EHR Usability Test Report of Systemedx Clinical Navigator, Version 2017.10

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

Systemedx Clinical Navigator. Version 2017.10

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Report Prepared By: Systemedx Support, Jacob Nelson
256-739-1398
support@systemedx.com

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EXECUTIVE SUMMARY

A usability test of Systemedx Clinical Navigator, Version 2017.10, was conducted on September 22, 2017. 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 clinical healthcare workers with varying job titles matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

This study collected performance data on 12 tasks typically conducted on an EHR:

- 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 120 minute one-on-one usability test, each participant was greeted by the administrator and were instructed that they could withdraw at any time. Participants had prior experience with the EHR. The administrator introduced the test, and instructed participants to complete a series of tasks (given one at a time) using the EHRUT. During the testing, the administrator timed the test and recorded user performance data on paper. The administrator gave the participant minimal 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 types 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. Various recommended metrics, in accordance with the examples set forth in the *NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records*, were used to evaluate the usability of the EHRUT. Following is a summary of the performance and rating data collected on the EHRUT.

Measure 170.315(a)(1) – Computerized Order Entry - medications	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Electronically Record Orders in an Ambulatory Setting	2	2	8/5	200	20/10	15%	3.5
2: Electronically Change Orders in an Ambulatory Setting	2	2	7/5	105	15/10	10%	4
3: Electronically Access Orders in an Ambulatory Setting	1	1	0/1	28	2/5	0%	5

Measure 170.315(a)(2) – Computerized Order Entry - Laboratory	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Electronically Record Orders in an Ambulatory Setting	1	1	2/5	55	5/10	10%	4.2
2: Electronically Change Orders in an Ambulatory Setting	1	1	2/5	33.7	3.7/5	0	4.8
3: Electronically Access Orders in an Ambulatory Setting	1	13.5	0/1	15.5	0.5/5	0	5

Measure 170.315(a)(3) – Computerized Order Entry – Diagnostic Imaging	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Electronically Record Orders in an Ambulatory Setting	2	2	6/5	84	27.1/20	10%	4.25
2: Electronically Change Orders in an Ambulatory Setting	1	1	1/4	29.25	12.75/10	25%	4.8
3: Electronically Access Orders in an Ambulatory Setting	1	1	0/1	21.7	4.92/5	0%	5

Measure 170.315(a)(4) – Drug-drug,Drug-allergy Interaction Checks	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)

1: Automatically and Electronically Indicate Drug-drug Interventions	2	2	1/4	78.25	15.9/15	8%	4.25
2: Automatically and Electronically Indicate Drug-allergy Interventions	2	2	1/4	38.5	7.53/10	0%	4.5
3. Allow/disallow users to adjust Severity Levels of Interactions	4	4	6/6	222.9	67.87/30	12%	4
4. Adjust Severity Level of Interventions Indicated for Drug-drug Interaction Checking	2	2	0/4	90.2	16.7/15	0	4.8

Measure 170.315(a)(5) – Demographics	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Record Demographics	2	2	2/5	226.3	40.99/30	20%	3.9
2: Change Demographics	2	2	0/3	190.5	21.88/30	25%	4.25

Measure 170.315(a)(6) – Problem List	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Record Problem List	2	1.8	6/4	89.4	29/20	8%	4
2: Change Problem List	2	2	7/4	157.3	27.3/20	12%	3.65
3: Access Problem List History	2	2	3/2	37.6	7.6/15	5%	4.6

Measure 170.315(a)(7) – Medication List	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Record Medication List	2	2	8/5	147.5	12.5/20	15%	4
2: Change Medication List	2	2	5/4	97.9	7.9/20	10%	3.7

3: Access Medication List History	2	2	3/3	48.7	8.7/15	10%	4.75

Measure 170.315(a)(8) – Medication Allergy List	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Record Medication Allergy List	2	2	8/5	113.8	6.2/30	15%	4.5
2: Change Medication Allergy List	3	3	6/4	117.3	2.7/20	8%	3.95
3: Access Medication Allergy List History	2	2	2/2	60.6	0.6/15	0	4.8

Measure 170.315(a)(9) – Clinical Decision Support	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Demonstrate that users can be authorized and unauthorized to configure CDS	2	1.9	2/5	64.6	4.6/10	15%	4.1
2: Trigger a CDS Intervention Interaction on one item	2	2	6/4	179.6	29.6/20	40%	3.4
3: Trigger a CDS Intervention Interaction on a combination of items	2	2	3/4	73.4	2.6/10	30%	3.9

Measure 170.315(a)(14) – Implantable Device List	**N**		**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#		Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Record Unique Device Identifier.	3		3	3/2	102.4	2.4/10	0	4.7

2: Enable user to access and change UDI for patient	3		3	0/2	79.1	10.9/10	0	5

Measure 170.315(b)(2) – Clinical Information Reconciliation and Incorporation	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Electronically and simultaneously display the data from at least two list sources in a manner that allows a user to view patient data and their attributes, which must include, at a minimum, the source and last modification date.	2	2	7/5	90.9	0.9/15	5%	4
2: Enable a user to create a single reconciled list of medications, medication allergies, or problems	1	0.9	2/5	96.9	6.9/15	20%	3.9
3: Enable a user to review and validate the accuracy of a final set of data and, upon a user's confirmation, automatically update the list.	2	2	1/3	13.05	0.3/10	0	4.7

Measure 170.315(b)(3) – E-Prescribing	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: User Generate Electronic Prescription and send successfully to pharmacy electronically	2	2	9/6	236.8	26.8/30	5%	3.7
2: User can cancel a sent electronic prescription	2	2	3/5	78	12/15	0	3.8

3: User can refill and send an existing patient prescription to pharmacy electronically	3	3	5/5	99.5	9.5/15	0	4

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be: 65.1. [5]

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

- Major findings

  Systemedx Clinical Navigator. Version 2017.10 under Test showed that overall it provides users with an effective and efficient way of recording clinical patient data that end users are satisfied with. Both experienced and novice users showed that they can navigate the software with relative ease.

- Areas for improvement

  Testing and participants' comments seemed to indicate that users had more difficulty with items related to medication orders and electronic prescriptions. Most did complete the tasks but had to often refer back to the directions to do so. Some participants indicated that clearer directions for these portions may have aided in the speed and number of deviations and errors associated with this portion. Ones that did complete the task did indicate relative satisfaction with the way it functioned however.

[5] See Tullis, T. & Albert, W. (2008). Measuring the User Experience. Burlington, MA: Morgan Kaufman (p. 149). Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

INTRODUCTION

The EHRUT tested for this study was Systemedx Clinical Navigator. Version 2017.10. Designed to present medical information to healthcare providers in an ambulatory setting, the EHRUT consists of a robust platform that efficiently allows users to record and review patients' clinical medical information. The usability testing attempted to represent realistic exercises and conditions.

The purpose of this study was to test and validate the usability of the current user interface, and provide evidence of usability in the EHR Under Test (EHRUT). To this end, measures of effectiveness, efficiency and user satisfaction, such as time on task and errors observed, were captured during the usability testing.

METHOD

PARTICIPANTS

A total of 10 participants were tested on the EHRUT(s). Participants in the test were nurses, practice management, and clinical assistants. Participants were recruited by Systemedx Support. In addition, participants had no direct connection to the development of or organization producing the EHRUT(s).

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.

Identifier	Gender	Age	Education	Occupation/Role	Professional Experience	Computer Experience	Product Experience	Assistive Technology Needs
101	Female	40-49	Associate degree	Billing/Coding	Family Practice	240	6	No
102	Female	20-29	Associate degree	Billing/Reception	Family Practice	60	4	No
103	Male	30-39	Bachelor's Degree	Business Office	Orthopaedics	180	72	No
104	Female	20-29	Bachelor's Degree	Nurse	Urgent Care	120	30	No
105	Female	40-49	Bachelor's Degree	Nurse	Allergist	96	24	No
106	Male	20-29	Doctorate degree (e.g., MD, DNP, DMD, PhD)	Doctor	Orthopaedics	120	12	No
107	Female	10-19	Some college credit, no degree	Reception	Urgent Care	48	6	No
108	Male	30-39	Associate degree	Triage Nurse	Urgent Care	144	48	No
109	Female	50-59	Master's Degree	Practice Management	Family Practice	180	36	No
110	Female	10-19	High school graduate, diploma or the equivalent (for example: GED)	Reception	Allergist	24	3	No

12 participants (matching the demographics in the section on Participants) were recruited and 10 actually attended and participated in the usability test. Two participants failed to show for the study.

Participants were scheduled for 120 minute sessions with 15 minutes in between each session for debrief by the administrator, and to reset systems to proper test conditions.

STUDY DESIGN

Overall, the objective of this test was to uncover areas where the

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

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

- Number of tasks successfully completed 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.

TASKS

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

- 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

Tasks were selected based on their frequency of use, criticality of function, and those that may be most troublesome for users.

PROCEDURES

Upon arrival, participants were greeted; their identity was verified and matched with a name on the participant schedule. Participants were then assigned a participant ID. [7] A representative from the test team witnessed the participant's signature.

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

Participants were instructed to perform the tasks (see specific instructions below):

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

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

3.9.

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

Participants were thanked for their time. No participants were compensated for their time.

TEST LOCATION

The test facility included a waiting area and a quiet testing room with a table, computer for the participant, and observing/recording monitor for the administrator. Only the participant and administrator were in the test room. To ensure that the environment was comfortable for users, noise levels were kept to a minimum with the ambient temperature within a normal range. All of the safety instruction and evacuation procedures were valid, in place, and visible to the participants.

TEST ENVIRONMENT

The EHRUT would be typically be used in a healthcare office or facility. In this instance, the testing was conducted in Systemedx corporate offices. For testing, the computer used was a desktop pc running Windows 10 operating system. The participants used a mouse and keyboard when interacting with the EHRUT.

The EHRUT used a 23 inch color display during the test. The application was set up by the vendor according to the vendor's documentation describing the system set-up and preparation. The application itself was running on a Windows 10 desktop pc using a test database on a broadband 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).

TEST FORMS AND TOOLS

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

1. User Testing Guide with Moderator's Note section
2. Post-test Questionnaire

Examples of these documents can be found in Appendices 2 & 3 respectively. The User Testing Guide was devised so as to be able to direct the users through what to change and for what reasons. The moderator's note section for each one being present to document required info related to each task.

PARTICIPANT INSTRUCTIONS

The administrator reads the following instructions aloud to the each participant (also see the full moderator's guide in Appendix [B4]):

> *Thank you for participating in this study. Your input is very important. Our session today will last about 2 hours (120 minutes). During that time you will use an instance of an electronic health record. I will ask you to complete 12 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 at all, this means is that something needs to be improved in the system. I will be here in case you need specific help, but I am not able to instruct you or provide help in how to use the application.*
>
> *Overall, we are interested in how easy (or how difficult) this system is to use, what in it would be useful to you, and how we could improve it. Please be honest with your opinions. All of the information that you provide will be kept confidential and your name will not be associated with your comments at any time. Should you feel it necessary you are able to withdraw at any time during the testing.*

Following the procedural instructions, participants were shown the EHR and as their first task, were given time (5 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 12 measures with multiple tasks for each one to complete. Tasks are listed in the moderator's guide in Appendix 2.

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 EHR Under Test by measuring participant success rates and errors
2. Efficiency of EHR Under Test by measuring the average task time and path deviations
3. Satisfaction with EHR Under Test by measuring ease of use ratings

DATA SCORING

The following table details how tasks were scored, errors evaluated, and the time data analyzed. [10]

Measures	**Rationale and Scoring**
Effectiveness: Task Success	A task was counted as a "Success" if the participant was able to achieve the correct outcome, without assistance, within the time allotted on a per task basis. The total number of successes were calculated for each task.

	The results are provided as an average of successful tasks across all users. 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 [e.g., 1.25] that 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.
Effectiveness: Task Failures	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. 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. [11] This should also be expressed as the mean number of failed tasks per participant. On a qualitative level, an enumeration of errors and error types should be collected.
Efficiency: Task Deviations	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.

	It is strongly recommended that task deviations be reported. Optimal paths (i.e., procedural steps) should be recorded when constructing tasks.
Efficiency: Task Time	Each task was timed from when the administrator said "Begin" until the participant said, "Done." If he or she failed to say "Done," the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task. Variance measures (standard deviation and standard error) were also calculated.
Satisfaction:	Participant's subjective impression of the ease of use of the

Task Rating	application was measured by administering both a simple post-task question as well as a post-session questionnaire. After each task, the participant was asked to rate "Overall, this task was:" on a scale of 1 (Very Difficult) to 5 (Very Easy). These data are averaged across participants. Common convention is that average ratings for systems judged easy to use should be 3.3 or above. To measure participants' confidence in and likeability of the EHRUT overall, the testing team administered the System Usability Scale (SUS) post-test questionnaire. Questions included, "I think I would like to use this system frequently," "I thought the system was easy to use," and "I would imagine that most people would learn to use this system very quickly." See full System Usability Score questionnaire in Appendix 3.

Table: Details of how observed data were scored.

RESULTS

DATA ANALYSIS AND REPORTING

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

The usability testing results for the EHRUT are detailed below. 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.

Measure 170.315(a)(1) – Computerized Order Entry - medications	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Electronically Record Orders in an Ambulatory Setting	2	2	8/5	200	20/10	15%	3.5

2: Electronically Change Orders in an Ambulatory Setting	2	2	7/5	105	15/10	10%	4
3: Electronically Access Orders in an Ambulatory Setting	1	1	0/1	28	2/5	0%	5

Measure 170.315(a)(2) – Computerized Order Entry - Laboratory	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Electronically Record Orders in an Ambulatory Setting	1	1	2/5	55	5/10	10%	4.2
2: Electronically Change Orders in an Ambulatory Setting	1	1	2/5	33.7	3.7/5	0	4.8
3: Electronically Access Orders in an Ambulatory Setting	1	13.5	0/1	15.5	0.5/5	0	5

Measure 170.315(a)(3) – Computerized Order Entry – Diagnostic Imaging	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Electronically Record Orders in an Ambulatory Setting	2	2	6/5	84	27.1/20	10%	4.25
2: Electronically Change Orders in an Ambulatory Setting	1	1	1/4	29.25	12.75/10	25%	4.8
3: Electronically Access Orders in an Ambulatory Setting	1	1	0/1	21.7	4.92/5	0%	5

Measure 170.315(a)(4) – Drug-drug,Drug-allergy Interaction Checks	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Automatically and Electronically Indicate Drug-drug Interventions	2	2	1/4	78.25	15.9/15	8%	4.25
2: Automatically and Electronically Indicate Drug-allergy Interventions	2	2	1/4	38.5	7.53/10	0%	4.5
3. Allow/disallow users to adjust Severity Levels of Interactions	4	4	6/6	222.9	67.87/30	12%	4
4. Adjust Severity Level of Interventions Indicated for Drug-drug Interaction Checking	2	2	0/4	90.2	16.7/15	0	4.8

Measure 170.315(a)(5) – Demographics	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Record Demographics	2	2	2/5	226.3	40.99/30	20%	3.9
2: Change Demographics	2	2	0/3	190.5	21.88/30	25%	4.25

Measure 170.315(a)(6) – Problem List	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Record Problem List	2	1.8	6/4	89.4	29/20	8%	4
2: Change Problem List	2	2	7/4	157.3	27.3/20	12%	3.65
3: Access Problem List History	2	2	3/2	37.6	7.6/15	5%	4.6

Measure 170.315(a)(7) – Medication List	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Record Medication List	2	2	8/5	147.5	12.5/20	15%	4
2: Change Medication List	2	2	5/4	97.9	7.9/20	10%	3.7
3: Access Medication List History	2	2	3/3	48.7	8.7/15	10%	4.75

Measure 170.315(a)(8) – Medication Allergy List	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Record Medication Allergy List	2	2	8/5	113.8	6.2/30	15%	4.5
2: Change Medication Allergy List	3	3	6/4	117.3	2.7/20	8%	3.95
3: Access Medication Allergy List History	2	2	2/2	60.6	0.6/15	0	4.8

Measure 170.315(a)(9) – Clinical Decision Support	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Demonstrate that users can be authorized and unauthorized to configure CDS	2	1.9	2/5	64.6	4.6/10	15%	4.1
2: Trigger a CDS Intervention Interaction on one item	2	2	6/4	179.6	29.6/20	40%	3.4
3: Trigger a CDS Intervention Interaction on a combination of items	2	2	3/4	73.4	2.6/10	30%	3.9

Measure 170.315(a)(14) – Implantable Device List	**N**		**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#		Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Record Unique Device Identifier.	3		3	3/2	102.4	2.4/10	0	4.7
2: Enable user to access and change UDI for patient	3		3	0/2	79.1	10.9/10	0	5

Measure 170.315(b)(2) – Clinical Information Reconciliation and Incorporation	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Electronically and simultaneously display the data from at least two list sources in a manner that allows a user to view patient data and their attributes, which must include, at a minimum, the source and last modification date.	2	2	7/5	90.9	0.9/15	5%	4
2: Enable a user to create a single reconciled list of medications, medication allergies, or problems	1	0.9	2/5	96.9	6.9/15	20%	3.9
3: Enable a user to review and validate the accuracy of a final set of data and, upon a user's confirmation, automatically update the list.	2	2	1/3	13.05	0.3/10	0	4.7

Measure 170.315(b)(3) – E-Prescribing	**N**	**Task Success**	**Path Deviation**	**Task time**	**Errors**	**Task Ratings**

							5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: User Generate Electronic Prescription and send successfully to pharmacy electronically	2	2	9/6	236.8	26.8/30	5%	3.7
2: User can cancel a sent electronic prescription	2	2	3/5	78	12/15	0	3.8
3: User can refill and send an existing patient prescription to pharmacy electronically	3	3	5/5	99.5	9.5/15	0	4

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 65.1. Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

DISCUSSION OF THE FINDINGS

What follows is a short summary discussing each of the major areas in light of the findings.

EFFECTIVENESS

The overall effectiveness of Systemedx Clinical Navigator. Version 2017.10 under Test in allowing the users to complete the tasks could be stated as very effective. The Users were able to complete fully the majority of the tasks set forth in the Test with few problems reported.

EFFICIENCY

Systemedx Clinical Navigator. Version 2017.10 under Test could be stated as moderately efficient. With some exceptions the tasks were quickly and easily accessible by the users tested. It was noted by more than one person that one of the tests, while easy, did take some time and navigation to complete.

SATISFACTION

Users partaking in the Systemedx Clinical Navigator. Version 2017.10 indicated overall that they were highly satisfied with how the EHRUT performed in achieving the goals set forth by the tests. They stated that the EHR met each item requested of the test.

MAJOR FINDINGS

Systemedx Clinical Navigator. Version 2017.10 under Test showed that overall it provides users with an effective and efficient way of recording clinical patient data that end users are satisfied with. Both experienced and novice users showed that they can navigate the software with relative ease.

AREAS FOR IMPROVEMENT

Users stated that the process for setting up Clinical Decision Support Rules was somewhat more complicated and drawn out than expected. Most did complete the tasks but had to often refer back to the directions to do so. Ones that did complete the task did indicate relative satisfaction with the way it functioned however.

Additionally, Testing and participants' comments seemed to indicate that users had more difficulty with items related to medication orders and electronic prescriptions. Most were able to successfully complete the tasks but had to often refer back to the directions to do so in some cases. Some participants indicated that clearer directions for these portions may have aided in the speed and number of deviations and errors associated with this portion. Users that did complete the task did indicate relative satisfaction with the way it functioned however.

APPENDICES

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

- Participant demographics
- User Testing Guide with Moderator's Note section
- System Usability Scale Questionnaire

Appendix 1: PARTICIPANT DEMOGRAPHICS

The report should contain a breakdown of the key participant demographics. A representative list is shown below.

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

Gender	
Men	**[3]**
Women	**[7]**
Total (participants)	**[10]**

Occupation/Role	
RN/BSN	**[3]**
Physician	**[1]**
Admin Staff	**[6]**
Total (participants)	**[10]**

Years of Experience	
Collective Years experience with product	**[20 + years]**
Facility Use of EHR	
Some paper, some electronic	**[2]**
All electronic	**[8]**
Total (participants)	**[10]**

Appendix 2: User Testing Guide with Moderator's Note section

EHRUT Usability Test Moderator's Guide
Moderator _____
Date _____ Time _____
Participant identifier _____ Location _____

Prior to testing:
- Confirm schedule with Participants
- Perform pre-test interview to confirm demographic information
- Ensure data recording equipment is running properly

Prior to each participant:
- Reset application default data
- Reset application to starting point for next task

After each participant:
- Perform exit interview to gather comments

Preliminary Questions
1. What 10 year age range do you fall into? (example 20-29, 30-39)
2. What is your education level?
3. What is your job title / appointment?
4. How long have you been working in this role?
5. How long have you been working with computers?
6. How many months experience do you have with Systemedx Clinical Navigator?

MODERATOR'S DATA SCORING

The following types of data were collected for each task 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
- Participant's satisfaction ratings of the system

Task 1: 170.315(a)(1) CPOE – Medication Orders

Instructions:
- Record, change, and access a patient's medication orders.

TEST DATA: Unless otherwise specified, use Test Patient = 1198 MU TEST PATIENT

1: Electronically Record Orders in an Ambulatory Setting
User records medication orders as follows by going to the chart from EHR Navigator>searching for the indicated patient and clicking the Medications button on the top button toolbar and entering the appropriate information as indicated below for each medication.

- Acetaminophen 500 MG one tablet by mouth as needed for 10 days; RxNorm code: 209459; sample NDC product code: 50580-451-03

- Amoxicillin 500 MG one capsule by mouth every 12 hours; RxNorm code: 308191; sample NDC product code: 35356-985-21

2. Change CPOE Medication Orders: Ambulatory
User makes changes to existing medication orders as follows by going to the chart from EHR Navigator>searching for the indicated patient and clicking the Medications button on the top button toolbar. Then they will double click on the appropriate medication in the existing list and updating information as indicated below for each medication.

User changes medication orders (highlighted in **bold**):

- Acetaminophen 500mg **one tablet twice daily for 3 days**; RxNorm code: 209459; sample NDC product code: 50580-451-03

- Amoxicillin 500 MG one capsule by mouth **every 6 hours**; RxNorm code: 308191; sample NDC product code: 35356-985-21

3. Access CPOE Medication Orders: Ambulatory
User accesses medication orders as follows by going to the chart from EHR Navigator>searching for the indicated patient and clicking the Medications button on the top button toolbar orders and verifies the following info to be accurate:

- Acetaminophen 500mg one tablet twice daily for 3 days; RxNorm code: 209459; sample NDC product code: 50580-451-03

- Amoxicillin 500 MG one capsule by mouth every 6 hours; RxNorm code: 308191; sample NDC product code: 35356-985-21

Measure 170.315(a)(1) – Computerized Order Entry - medications	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Electronically Record Orders in an Ambulatory Setting							

2: Electronically Change Orders in an Ambulatory Setting							
3: Electronically Access and Display Orders in an Ambulatory Setting							

Task 2: 170.315(a)(2) Record, Change, and Access Laboratory Order

Instructions:

- The user electronically records a patient's laboratory order.
- The user changes the laboratory order previously recorded.
- The user can access the patient's laboratory order(s).

TEST DATA: Unless otherwise specified, use Test Patient = 1198 MU TEST PATIENT

1: Electronically Record Lab Orders in an Ambulatory Setting

User records laboratory orders as follows: by going to the chart from EHR Navigator>searching for the indicated patient and clicking the Orders button on the top button toolbar. They can then click New to begin a new order and select the appropriate Order code.

- Cholesterol in HDL in serum or plasma; LOINC code: 2085-9

2: Electronically Change Lab Orders in an Ambulatory Setting

User changes laboratory orders (highlighted in **bold**): by going to the chart from EHR Navigator>searching for the indicated patient and clicking the Orders button on the top button toolbar. They can then double click on existing order and select the appropriate changes

- Cholesterol in **LDL** in serum or plasma **by direct assay**; LOINC code: **18262-6**

3: Electronically Access and Display Lab Orders in an Ambulatory Setting

User accesses laboratory orders: by going to the chart from EHR Navigator>searching for the indicated patient and clicking the Orders button on the top button toolbar. They can then verify the existing orders are correct.

- Cholesterol in LDL in serum or plasma by direct assay; LOINC code: 18262-6

Measure 170.315(a)(2) – Computerized Order Entry - Laboratory	**N**	**Task Success**	**Path Deviation**	**Task time**	**Errors**	**Task Ratings** 5=Easy

Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Electronically Record Orders in an Ambulatory Setting							
2: Electronically Change Orders in an Ambulatory Setting							
3: Electronically Access and Display Orders in an Ambulatory Setting							

Task 3: 170.315(a)(3) Record, Change, and Access Diagnostic Imaging Order
Instructions:

- The user electronically records a patient's diagnostic imaging order.
- The user changes the diagnostic imaging order previously recorded.
- The user can accesses the patient's diagnostic imaging order(s).

TEST DATA: Unless otherwise specified, use Test Patient = 1198 MU TEST PATIENT

1: Electronically Record Orders in an Ambulatory Setting
User records diagnostic imaging orders as follows: by going to the chart from EHR Navigator>searching for the indicated patient and clicking the Orders button on the top button toolbar. They can then click New to begin a new order and select the appropriate Order code under the **XRAY** type.

User records diagnostic imaging orders as follows:

- MRI chest w/o contrast material; CPT code 71550
- Radiologic examination knee 3 views (Radiologic examination knee 3 views)
  CPT® code: 73562

2: Electronically Change Orders in an Ambulatory Setting
User changes diagnostic imaging orders (highlighted in **bold**): by going to the chart from EHR Navigator>searching for the indicated patient and clicking the Orders button on the top button toolbar. They can then double click on existing order and select the appropriate changes

- Change MRI chest w/o contrast material; CPT code 71550 to **MRI chest w/o & w/contrast material; CPT code 71552**

3: Electronically Access and Display Orders in an Ambulatory Setting

User access diagnostic imaging orders as follows: by going to the chart from EHR Navigator>searching for the indicated patient and clicking the Orders button on the top button toolbar. They can then verify the existing orders are correct.

- MRI chest w/o & w/contrast material; CPT code 71552
- Radiologic examination knee 3 views (Radiologic examination knee 3 views)
  CPT® code: 73562

Measure 170.315(a)(3) – Computerized Order Entry – Diagnostic Imaging	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Electronically Record Orders in an Ambulatory Setting							
2: Electronically Change Orders in an Ambulatory Setting							
3: Electronically Access and Display Orders in an Ambulatory Setting							

TASK 4: 170.315(a)(4) – Drug-drug,Drug-allergy Interaction Checks

Required Test Procedures
1.01: Using the Vendor-identified function(s), the Tester shall sign on to the EHR,
select an existing patient record identified by the Vendor, and confirm that the Vendor-supplied medication and medication allergy test data are included in the medication and medication allergy lists for the patient
1.02: The Tester shall enter medication orders into the existing patient's record via CPOE, automatically triggering at least one of the drug-drug interventions identified by the Vendor.
1.03: The Tester shall enter medication orders into the existing patient's record via CPOE, automatically triggering at least one of the drug-allergy interventions identified by the Vendor.
1.04: The Tester shall verify that the drug-drug contraindication intervention(s) and the drug-allergy contraindication intervention(s) are triggered during CPOE before the medication orders are completed and acted upon and based on the information in the patient's medication list and medication allergy list

1: Automatically and Electronically Indicate Drug-drug Interventions
Test Data:
Patient = Intervention Patient (1 or 2) 1157 OR 1158

Update Historical Medications: Naproxen 500mg tablet; historical type
Warfarin 5mg tablet; historical type

*** should result in drug-to-drug interaction alert about Anticoagulants/NSAIDS. This can then be canceled meeting item 4 regarding interventions**
-- user can cancel the prescribing of the second med

2: Automatically and Electronically Indicate Drug-allergy Interventions

User adds new historical medication: Augmentin 500mg tablet;

***should result in a Drug-Allergy interaction concerning Augmentin/Penicillins. This can be overridden, citing combination previously taken also meeting item 4 above regarding intervention**
-- users can cancel the prescribing of the augmentin

3. Allow/disallow users to adjust Severity Levels of Interactions

Test Data:

- Log in as TEST USER 1 (PASSWORD=2)
  Attempt to access the drug interactions tool (this is found in MNT>EMR>Drug Interactions)
  It should allow this user to open this feature and see and change the user interaction levels for this user to HIGH.
- Log in as TEST USER 2 (PASSWORD=2)
  Attempt to access the drug interactions tool (this is found in MNT>EMR>Drug Interactions)
  It should not allow this user to open this module
- Log in as TEST USER 1 – verifying that this user has the Drug Interaction level set to HIGH, the user will then goto the chart for Intervention Patient 1 (chart id: 1157) and enter the following Call-in medications
  - Warfarin 5 mg 30 tablets as directed.
  - Propranolol 40 mg 30 tablets as directed.
- **It should alert the user of a Possible Drug interaction, and the user can cancel out of prescribing that.**

4. Adjust Severity Level of Interventions Indicated for Drug-drug Interaction Checking

- The user will then change the Drug Interaction Level (MNT>EMR>Drug Interactions) for TEST USER 2 to be LOW and exit the program. Upon re-entry as Test User 2, the new Drug Interaction Restrictions should apply. The patient will attempt to add the same Propranolol & Warfarin RX combination to the same patient (chart id: 1157).
- The Medication should prescribe without Alert

Measure 170.315(a)(4) – Drug-drug,Drug-allergy Interaction Checks	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Automatically and Electronically Indicate Drug-drug Interventions							
2: Automatically and Electronically Indicate Drug-allergy Interventions							
3. Allow/disallow users to adjust Severity Levels of Interactions							

4. Adjust Severity Level of Interventions Indicated for Drug-drug Interaction Checking							

Task 5: 170.315(a)(5) Demographics
Patient Demographic information is added and edited in the Patient Maintenance module that is accessible from the EMR Navigator screen. The Sexual Orientation & Gender Identity selections are made in the submenu next to the Sex field.

1: Record Demographics
User records demographics by charting the following three test patients and demonstrates health IT module can record codified entries listed:

Patient 1: Jordan Jones

- Date of Birth: **3/30/1977**
- Sex : **Female**
- Race: **Samoan** (CDC: 2080-0)
  Found OMB standard: *Native Hawaiian or Other Pacific Islander > Polynesian* (CDC: 2076-8)
- Ethnicity : **Not Hispanic or Latino** (CDC: 2186-5)
- Preferred Language : **English**, US (ISO: en)
- Sexual Orientation : **Lesbian, gay, or homosexual** (SNOMED: 38628009)
- Gender Identity : **Identifies as Female** (SNOMED: 446141000124107)

Patient 2: Bobby Boyd

- Date of Birth : **8/31/1938**
- Sex : **Male**
- Race :
  Haitian (CDC: 2071-9)
  Found under OMB standard *Black or African American* (CDC: 2054-5)
  Dominica Islander (CDC: 2070-1)
  Found under OMB standard: *Black or African American* (CDC: 2054-5)
- Ethnicity : **Not Hispanic or Latino** (CDC: 2186-5)
- Preferred Language : **French** (ISO: fr)
- Sexual Orientation : **Straight or heterosexual** (SNOMED: 20430005)
- Gender Identity : **Identifies as Male** (SNOMED: 446151000124109)

2: Change Demographics
User changes demographics (highlighted in **bold**) for the following three test patients and demonstrates health IT module can record the codified entries listed:

Patient 1: Jordan Jones

- Date of Birth : **9/17/1954**
- Sex : **Male**
- Race : **Declined to Specify**
- Ethnicity : **Declined to Specify**
- Preferred Language : **Declined to Specify**
- Sexual Orientation : **Don't know** (HL7 v3: nullFlavor UNK)
- Gender Identity : **Genderqueer, neither exclusively male nor female (**SNOMED: 446131000124102)

Patient 2: Bobby Boyd

- Date of Birth : **3/15/1982**
- Sex : **Female**
- Race : **Dominican** (CDC: 2069-3)
  OMB standard: *Black or African American* (CDC: 2054-5)
- Ethnicity :
  Dominican (CDC: 2184-0)
  OMB standard: *Hispanic or Latino* (CDC: 2135-2)
  Latin American (CDC: 2178-2)
  OMB standard: *Hispanic or Latino* (CDC: 2135-2)
- Preferred Language : **Spanish** (ISO: es)
- Sexual Orientation : **Bisexual (**SNOMED: 42035005)
- Gender Identity : **Male-to-Female (MTF)/Transgender Female/Trans Woman (**SNOMED: 407376001)

Measure 170.315(a)(5) – Demographics	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Record Demographics							
2: Change Demographics							

Task 6: 170.315(a)(6) – Problem List
User records Problems as follows by going to the chart from EHR Navigator>searching for the indicated patient and clicking the Problems button on the top button toolbar and entering the appropriate information as indicated below for each diagnosis.

patientid = 53218 may be used on this test

1: Record Problem List
User selects records containing pre-loaded problems and records additional problems as follows:

Encounter #1 – User will confirm that the patient has existing active problem that was entered before the current test Date:

- Essential (Primary) Hypertension; ICD10 code: I10

Encounter 2 – Problems To Be Entered on Test Date:

- Type 2 diabetes mellitus without complications; ICD10 Code: E11.9

- Acquired Hypothyroidism (disorder): **SNOMED code: 111566002**

2: Change Problem List
User changes the problems as indicated in **bold** highlight: Problems must be marked resolved by accessing them from inside the Office Visit. Users can do this by clicking on the OV 2007 button on the right hand side.

- Essential (Primary) Hypertension; ICD10 code: I10

- **RESOLVE** Type 2 diabetes mellitus without complications;
  ICD10 Code: E11.9

- **Severe Hypothyroidism (disorder)**
  SNOMED code: 83986005
  Date Changed: Encounter #3/Hospital Day #3

3: Access Problem List History
User confirms that the problem list shows accurately to the changes that were made.
a: Active Problem List

- Essential (Primary) Hypertension; ICD10 code: I10

- Severe Hypothyroidism (disorder)
  SNOMED code: 83986005
  Date Changed: Encounter #3/Hospital Day #3

b: Problem List (active and discontinued) - the inactive problems may be shown by activating the "All" toggle in the problems list.

- Essential (Primary) Hypertension; ICD10 code: I10

- Severe Hypothyroidism (disorder)
  SNOMED code: 83986005
  Date Changed: Encounter #3/Hospital Day #3

- **(inactive)** Type 2 diabetes mellitus without complications;
  ICD10 Code: E11.9

Measure 170.315(a)(6) – Problem List	**N**	**Task Success**	**Path Deviation**	**Task time**	**Errors**	**Task Ratings**

							5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Record Problem List							
2: Change Problem List							
3: Access Problem List History							

TASK 7: 170.315(a)(7) – Medication List

Required Test Procedure

1.01: Tester shall select patient active medication data from the ONC-supplied test data set below.
1.02: Using the EHR function(s) identified by the Vendor, the Tester shall select the patient's existing record and enter patient active medications data from the ONC-supplied test data set
1.03: the Tester shall verify that the patient active medication test data have been entered correctly and without omission

User records medication orders as follows by going to the chart from EHR Navigator>searching for the indicated patient and clicking the Medications button on the top button toolbar and entering the appropriate information as indicated below for each medication. Each Medication in this example may be Historical in Type.

TEST DATA – patientid = 53218 may be used on this test
User selects records containing pre-loaded medications for first encounter or records medications as follows:

Encounter #1 – to be entered Before Test Date:

- **Ceftriaxone 250 MG Solution for injection twice daily; RxNorm code: 563973; sample NDC product code: 55154-6962-5**

- **Tylenol 500 MG one tablet by mouth as needed for 10 days; RxNorm code: 209459; sample NDC product code: 50580-451-03**

Encounter #2 - To Be Entered on Test Date:

- Amoxicillin 500 MG one capsule by mouth every 12 hours; RxNorm code: 308191; sample NDC product code: 35356-985-21

- Lisinopril 20 MG; three tablets once daily for 30 days; 100 count; 1 refill; RxNorm code: 316153; sample NDC code: 0378-2075-1

2: Electronically Change Patient Active Medication List in an Ambulatory Setting
Required Test Procedure

Tester shall update the patient's medication list as indicated by the items in bold below. Medications are discontinued by giving them an end date.

TEST DATA

- **DISCONTINUED** Lisinopril 20 MG; RxNorm code: 316153; sample NDC code: 0378-2075-1Sample NDC product code: 52959-989
- **Amoxicillin 500 MG** changed to **Amoxicillin 250 MG** one capsule by mouth every 12 hours; RxNorm code: 308191; sample NDC product code: 35356-985-21
-

Revised Active Medication List

- Ceftriaxone 250 MG Solution for injection twice daily; RxNorm code: 563973; sample NDC product code: 55154-6962-5

- Tylenol 500 MG one tablet by mouth as needed for 10 days; RxNorm code: 209459; sample NDC product code: 50580-451-03

- Amoxicillin 250 MG one capsule by mouth every 12 hours; RxNorm code: 308191; sample NDC product code: 35356-985-21

3: Electronically Access and Display Patient Active Medication List and Medication History in an Ambulatory Setting

Required Test Procedure

Tester shall access the medication list and verify that the info displays properly. Discontinued/inactive medications are displayed by clicking the "all" filter.

3a: Electronically Access and Display Patient Active Medication List in an Ambulatory Setting

Active Medication List

- Ceftriaxone 250 MG Solution for injection twice daily; RxNorm code: 563973; sample NDC product code: 55154-6962-5

- Tylenol 500 MG one tablet by mouth as needed for 10 days; RxNorm code: 209459; sample NDC product code: 50580-451-03

- Amoxicillin 250 MG one capsule by mouth every 12 hours; RxNorm code: 308191; sample NDC product code: 35356-985-21

3b: Electronically Access and Display Patient Medication History in an Ambulatory Setting

Medication History List (active and discontinued)

- Ceftriaxone 250 MG Solution for injection twice daily; RxNorm code: 563973; sample NDC product code: 55154-6962-5

- Tylenol 500 MG one tablet by mouth as needed for 10 days; RxNorm code: 209459; sample NDC product code: 50580-451-03

- Amoxicillin 250 MG one capsule by mouth every 12 hours; RxNorm code: 308191; sample NDC product code: 35356-985-21

- Lisinopril 20 MG; three tablets once daily for 30 days; 100 count; 1 refill; RxNorm code: 316153; sample NDC code: 0378-2075-1 (INACTIVE)

Measure 170.315(a)(7) – Medication List	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Record Medication List							
2: Change Medication List							
3: Access Active Medication List And History							

TASK 8: 170.315(a)(8) – Medication Allergy List

170.315(a)(8) – 1: Electronically Record Patient Active Medication Allergy List in an Ambulatory Setting Required Test Procedure
1.01: Tester shall select patient active medication allergy data from ONC-supplied test data set below.
1.02: Using the EHR function(s) identified by the Vendor, the Tester shall select the patient's existing record and enter patient active medication allergy data from the test data set below.
1.03: the Tester shall verify that the patient active medication allergy test data have been entered correctly and without omission

User accesses and records Allergies orders as follows by going to the chart from EHR Navigator>searching for the indicated patient and clicking the Allergy button on the top button toolbar and entering the appropriate information as indicated below for each allergy. Patient ID = 1198, or 53218 may to be used for this test

Ambulatory Setting Test Data
1: Electronically Record Patient Active Medication Allergy List in an Ambulatory Setting

User selects records containing pre-loaded allergies or records allergies as follows:

Encounter #1 – already entered Before Test Date

- Sulfasalazine;
  Reaction: Wheezing, MILD

Encounter #2 – entered on Test Date

- Penicillin V;
  Reaction: Dizziness, MODERATE

  Encounter #3 – Entered on Test Date
- Carbamazepine;
  Reaction: Rash, MODERATE

2: Electronically Change Patient Active Medication Allergy List in an Ambulatory Setting

TEST DATA
User changes medication allergies as indicated in **bold** highlight:

- **INACTIVE** Sulfasalazine
  Reaction: Wheezing, MILD

- **Penicillin V** inactivated and replaced with **Penicillin G**
  Reaction: Dizziness, MILD

- **Codeine** added
  Reaction: Skin rash, Moderate

Revised Medication Allergy List (active and historical)
- Sulfasalazine
  Reaction: (Wheezing) Severity: (Mild) Status: (DELETED)

- Penicillin V;
  Reaction: Dizziness, MODERATE (DELETED)

- Penicillin G
  Reaction: (Dizziness) Severity: (MILD) Status: (Active)

- Codeine
  Reaction: (Skin rash) Severity: (Moderate) Status: (Active)

- Carbamazepine;
  Reaction: Rash, MODERATE (ACTIVE)

3: Electronically Access and Display Patient Active Medication Allergy List and Medication Allergy History in an Ambulatory Setting
TESTING DATA
3a: Active Medication Allergy List
User accesses active medication allergy list and verifies that the data displays accordingly:

- Penicillin G

Reaction: (Dizziness) Severity: (Mild) Status: (Active)

- Codeine
  Reaction: (Skin rash) Severity: (Moderate) Status: (Active)

- Carbamazepine;
  Reaction: Rash, MODERATE (ACTIVE)

3b: Medication Allergy History List (active and historical)

User accesses medication allergy list history and verifies that the data displays accordingly:

- Sulfasalazine
  Reaction: (Wheezing) Severity: (Mild) Status: (DELETED)

- Penicillin V;
  Reaction: Dizziness, MODERATE (DELETED)

- Penicillin G
  Reaction: (Dizziness) Severity: (Mild) Status: (Active)

- Codeine
  Reaction: (Skin rash) Severity: (Moderate) Status: (Active)

- Carbamazepine;
  Reaction: Rash, MODERATE (ACTIVE)

Measure 170.315(a)(8) – Medication Allergy List	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Record Medication Allergy List							
2: Change Medication Allergy List							
3: Access Medication Allergy List History							

TASK 9: 170.315(a)(9) – Clinical Decision Support

1: Demonstrate that users can be authorized and unauthorized to configure CDS

Tester follows steps below to confirm system functionality of Clinical Decision Support. The setup of Clinical Decision Support can be found by going to MAINTENANCE **(**Quick Access>MNT>Clinical Decision Support Rules)**.**

TEST DATA 1:

- Tester shall log in as TEST USER 2 (password = 2) and attempt to access and ADD/EDIT Clinical Decision Support Rules. Quick Access>MNT>Clinical Decision Support Rules. The option for Clinical Deciscion Support Rules should not even be visible for the user to access where it would normally be under the "chart tabs" maintenance item.
- Tester shall then log in as TEST USER 1 (password = 2) and attempt to access and ADD/EDIT Clinical Decision Support Rules as in step 1. Test User 1 should have access allowed to make changes to existing rules as well as add new ones.

2: Trigger a CDS Intervention Interaction on one item

Required Test Procedures

The Tester shall verify that clinical decision support interventions trigger electronically based on data from at least one of the following data categories:

- □ Problem list
- □ Medication list
- □ Medication allergy list
- □ Demographics
- □ Laboratory tests and values/results
- □ Vital signs

TEST DATA 2:

- Tester shall log in as Test User 1 and add ONE clinical decision support rule. (Found in MNT>CLINICAL DECISION SUPPORT RULES) – User shall add CDSR for patients age 65-110 to alert them if they have any problem with diabetes added to the chart to give a message to "Give Education about maintaining diabetes"
- Tester shall then pull up chart for patient: Clinical Test (1170) and add a problem with Diabetes in the description. (E11.9) – Should pop up the alert message to Give Education.

3: Trigger a CDS Intervention Interaction on a combination of items

Required Test Procedures

The Tester shall verify that clinical decision support interventions trigger electronically based on data from at least one combination of data from two or more of the following data categories:

- □ Problem list
- □ Medication list
- □ Medication allergy list
- □ Demographics
- □ Laboratory tests and values/results
- □ Vital signs

TEST DATA 3 – PATIENTID = 309:

- Give patient low height (69in) and high weight (220lb) in vitals (form accessed on right hand side) to produce a High BMI warning if the resulting BMI it is above 25.

- Give patient additional Problem (diagnosis) of Hypertension (I10) and it should flag to give counseling on health benefits of losing weight. This rule requires the patient to have both observations of high BMI and a diagnosis of Hypertension to exist.

Measure 170.315(a)(9) – Clinical Decision Support	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Demonstrate that users can be authorized and unauthorized to configure CDS							
2: Trigger a CDS Intervention Interaction on one item							
3: Trigger a CDS Intervention Interaction on a combination of items							

Task 10: 170.315(a)(14) Implantable Device List

The Implantable Device List can be found by navigating to the quick tab on the right hand side labeled, "Implantable Devices". The user can then search for and select a patient and enter the UDI as indicated for the desired device and allow the system to parse the device information.

1: Record Unique Device Identifier.

User demonstrates health IT module records the following three unique device identifiers (UDI) in formats established by all three UDI issue agencies using data obtained from AccessGUDID:

For Test patient indicated by the proctor, enter the following UDI's

- Polyester Suture
  (01)10884521062856(11)141231(17)150707(10)A213B1(21)1234

- Cardiopulmonary bypass system filter, arterial blood line
  +B066000325011NS1/$$420020216LOT123456789012345/SXYZ456789012345678/16D20130202C1

- Cadaveric-donor/synthetic mineral bone graft
  =/W4146EB0010T0475=,000025=A99971312345600=>014032=}013032&,1000000000000XYZ123

2: Enable user to access and edit device details for patient

1. Add the implant date to the Cadaveric-donor/synthetic mineral bone graft**, Date = 06/01/2016** Edit reason = Entry Error
2. Change the Polyester Sutures to **inactive status**. Edit reason = Other, "**Sutures Removed"**

3. Confirm that the inactive Device no longer displays in the active Device list. But also that the full list of active and inactive devices can still be displayed by clicking the "Show All" checkbox.

Measure 170.315(a)(14) – Implantable Device List	**N**		**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#		Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Record Unique Device Identifier.								
2: Enable user to access and change UDI details for patient								

TASK 11 : 170.315(b)(2) – Clinical Information Reconciliation and Incorporation

The Reconciliation functionality resides within Medications as well as Problems and Allergies. It is accessed for each module individually as a button at the top of the respective module labeled as "RECONCILE"

Active Medication List

1: Electronically and Simultaneously Display Medication List Data in a Single View

Required Test Procedures

1.01: Tester shall log in to the EHR and shall select a patient record identified by the Vendor (1195)

1.02: Using the Vendor-identified EHR function(s), the Tester shall display two or more medication lists at the same time on the EHR screen

1.03: The Tester shall verify that at least two medication lists are displayed in a manner that allows a user to view, at a minimum, the source of the medication list and the last date each medication was documented, ordered, prescribed, refilled, or edited correctly and accurately

Test Data – Medication List #1

Patient = Reconcile Test (chart 1195)

Source of Medication List: Vendor-supplied (an incorporated Transition of Care/Referral Summary)

• Simvastatin 20 mg tablet by mouth once daily
RxNorm code: 312961; sample NDC product code: 52959-989
Status: (Active)

• Lorazepam 0.5 mg tablet by mouth three times daily
RxNorm code: 197900; sample NDC product code: 54868-2145
Status: (Active)

Test Data – Medication List #2

Source of Medication List: Vendor-supplied (a medication list reported by the patient)

• Insulin Glargine (or Lantus) 10 units once daily
RxNorm code: 847230 (or 847232); sample NDC product code: 0088-2219
Status: (Active)

• Metoprolol Tartrate 50 mg tablet by mouth once daily
RxNorm code: 866514; sample NDC product code: 63629-1463
Status: (Discontinued)

• Warfarin 5 mg tablet by mouth once daily Monday, Wednesday, Friday, Sunday RxNorm code: 855332; sample NDC product code: 54868-4286
Status: (Active)

• Warfarin Sodium 2.5 mg tablet by mouth once daily Tuesday, Thursday, Saturday RxNorm code: 855312; sample NDC product code: 54868-4400
Status: (Active)

170.315(b)(2) – 2: Create a Single Reconciled Medication List
Required Test Procedures
Tester shall merge at least two medication lists into a single reconciled medication list

Test Data – Single Reconciled Medication List
Simvastatin was **merged**
Lorazepam was **merged**
Insulin Glargine (or Lantus) was **merged**
Metroprolol Tartrate was **removed (NOT Merged)**
Warfarin Sodium 5 mg was **merged**
Warfarin Sodium 2.5 mg was **merged**

• Simvastatin 20 mg tablet by mouth once daily
RxNorm code: 312961; sample NDC product code: 52959-989
Status: (Active) Last modification date: (the current date)

• Lorazepam 0.5 mg tablet by mouth three times daily
RxNorm code: 197900; sample NDC product code: 54868-2145
Status: (Active) Last modification date: (the current date)

• Insulin Glargine (or Lantus) 10 units once daily
RxNorm code: 847230 (or 847232); sample NDC product code: 0088-2219
Status: (Active) Last modification date: (the current date)

• Warfarin Sodium 5 mg tablet by mouth once daily Monday, Wednesday, Friday, Sunday
RxNorm code: 855332; sample NDC product code: 54868-4286
Status: (Active) Last modification date: (the current date)

• Warfarin Sodium 2.5 mg tablet by mouth once daily Tuesday, Thursday, Saturday
RxNorm code: 855312; sample NDC product code: 54868-4400
Status: (Active) Last modification date: (the current date)

3: Enable a user to review and validate the accuracy of a final set of data and, upon a user's confirmation, automatically update the list.
3: the Tester shall verify that the patient's medication list displays the reconciled medications correctly and accurately

Test Data – Single Reconciled Medication List

• Simvastatin 20 mg tablet by mouth once daily
RxNorm code: 312961; sample NDC product code: 52959-989
Status: (Active) Last modification date: (the current date)

• Lorazepam 0.5 mg tablet by mouth three times daily
RxNorm code: 197900; sample NDC product code: 54868-2145
Status: (Active) Last modification date: (the current date)

• Insulin Glargine (or Lantus) 10 units once daily
RxNorm code: 847230 (or 847232); sample NDC product code: 0088-2219
Status: (Active) Last modification date: (the current date)

• Warfarin Sodium 5 mg tablet by mouth once daily Monday, Wednesday, Friday, Sunday RxNorm code: 855332; sample NDC product code: 54868-4286
Status: (Active) Last modification date: (the current date)

• Warfarin Sodium 2.5 mg tablet by mouth once daily Tuesday, Thursday, Saturday
RxNorm code: 855312; sample NDC product code: 54868-4400
Status: (Active) Last modification date: (the current date)

Measure 170.315(b)(2) – Clinical Information Reconciliation and Incorporation	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: Electronically and simultaneously display the data from at least two Medication list sources in a manner that allows a user to view patient data and their attributes, which must include, at a minimum, the source and last modification date.							

2: Enable a user to create a single reconciled list of medications							
3: Enable a user to review and validate the accuracy of a final set of data and, upon a user's confirmation, automatically update the list.							

TASK 12: - 170.315(b)(3) – E-Prescribing

User accesses and records Electronic prescriptions as follows by going to the chart from EHR Navigator>searching for the indicated patient and clicking the Medication button on the top button toolbar and entering the appropriate information as indicated below for each Medication with the type selected as Escripts. USER DOCTOR1 (PASSWORD = '1') SHALL BE USED FOR THIS TEST.
Patient ID = 1170 or 53218 may be used as an alternative patient ids

1: User Generate Electronic Prescription and send successfully to pharmacy electronically for the scenario presented below.
Test Data:
CHART 53218 , Hydrochlorothiazide 50 mg tablet

A.) A NEW prescription for Hydrochlorothiazide 50 mg tablets is written for patient, CLINICAL TEST by their physician, Test Doctor1. It is transmitted to the TX Pharmacy Store to be filled.

Element Name	Data
1. Medication name	Hydrochlorothiazide 50 mg tablet
Directions	Take 1 tablet every day by mouth
Quantity	30
Refills	1
Substitution Allowed?	Yes
Prescriber	Test Doctor 1
2. Medication name	ProAir HFA Inhalation Aerosol 90 mcg/actuation 6.7 g canister
Directions	Inhale 2 puffs by mouth every 4 hours as needed for shortness of breath
Refills	0
Quantity	1
Substitution Allowed	Yes
Pharmacy Name	TX Pharmacy Store

Address Line 1	W136 N8095 Texans Way
Address Line 2	
City	Houston
State	tx
ZIP Code	
Phone	832-515-8232

** USER MAY RECEIVE MESSAGE THAT MESSAGE WAS UNABLE TO BE SENT SINCE THIS IS A TEST DATABASE.

B.) User confirms the sent message in the ERX History screen

2: User can send a cancel request for a sent electronic prescription – Patientid = 53218

A.) User opens the ERX History for the patient by clicking the button by the same name at the top of the medications module.

B.) They then double-click the first log message for the electronic prescripton labeled as "NEWRX"

C.) On the proceeding screen, the user should have the option to cancel the prescription.
** USER MAY RECEIVE MESSAGE THAT MESSAGE WAS UNABLE TO BE SENT SINCE THIS IS A TEST DATABASE.

D.) Refreshing the ERX History screen at the top will show the additional Log messages from where this was sent.

3: User can refill and send an existing patient prescription to pharmacy electronically

A.) User opens the medications for the same patient (**Patientid = 1170**) and using the RX button refills the following Medications with **Test Doctor1** as the selected physician and sends them to **Mail Order Pharmacy 10.6MU**:

- Nexium 20mg Capsule, 1 Daily in the morning, qty = 30, 1 refill
- Atenolol 25mg Tablet, Take 1 tab twice a day, qty = 60, 3 refills

B.) User confirms the sent message in the ERX History screen

Measure 170.315(b)(3) – E-Prescribing	**N**	**Task Success**	**Path Deviation**	**Task time**		**Errors**	**Task Ratings** 5=Easy
Task	#	Mean (SD)	Deviations (Observed/ Optimal	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1: User Generate Electronic Prescription and send successfully to pharmacy electronically							
2: User can cancel a sent electronic prescription							
3: User can refill and send an existing patient prescription to pharmacy electronically							

Appendix 3: SYSTEM USABILITY SCALE QUESTIONNAIRE

*In 1996, Brooke published a "***low-cost usability scale that can be used for global assessments of systems usability***" known as the System Usability Scale or SUS.*[16] *Lewis and Sauro (2009) and others have elaborated on the SUS over the years. Computation of the SUS score can be found in Brooke's paper, in at* **http://www.usabilitynet.org/trump/documents/Suschapt.doc** *or in Tullis and Albert (2008).*

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

[16] Brooke, J.: SUS: A "quick and dirty" usability scale. In: Jordan, P. W., Thomas, B., Weerdmeester, B. A., McClelland (eds.) *Usability Evaluation in Industry* pp. 189--194. Taylor & Francis, London, UK (1996). SUS is copyrighted to Digital Equipment Corporation, 1986.

Lewis, J R & Sauro, J. (2009) "The Factor Structure Of The System Usability Scale." in *Proceedings of the Human Computer Interaction International Conference (HCII 2009), San Diego CA, USA*