device identifier (UDI) (01)H67904003348S0(11)141231(17)150707(10)A213B1(21)8551234
- **Add** this device to the patient's chart with an **Add Device date** of **1/1/2015**.

Task 6:

- Begin an office visit for the patient.

Task 7:

- Review the patient's **medication allergy** list.
- Indicate that you have **reviewed** the medication allergy list.

Task 8:

- Enter a medication allergy of **Floxin** for the patient with a Reaction to the medication as **Headache** and a **Severity** of **Severe**. Enter the **Onset Date for the Allergy** as **today**.

Task 9:

- Find the **medication list** for the patient.
 - Review the patient's medication list.
 - Indicate that you have reviewed the medication list.

Task 10:

- Add a historical medication that another doctor prescribed of **Percocet 5mg- 325 mg tablet** for the patient.

Task 11:

- Discontinue the drug **Lipitor 10mg** for the patient. Enter the discontinue reason for the medication as **Course Complete**.

Task 12:

- View the **Discontinued Medications** for the patient.

Task 13:

- Prescribe the drug **Coumadin 2mg tablet** for the patient as part of the medical record.
- Respond to the Drug Interaction check with **Benefits Outweigh Risks**.

Task 14:

- Prescribe the drug **Amoxicillin** for the patient.
- Respond to the **Drug-Allergy** interaction check with **Pt. Tolerated Med Previously**.

Task 15:

- Electronically prescribe the drug **Enablex 15mg tablet, extended release 24hr** for the patient.

Task 16:

- The system provides clinical decision support. Locate the **Clinical Recommendations or Guidelines** that have been triggered for your patient.

Task 17:

- Order a **Fecal Occult Blood Test (FOBT)** for the patient with a **Diagnosis of Family History of Colonic Polyps** and an **Order Date of today**.

Task 18:

- Order an **Abdomen MRI** test for the patient with a diagnosis of **Abdominal Pain Unspecified**, Contrast of - **With and Without Contrast**, Type of Contrast - **IV Contrast**, and an **order date of today**.

Task 19:

- Find the **orders** on the patient chart and view one of the orders.

Each task was provided to the participant through the usability software. Task timing began once the participant finished reading the task and clicked the **Start Task** button. The task time was stopped once the participant had completed, or failed to complete, the task and the moderator

had indicated to move on to the next task. The end of the task was indicated by the participant clicking the **End Task** button. Scoring is discussed below in the [Data Scoring section](#).

Following each task, the participant was asked to rate each task from 1, being very difficult, to 5, being very easy. Each participant was asked to complete a post-test System Usability Scale questionnaire. ([See Appendix 3: SUS Questionnaire](#)) and thanked for their participation. Participants' demographic information was recorded in a spreadsheet. Task success, task failures, time on task, verbal responses, observations, enhancement recommendations, individual task ratings, and post-test questionnaire results were recorded in the usability software.

Test Environment

UroChartEHR is typically used in a Urology office or facility. For purposes of this test, it was conducted in a conference room set up with a designated testing computer, 17 inch monitor, full keyboard, Windows 7 Professional operating system, with the latest version of UroChartEHR installed and accessed through a Parallels remote access client on a WAN connection. The UroChartEHR environment was set up with a test database that included 10 patients and 10 physicians with the ability to refresh the data after each test. CCDA data files were loaded in the test environment for the participants to complete a specific task. The system performance was representative of what actual users would experience in an office implementation. Each participant was assigned a specific patient and physician. Ten of the 12 participants connected through the Web-meeting and were passed keyboard and mouse control of the testing computer to complete the tasks. The remaining 2 participants had direct access to the testing computer.

Only the participant and administrator were in the test room. All observers were in another room or joined the web-meeting with the phone muted. The participant's interaction with UroChartEHR was captured and recorded digitally with Morae usability software running on the test machine. A web camera (when available) recorded participant's facial expressions synced with the screen capture, and verbal comments were recorded with a microphone.

Test Forms and Tools

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

1. Morae Usability Software version 3.3.4
2. Moderator's Guide
3. Post-test Questionnaire
4. Software Usability Scale (SUS)

Participant Instructions

I will explain a little about how the test will work. The test will take about 1 hour to complete. Instructions for each task will be displayed at the top of the screen. To begin the test, click the **Start** button. This will display the instructions for the first task. Please read the instructions out loud and when you are ready to begin the task, click the **Start Task** button. If you need to see the instructions again, click the **Show Instructions** button; to hide them, click the **Hide Instructions** button. When you have completed the task, click the **End Task** button and the instructions for the next task will be displayed. To begin the next task, click the **Start Task** button. At the end of each task you will be asked to rate each on a scale of "1 - very difficult to 5 - very easy." After you have completed the last task, you will be asked to complete a brief 10 question survey. After you have completed the survey, the test is complete. Please click the **OK** button to complete the test.

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 UroChartEHR by measuring participant success rates
2. Efficiency of UroChartEHR by measuring the average task time
3. Satisfaction with UroChartEHR by measuring ease of use ratings

Data Scoring

Usability	Description
Effectiveness: Task Completed	<p>A task was counted as “Completed” if the participant was able to achieve the correct outcome without prompting. The total number of “Completed” 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>
Effectiveness: Task Completed with Prompting	<p>A task was counted as “Completed with Prompting” if the participant was able to achieve the correct outcome with prompting from the moderator without the moderator providing specific assistance on how to complete the task. The total number of “Completed with Prompting” 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>
Effectiveness: Task Failures	<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 “Failed to Complete.” The total number of “Failed to Complete” 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>
Efficiency: Time on Task	<p>Amount of time it took for a participant to complete a specific task as well as the average of the task time of all participants. Provided as a time in seconds with an average and standard deviation. Only Tasks marked as “Completed” or Completed with Prompting” were included in this measure.</p>
Satisfaction: Task Rating	<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. Common convention is that average ratings for systems judged easy to use should be 3.3 or above. Provided as a number with an average (mean) and standard deviation. To measure participants’ confidence in, and likeability of, UroChartEHR overall, a System Usability Scale (SUS) post-test questionnaire was administered. (See Appendix 3: SUS Questionnaire)</p>

Results

Data Analysis and Reporting

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above. Participants who failed to follow session and task instructions had their data excluded from the analyses.

Participant 112's data has been excluded from the quantitative data as the data was lost due to a technical issue with the testing computer. Qualitative data, however, was still able to be collected for the participant.

The usability testing results for UroChartEHR are detailed below. The results should be seen in light of the objectives and goals outlined in the [Study Design Section](#). The data should yield actionable results that, if corrected, yield material, positive impact on user performance.

Tasks	Measures						
	Participant #	Task Success	Time on Task in Seconds	Task Deviation - Observed	Task Time Deviation from Optimal in Seconds	Errors	Task Ratings 1 = Very Difficult / 5 = Very Easy
Task 1: Find the patient and review their demographic information in the system. <ul style="list-style-type: none"> • Make the following updates to the patient's demographics. <ul style="list-style-type: none"> • Ethnicity: Change to "Panamanian" • Race: Add "Filipino" to existing Race • Preferred Language: Add "Tagalog" as the patient's preferred language 	101	Completed	185	22	60	0	5
	102	Completed	235	24	110	0	3
	103	Failed to complete	342	21		1	4
	104	Failed to complete	156	22		1	4
	105	Completed with prompting	351	21	226	1	4
	106	Failed to complete	219	21		1	4
	107	Completed with prompting	492	21	367	1	2
	108	Completed with prompting	311	20	186	1	3
	109	Completed	211	20	86	0	4
	110	Failed to complete	116	20		1	4
	111	Failed to complete	162	20		1	3
		27.27% - Completed	Mean: 253	Mean: 21.09	Mean: 173	Mean: 72.73%	Mean: 3.64
		27.27% - Completed w/prompting	SD: 111	SD: 1.22	SD: 114	SD: 46.71%	SD: 0.81
		45.45% - Failed to complete		Optimal Steps - 20	Optimal - 125		
	54.55% - Mean						
	10.50% - SD						

Task 2: Import the CCDA "Continuity of Care" file to patient chart File Location - C:\CCDA xml\Discharge Summary.xml • Reconcile the "Continuity of Care" information with the patient chart • Add the following to the patient chart: • Problems <ul style="list-style-type: none"> • Benign Essential hypertension • Family HX Malignancy Bladder • Incomplete Bladder Emptying • Urgency of Urination • Allergies <ul style="list-style-type: none"> • Peritoneal dialysis Soln 48... • Medications <ul style="list-style-type: none"> • Lipitor • Lotensin HCT 	101	Failed to complete	466	15		1	2
	102	Completed with prompting	204	9	114	1	2
	103	Failed to complete	779	9		1	3
	104	Completed with prompting	408	11	318	1	3
	105	Failed to complete	949	11		1	1
	106	Completed with prompting	489	9	399	1	3
	107	Completed with prompting	423	8	333	1	2
	108	Completed with prompting	873	8	783	1	1
	109	Completed with prompting	283	9	193	1	3
	110	Completed with prompting	244	7	154	1	2
	111	Completed with prompting	796	8	706	1	2
		0% - Completed	Mean: 538	Mean: 9.45	Mean: 375	Mean: 100.00%	Mean: 2.22
		72.73% - Completed w/prompting	SD: 266	SD: 2.21	SD: 248	SD: 0.00%	SD: 0.83
		27.27% - Failed to complete		Optimal Steps - 7	Optimal - 90		
	72.73% - Mean						
	36.74% - SD						

Task 3: View the CCDA "Continuity or Care" from the patient's chart	101	Completed	17	3	-3	0	5
	102	Completed	46	3	26	0	4
	103	Completed	60	3	40	0	3
	104	Completed	30	3	10	0	5
	105	Completed with prompting	303	5	283	1	3
	106	Completed with prompting	137	4	117	1	5
	107	Completed	83	3	63	0	3
	108	Completed with prompting	119	3	99	1	5
	109	Completed with prompting	182	4	162	1	3
	110	Completed with prompting	112	4	92	1	2
	111	Completed with prompting	246	4	226	1	2
		45.45% - Completed	Mean: 121	Mean: 3.55	Mean: 101	Mean: 54.55%	Mean: 3.64
		54.55% - Completed w/prompting	SD: 91	SD: 0.69	SD: 91	SD: 52.22%	SD: 1.21
		0% - Failed to completed		Optimal Steps - 3	Optimal - 20		
	100% - Mean						
	29.22% - SD						

Task 4: Find the patient's problem list and verify the list is properly updated: <ul style="list-style-type: none"> Add diagnosis of Overactive Bladder. Discontinue the diagnosis of Kidney Stone 	101	Failed to complete	101	12		1	4
	102	Completed with prompting	288	14	163	1	1
	103	Completed with prompting	372	12	247	1	2
	104	Failed to complete	451	14		1	2
	105	Failed to complete	653	15		1	1
	106	Completed with prompting	675	12	550	1	2
	107	Completed with prompting	302	11	177	1	2
	108	Failed to complete	839	13		1	3
	109	Completed with prompting	261	12	136	1	3
	110	Completed with prompting	120	11	-5	1	4
	111	Completed with prompting	680	12	555	1	2
		0% - Completed	Mean: 431	Mean: 12.55	Mean: 260	Mean: 100.00%	Mean: 2.36
		63.64% - Completed w/prompting	SD: 248	SD: 1.29	SD: 213	SD: 0.00%	SD: 1.03

36.36% - Failed to complete	Optimal Steps - 11	Optimal - 125
63.64% - Mean		
31.93% - SD		

Task 5 The patient has a surgically implanted device in their leg and has provided you with the unique device identifier (UDI) (01)H6790400334850(11)141231(17)150707(10)A213B1(21)8551234 <ul style="list-style-type: none"> Add this device to the patient's chart with an Add Device date of 1/1/2015 	101	Completed	70	7	32	0	4
	102	Completed with prompting	125	7	87	1	2
	103	Completed with prompting	276	7	238	1	4
	104	Failed to complete	392	11		1	2
	105	Failed to complete	437	8		1	1
	106	Completed with prompting	759	10	721	1	3
	107	Completed with prompting	350	7	312	1	2
	108	Completed with prompting	198	7	160	1	4
	109	Completed with prompting	122	6	84	1	4
	110	Completed with prompting	180	6	142	1	2
	111	Completed with prompting	584	8	546	1	1
		9.09% - Completed	Mean: 317	Mean: 7.64	Mean: 258	Mean: 90.91%	Mean: 2.64
		72.73% - Completed w/prompting	SD: 214	SD: 1.57	SD: 1.57	SD: 30.15%	SD: 1.21

18.185 - Failed to complete	Optimal Steps - 6	Optimal - 38
81.82% - Mean		
34.42% - SD		

Task 6: Begin an office visit for the patient.	101	Completed	15	0	-10	0	5
	102	Completed	26	0	1	0	5
	103	Completed with prompting	142	0	117	1	4
	104	Completed	36	0	11	0	5
	105	Completed	103	0	78	0	5
	106	Completed	25	0	0	0	5
	107	Completed	19	0	-6	0	4
	108	Completed	5	0	-20	0	5
	109	Completed	40	0	15	0	5
	110	Completed	16	0	-9	0	5
	111	Completed with prompting	266	0	241	1	2
	81.82% - Completed		Mean: 63	Mean: 0.00	Mean: 37.95	Mean: 18.18%	Mean: 4.55
	18.18% - Completed w/prompting		SD: 79	SD: 0.00	SD: 79.39	SD: 40.45%	SD: 0.93
	0% - Failed to complete			Optimal Steps - 6	Optimal - 25		
100% - Mean							
42.96% - SD							

Task 7: Review the patient's medication allergy list • Indicate that you have reviewed the medication allergy list.	101	Completed	10	3	5	0	5
	102	Completed	11	3	6	0	5
	103	Completed	29	3	24	0	5
	104	Completed	32	3	27	0	5
	105	Completed with prompting	52	3	47	1	5
	106	Completed	83	3	78	0	5
	107	Completed	15	3	10	0	5
	108	Completed	20	3	15	0	5
	109	Completed	17	3	12	0	5
	110	Completed	20	3	15	0	5
	111	Completed	69	3	64	0	3
	90.91% - Completed		Mean: 33	Mean: 3.00	Mean: 28	Mean: 9.09%	Mean: 4.82
	9.09% - Completed w/prompting		SD: 25	SD: 0.00	SD: 25	SD: 30.15%	SD: 0.60
	0% - Failed to complete			Optimal Steps - 3	Optimal - 5		
100% - Mean							
50.07% - SD							

Task 8:								
Enter a medication allergy of Floxin for the patient.		101	Completed	40	5	8	0	4
• With a Reaction to the medication as Headache and Severity of Severe .		102	Completed	117	6	85	0	3
• Enter the Onset Date for the Allergy as today		103	Completed with prompting	238	6	206	1	4
		104	Completed with prompting	108	5	76	1	4
		105	Completed	93	5	61	0	5
		106	Completed	83	5	51	0	5
		107	Completed	93	5	61	0	4
		108	Completed	53	5	21	0	5
		109	Completed	78	5	46	0	5
		110	Completed	64	5	32	0	4
		111	Completed	337	6	305	0	2
			81.82% - Completed	Mean: 119	Mean: 5.27	Mean: 87	Mean: 18.18%	Mean: 4.09
			18.18% - Completed w/prompting	SD: 89	SD: 0.47	SD: 89	SD: 40.45%	SD: 0.94
			0% - Failed to complete		Optimal Steps - 5	Optimal - 32		
			100% - Mean					
			42.96% - SD					

Task 9								
Find the medication list for the patient.		101	Completed	14	4	9	0	5
• Review the patient's medication list.		102	Completed	11	4	6	0	5
• Indicate that you have reviewed the medication list.		103	Completed	27	4	22	0	5
		104	Completed	35	4	30	0	5
		105	Completed	16	4	11	0	5
		106	Completed	14	4	9	0	5
		107	Completed	19	4	14	0	5
		108	Completed	14	4	9	0	5
		109	Completed	10	4	5	0	5
		110	Completed	12	4	7	0	5
		111	Completed	81	4	76	0	3
			100% - Completed	Mean: 22	Mean: 4.00	Mean: 18	Mean: 0.00%	Mean: 4.82
			0% - Completed w/prompting	SD: 22	SD: 0.00	SD: 21	SD: 0.00%	SD: 0.60
			0% - Failed to complete		Optimal Steps - 4	Optimal - 5		
			100% - Mean					
			57.74% - SD					

Task 10 Add a historical medication that another doctor prescribed of Percocet 5mg- 325 mg tablet for the patient.	101	Completed with prompting	111	5	76	1	3
	102	Completed	38	5	3	0	4
	103	Completed	49	5	14	0	5
	104	Completed	76	5	41	0	5
	105	Completed	43	5	8	0	5
	106	Completed	116	5	81	0	4
	107	Completed with prompting	98	5	63	1	4
	108	Completed	59	5	24	0	5
	109	Completed	37	5	2	0	5
	110	Completed	48	5	13	0	5
	111	Completed	75	5	40	0	3
	81.82% - Completed		Mean: 68	Mean: 5.00	Mean: 33	Mean: 18.18%	Mean: 4.36
	18.18% - Completed w/prompting		SD: 29	SD: 0.00	SD: 29	SD: 40.45%	SD: 0.81
	0% - Failed to complete			Optimal Steps - 5	Optimal - 35		
100% - Mean							
42.96% - SD							

Task 11: Discontinue the drug Lipitor 10mg for the patient. • Enter the discontinue reason for the medication as Course Complete.	101	Completed	10	6	-20	0	5
	102	Completed	154	7	124	0	1
	103	Failed to complete	213	8		1	1
	104	Completed with prompting	46	6	16	1	5
	105	Completed	86	6	56	0	4
	106	Failed to complete	389	7		1	1
	107	Completed with prompting	288	6	258	1	2
	108	Completed with prompting	315	7	285	1	3
	109	Completed	46	6	16	0	4
	110	Completed	27	6	-3	0	5
	111	Completed with prompting	185	7	155	1	3
	45.45% - Completed		Mean: 160	Mean: 6.55	Mean: 99	Mean: 54.55%	Mean: 3.09
	36.36% - Completed w/prompting		SD: 130	SD: 0.69	SD: 114	SD: 52.22%	SD: 1.64
	18.18% - Failed to complete			Optimal Steps - 6	Optimal - 30		
81.82% - Mean							
13.89% - SD							

Task 12: <ul style="list-style-type: none"> View the Discontinued Medications for the patient. 	101	Completed	6	5	-18	0	5
	102	Completed	24	5	0	0	3
	103	Completed with prompting	83	5	59	1	3
	104	Completed	35	5	11	0	4
	105	Completed with prompting	288	7	264	1	3
	106	Failed to complete	149	5		1	1
	107	Completed	34	5	10	0	3
	108	Completed	10	5	-14	0	5
	109	Completed	20	5	-4	0	5
	110	Completed	13	5	-11	0	5
	111	Completed	9	5	-15	0	4
		72.73% - Completed	Mean: 61	Mean: 5.18	Mean: 28	Mean: 27.27%	Mean: 3.73
		18% - Completed w/prompting	SD: 87	SD: 0.60	SD: 86	SD: 46.71%	SD: 1.27
		9.09 - Failed to complete		Optimal Steps - 5	Optimal - 24		
	90.91% - Mean						
	34.42% - SD						

Task 13: <ul style="list-style-type: none"> Prescribe the drug Coumadin 2mg tablet for the patient as part of the medical record. Respond to the Drug-Allergy Interaction check with Benefits Outweigh Risk 	101	Completed	48	7	-8	0	5
	102	Completed	24	7	-32	0	2
	103	Failed to complete	262	7		1	3
	104	Completed with prompting	133	7	77	1	4
	105	Completed with prompting	255	7	199	1	3
	106	Completed with prompting	537	8	481	1	3
	107	Completed	163	7	107	0	3
	108	Completed	216	7	160	0	5
	109	Completed	144	7	88	0	5
	110	Completed	97	7	41	0	4
	111	Completed	135	8	79	0	3
		63.64% - Completed	Mean: 183	Mean: 7.18	Mean: 119	Mean: 36.36%	Mean: 3.64
		27.27% - Completed w/prompting	SD: 140	SD: 0.40	SD: 145	SD: 50.45%	SD: 1.03
		9.09% - Failed to complete		Optimal Steps - 7	Optimal - 56		
	90.91% - Mean						
	27.77% - SD						

Task 14: <ul style="list-style-type: none"> Prescribe the drug Amoxicillin for the patient. Respond to the Drug-Allergy interaction check with Pt. Tolerated Med Previously. 	101	Completed	49	9	-26	0	5
	102	Completed	54	9	-21	0	2
	103	Failed to complete	108	9		1	4
	104	Completed with prompting	186	9	111	1	2
	105	Completed with prompting	223	9	148	1	3
	106	Completed with prompting	160	9	85	1	4
	107	Failed to complete	314	10		1	2
	108	Completed with prompting	169	9	94	1	4
	109	Completed	93	9	18	0	5
	110	Completed	76	9	1	0	5
	111	Failed to complete	169	9		1	2
	36.36% - Completed		Mean: 146	Mean: 9.09	Mean: 51	Mean: 63.64%	Mean: 3.45
	36.36% - Completed w/prompting		SD: 80	SD: 0.30	SD: 66	SD: 50.45%	SD: 1.29
	27.27% - Failed to complete			Optimal Steps - 9	Optimal - 75		
72.73% - Mean							
5.25% - SD							

Task 15: <ul style="list-style-type: none"> Electronically prescribe the drug Enblex 15mg tablet, extended release 24hr for the patient. 	101	Completed	25	6	-50	0	5
	102	Completed	97	6	22	0	4
	103	Completed	94	6	19	0	4
	104	Completed	70	6	-5	0	5
	105	Completed	108	6	33	0	5
	106	Completed	82	6	7	0	5
	107	Completed	68	6	-7	0	4
	108	Completed	45	6	-30	0	5
	109	Completed	57	6	-18	0	5
	110	Completed	28	6	-47	0	5
	111	Failed to complete	106	6		1	3
	90.91% - Completed		Mean: 71	Mean: 6.00	Mean: -7	Mean: 9.09%	Mean: 4.55
	0% - Completed w/prompting		SD: 29	SD: 0.00	SD: 29	SD: 30.15%	SD: 0.69
	9.09% - Failed to complete			Optimal Steps - 6	Optimal - 75		
90.91% - Mean							
50.07% - SD							

Task 16: The system provides clinical decision support locate the Clinical Recommendations or Guidelines that have been triggered for your patient	101	Completed with prompting	179	8	169	1	2
	102	Completed	65	2	55	0	2
	103	Failed to complete	89	3		1	1
	104	Failed to complete	141	3		1	2
	105	Failed to complete	253	3		1	1
	106	Failed to complete	318	5		1	1
	107	Completed with prompting	306	3	296	1	2
	108	Completed with prompting	259	3	249	1	2
	109	Failed to complete	368	3		1	1
	110	Completed with prompting	177	4	167	1	2
	111	Failed to complete	140	4		1	1
		9.09% - Completed	Mean: 209	Mean: 3.73	Mean: 187	Mean: 90.91%	Mean: 1.55
		36.36% - Completed w/prompting	SD: 99	SD: 1.62	SD: 92	SD: 30.15%	SD: 0.52
		54.55% - Failed to complete		Optimal Steps - 2	Optimal - 10		
	45.45% - Mean						
	22.88% - SD						

Task 17: <ul style="list-style-type: none"> Order a Fecal Occult Blood Test (FOBT) for the patient with a Diagnosis of Family History of Colonic Polyps and an Order Date of today. 	101	Completed	82	7	32	0	4
	102	Completed with prompting	373	10	323	1	1
	103	Completed with prompting	237	6	187	1	4
	104	Completed with prompting	379	7	329	1	3
	105	Completed with prompting	965	11	915	1	2
	106	Completed with prompting	476	10	426	1	3
	107	Completed with prompting	264	10	214	1	3
	108	Completed	296	6	246	0	4
	109	Completed with prompting	259	9	209	1	3
	110	Completed with prompting	252	5	202	1	1
	111	Failed to complete	313	7		1	1
		18.18% - Completed	Mean: 354	Mean: 8.00	Mean: 308	Mean: 81.82%	Mean: 2.64
		72.73% - Completed w/prompting	SD: 226	SD: 2.05	SD: 2.05	SD: 40.45%	SD: 1.21
		9.09% - Failed to complete		Optimal Steps - 5	Optimal - 50		
	90.91% - Mean						
	34.42% - SD						

Task 18: Order an Abdomen MRI test for the patient with a diagnosis of Abdominal Pain Unspecified , Contrast of - With and Without Contrast , Type of Contrast - IV Contrast , and an order date of today.	101	Completed	27	8	-23	0	5
	102	Completed	60	10	10	0	4
	103	Completed	62	6	12	0	5
	104	Completed	43	7	-7	0	4
	105	Completed	51	11	1	0	5
	106	Completed	73	10	23	0	5
	107	Completed	109	10	59	0	4
	108	Completed	51	6	1	0	5
	109	Completed	40	9	-10	0	5
	110	Completed	48	5	-2	0	5
	111	Failed to complete	119	7		1	1
		90.91% - Completed	Mean: 62	Mean: 8.09	Mean: 6	Mean: 9.09%	Mean: 4.36
		0% - Completed w/prompting	SD: 28	SD: 2.02	SD: 22	SD: 30.15%	SD: 1.21
		9.09% - Failed to complete		Optimal Steps - 8	Optimal - 50		
	90.91% - Mean						
	50.07% - SD						

Task 19: Find the orders on the patient chart and view one of the orders.	101	Completed	20	3	-5	0	5
	102	Failed to complete	55	3		1	4
	103	Completed with prompting	170	5	145	1	2
	104	Completed with prompting	109	4	84	1	3
	105	Completed with prompting	170	5	145	1	3
	106	Completed with prompting	161	5	136	1	5
	107	Completed with prompting	215	5	190	1	3
	108	Completed	42	3	17	0	5
	109	Completed	46	3	21	0	5
	110	Completed	76	3	51	0	3
	111	Failed to complete	10	3		1	3
		36.36% - Completed	Mean: 98	Mean: 3.82	Mean: 87	Mean: 63.64%	Mean: 3.73
		45.45% - Completed w/prompting	SD: 71	SD: 0.98	SD: 70	SD: 50.45%	SD: 1.10
		18.18% - Failed to complete		Optimal Steps - 3	Optimal - 25		
	81.82% - Mean						
	13.89% - SD						

Completed - Total	Completed with prompting - Total	Failed to complete - Total
108	69	32
51.67%	33.01%	15.31%

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks and the selected participants to be: **64**.

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

Discussion of Findings

The results of the usability testing provided several areas for improvements in efficiency and learnability. Screen use, search methods, clinical decision support, clinical information reconciliation, and navigation resulted in several opportunities for improvement.

Effectiveness

The following tasks caused some confusion and hesitation on behalf of the users:

- During the test of Clinical Information Reconciliation many users initially looked for the Clinical Information Reconciliation import process in the context of the patient chart as the document was related to the patient. In order to incorporate the CCDA into the system and perform Clinical Information Reconciliation users were prompted to look for an administrative function. After locating the proper area to import the clinical information documents the actions of choosing the document, clicking the Import button were not intuitive to the users. Once finding the CCDA document to upload and clicking the import button, most users did not know what to do at that point or thought the import process was completed by the import process.
- Most users struggled with the clinical information reconciliation process most users did not see the Plus icons to add the information from the imported document to the selected patient's chart. Many initially noticed the Deny button but the Plus buttons eluded them. Lack of feedback to the users that the process was completed successfully caused several users confusion.
- Clinical Decision Support should be much easier to locate on the screen. The Shield icon used to identify alerts and tasks was not recognized by most of the users. As well, locating Clinical Recommendations under the Chart Management > Tasks was not intuitive for the users. One commenting that "task to me doesn't mean a clinical activity it means a message, phone call, something like that".
- Discontinuing a medication has two different paths with different workflows which confused the users and leaving some unsure if they discontinued the drug correctly.
 - Workflow one: From the Open Office Visit > Medications menu select the drug to be discontinued which opens the historical medication window and click the Discontinued button. Clicking the Discontinued button provided no feedback to the users which caused confusion so most users were unsure what step to take next or if it was completed successfully. To successfully discontinue the drug a Stop and Start date needed to be entered for the drug. However this was not indicated to the user.

- Workflow two: From the Open Office Visit > Medications menu > Click the Medications List header (this was not intuitive to the users) which opened a new window with the Current Medications tab selected by default > select the drug to discontinue > click the Discontinue button which opens a window asking for Reason for Discontinue and enter a Discontinue date.
- Many of the users had difficulty locating the Implantable Devices button once they found the Surgical History screen. Some redesign of the button could help with this issue.

Efficiency

Below is a summary about improvements that would increase efficiency:

- Most of the test participants had difficulty locating the patient's Problem List and Diagnoses. Adding these as initial menu items could help to reduce the confusion and improve the discoverability of the application.
- Searching in the application in most cases required the user to know a category for a medication, diagnosis, lab, patient demographics etc... If the user was unfamiliar with the categories it made it difficult to perform a search for the needed data. Implementing search methods that do not require the user to know or understand categories would remove this confusion.
- Many users did not notice button transitions between the active and inactive states. When viewing documents the View button transition between active and inactive could be more distinct.
- Many buttons look very similar and caused confusion. One example, when writing a new script the Sign & ERX Script, Sign & Print Script and Sign New Script buttons all look very similar. This caused the users some hesitation and confusion when finishing the write new script process. Implementing a color pattern for primary, secondary or tertiary buttons may help to reduce this issue.
- Most users initially attempted to order labs through the Labs menu. After a little scanning of the screen they determined this is where lab results would be entered but could not order labs from here. Consolidation of ordering labs and entering lab results into one area could reduce the confusion and menu items.
- Editing or updating the Race demographic is different than the Ethnicity and Preferred Language which caused some confusion. Editing or updating the Ethnicity and Preferred Language utilizes a drop down menu with a More selection used for searching when needed. The Race selection has a Plus icon and a categorized search method. If the user does not know the category the search method was not helpful causing the user to guess at a category then do a search to find the data. Implementing the same patterns for similar data elements will help to reduce confusion and the learnability of the application.

- During the testing of prescribing a drug in the Write a New Script process several users could not locate the drug in the provided category lists. Most users needed to be prompted to look for a possible search method for the drug. The headers used for category lists are links to search however this only searches in that category if the user does not know the category the search is not much help. As well, the category headers offer no indication that they are clickable. After prompting most of users found and used the Reference List tab to search and find the drugs to prescribe. This pattern removes the user from the current context of a workflow. Most users expected there to be a search in the current workflow and that it should be a global search without the need to know the category.
- List headers as buttons to open the problem list or other areas are not intuitive to most users. Most users needed to be prompted to look for it. One user commented “Without prompting I would never have found the plus thing” referring to the Magnifying Glass with the Plus sign on the header.
- During the order a lab test clicking the Link Codes button was not seen as the next step in the process after selecting the Lab, Diagnosis, Time and Priority. Placing this between the Tabs and Lab order sections may help to indicate this is a required step in the process of ordering a lab.

Satisfaction

Some comments from the customers and suggested opportunities to improve UroChartEHR user satisfaction:

- User comment “Help guide us through the application without driving us nuts”.
- Implementing global search (omnibox) type search methods will help reduce confusion in multiple processes, increase the easy of learning and reduce the cognitive load for the user.
- Increasing the size of the application would allow the use of more white space in the application and the ability to create more intuitive workflows.
- Ability to order labs from a task would remove additional steps when a lab needs to be ordered for a patient.
- Naming of diagnoses by Area, then Problem is not consistent though out application.
- May want to consider bringing the actions such as view next to the items or making the inactive and active buttons states more distinct from one another. There is very little difference between the two states.
- Success and error messages should be more prominent on the screen. Many times during the testing the users missed messages that would have assisted them.

- Many users comments they were looking for a Today button when asked to add date during a test.

Major Findings

- Application would benefit from using the full width of the computer screen or viewport size. This would allow improvements to workflows by having additional screen real estate to work with and enlarging buttons to make them easier to read and scan.
- Multiple windows open caused navigation confusion.
- Headers as clickable links without an indication to what will be available by clicking it caused many users to not find the Problem List or Diagnosis lists.
- Make the Clinical Information Reconciliation process lead the user through the process and provide clear success or error feedback to the user.
- Move CCDA Continuity of Care import process into the patient chart context.
- Global search or omnibox type methods would help reduce the learning curve for new and novice users.
- Different types of search methods and category specific searches (some areas have a search box while others use a magnifying glass icon to open the search method) require users to know a category or area before a successful search can be done.
- Users need to be able to find the patients Problem list easier.
- General Navigation - several users had trouble navigating the many menu items.
- Clinical decision support is not intuitive for the user and should be a proactive process alerting the user and displayed on the screen until a task or recommendation is completed or dismissed.
- Clickable headers as a navigation pattern caused many users confusion.
- Reference Lists are an effective search method but should not be outside of a workflow.

Areas for Improvement

- Allow application to use the full screen or viewport size.
- Create a guided process to reduce the confusion about properly importing and completing the clinical reconciliation process.
- Implement global search (omnibox) methods removing the need to know categories in specific areas to make finding data easier and faster. As well, use the same types of search methods throughout the application.
- Consolidate menu items to reduce the chances of getting lost in the application.
- Create consistent search methods not based on a categories in a workflow.

- Clinical recommendation should be a proactive, interruptive process and forces the user to take action on a recommendation.

Appendices

1. [Participant Screener](#)
2. [Moderator guide](#)
3. [System Usability Scale Questionnaire](#)
4. [UroChartEHR Product Experience Definitions](#)

Appendix 1: Participant Screener

- 1 Pilot Participant
- Total of 15 recruited (minimum of 10 needed)
 - Mix of Physicians/Nurses/Mid-level provider minimum (10 would be preferable in case of no shows and reschedules)
 - Mix of male and female
 - Current UroChartEHR users, non-UroChartEHR users, current users of Meridian.
 - Mix of age ranges and experience levels
 - Must have a basic clinical understanding

What

Our UroChartEHR product team is working to achieve MU3 certification this year and we need your help. This certification will allow UroChartEHR practices to qualify for Medicare and Medicaid EHR incentive programs and payments.

Why

MU3 certification requires proof that the application has a process for usability assessment and shows proof of this assessment being completed.

Who

We need YOU - nurses and clinically savvy resources - to perform the usability study. There are a minimum number of participants required, so your contribution will go a long way towards providing the input needed to meet certification requirements.

How

Participants will be asked to log into UroChartEHR and then follow a few simple scripts to complete several tasks. This is a test of the application - not the person - so there is nothing you can do wrong. You do not need an understanding of urology or of the UroChartEHR application.

When

Openings are available February 6th through March 1st between 8-5pm central and we will schedule around your availability. If you are not local to Frisco but plan on being in Frisco in February, we would love to do the study in person. For those who are remote, we will use WebEx/conference call to complete the work. We estimate the study will take less than 60 minutes to complete.

We recognize how busy everyone is and appreciate you considering helping with this effort. Please take a look at your calendar and let us know if you are able to give an hour of your time to help our UroChartEHR team meet their 2017 goal of MU3 certification. At this time, all time slots are open.

Demographics

1. What experience do you have with UroChartEHR?
 - None - You have never used UroChartEHR.
 - Fundamental Awareness - You have a basic knowledge or an understanding UroChartEHR.
 - Novice - You have the level of experience gained through formal or on-the-job training.
 - Intermediate - You are able to successfully complete tasks in UroChartEHR as required.
 - Advanced - You can perform all tasks in UroChartEHR without assistance.
 - Expert - You are known as an expert with UroChartEHR.

2. What is your age range?
 - 18-24 years old
 - 25-34 years old
 - 35-44 years old
 - 45-54 years old

- 55-64 years old
- 65 or older

3. What is your current job role or occupation?

4. How long have you been in this role or occupation?

- Less than 6 months
- 6 to 12 months
- 1 to 3 years
- 4 to 6 years
- 8 to 10 years
- 10 years or more

Appendix 2: Moderator Guide

Introduction (4 minutes)

Hi, _____. My name is _____, and I'm going to be talking you through the test session today.

First, thank you for taking time to help us today. Before we begin, I am going to take a few minutes to explain a little about what we are doing today.

The UroChartEHR product team is working to achieve MU3 certification. Achieving this certification will allow UroChartEHR practices to qualify for Medicare and Medicaid EHR incentive programs and payments.

As part of the certification, proof is required that the application has a process for usability assessment and that the assessment has been completed.

The first thing I want to make clear right away is that we're testing the application, not you. You can't do anything wrong here. In fact, this is probably the one place today where you don't have to worry about making mistakes.

Also, please don't worry that you're going to hurt our feelings. We're doing this to improve the application as well as get the certification, so we need to hear your honest reactions.

If you have any questions as we go along, please ask them. I may not be able to answer them right away, since we're interested in how people do when they don't have someone to help them. But if you still have questions when we're done, I'll try to answer them then. If you need to take a break at any point, just let me know.

With your permission, we're going to record what happens on the screen and our conversation. The recording will only be used to help us determine how to improve the application, and it won't be seen by anyone except the people working on this project. And it helps me, because I don't have to take as many notes during the test.

If you would, I'm going to ask you to sign a simple permission form for us. It just says that we have your permission to record you, and that the recording will only be seen by the people working on the project.

Do you have any questions so far? [2 minutes]

OK, great. We're done with the questions, and we can begin the tasks.

Before we begin the test

I will explain a little about how the test will work. The test will take about 1 hour to complete. Instructions for each task will be displayed at the top of the screen. To begin the test, click the **Start** button. This will display the instructions for the first task. Please read the instructions out loud and when you are ready to begin the task, click the **Start Task** button. If you need to see the instructions again, click the **Show Instructions** button; to hide them, click the **Hide Instructions** button. When you have completed the task, click the **End Task** button and the instructions for the next task will be displayed. To begin the next task, click the **Start Task** button. At the end of each task you will be asked to rate each on a scale of "1 - very difficult" to "5 - very easy." After you complete the last task, you will be asked to complete a brief 10 question survey. After you complete the survey, the test is complete. Please click the **OK** button to complete the test.

Begin Test (45 minutes)

- Start the Morae screen recorder

So now we're ready to begin the tasks. Please read Task 1 out loud and begin.

Post Test (20 minutes)

- Ask any follow-up/probing questions

Thank you, that was very helpful.

Do you have any questions for me, now that we're done?

Thank the participant; close the call and Web meeting

Appendix 3: System Usability Scale Questionnaire

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

Appendix 4: UroChartEHR Product Experience Definitions

- None - You have never used UroChartEHR.
- Fundamental Awareness - You have a basic knowledge or an understanding UroChartEHR.
- Novice - You have the level of experience gained through formal or on-the-job training.
- Intermediate - You are able to successfully complete tasks in UroChartEHR as required.
- Advanced - You can perform all tasks in UroChartEHR without assistance.
- Expert - You are known as an expert with UroChartEHR