StreamlineMD

A PRC Medical Company

# STREAMLINEMD EHR SAFETY ENHANCED DESIGN NIST 7742

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# Executive Summary

In February and March 2019, a usability study of StreamlineMD EHR Version 15.0 from StreamlineMD, LLC, an ambulatory electronic health record software, was conducted remotely by StreamlineMD, LLC client relations team. The purpose of this summative study was to test and validate the usability of the current user interface and provide evidence of usability in StreamlineMD EHR.

During the usability test, 10 users matching the target demographic criteria served as participants in the usability test. Each participant used StreamlineMD EHR to perform role-specific tasks.

This study collected performance data on 41 tasks typically conducted on an EHR by physicians/ nurse practitioner and nurses/clinical assistants. The tasks are correlated to the twelve certification criteria in *45 CFR Part 170 Subpart C of the Health Information Technology: 2015 Edition Health Information Technology (Health IT) Certification Criteria, 2015 Edition Base Electronic Health Record (EHR) Definition, and ONC Health IT Certification Program Modifications*:

§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 Interactions 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

The remote, one-on-one usability test was 60 minutes for each user. During each usability test, StreamlineMD EHR client relations team member greeted the participant. Each participant was provided request for informed consent/release which were signed and stored in our records.

All participants were current users of StreamlineMD EHR, so they had prior experience with some version of the EHR.

The client relations member introduced the test and instructed participants to complete a series of tasks (given one at a time) using the EHR Under Test (EHRUT).

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During each test, the participant's screens and audio were recorded electronically and the data logger recorded notes on paper and electronically. The recordings were later analyzed to determine task times and evaluate user performance.

All participant data was de-identified—no correspondence could be made from the identity of the participant to the data collected.

The UCD process used was based on NISTIR 7741[1] and various recommended metrics were used to evaluate the usability of the EHRUT. Use was in accordance with the examples set forth in the *NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records*. The following quantitative data were collected for each participant:

- Number of tasks successfully completed within the allotted time without assistance
- Time to complete each task
- Number and types of errors
- Path deviations
- Satisfaction ratings of the system and its components
- System Usability Scale (SUS)

In addition, results include the following qualitative observations:

- Major findings
- Areas for improvement
- Participant's verbalizations

The results from the System Usability Scale (SUS)[2] scored the subjective satisfaction with the system based on performance with these tasks to be:

**Overall SUS for all users: 94.50**

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# Introduction

The EHR Under Test (EHRUT) tested for this study was StreamlineMD EHR Version 15.0, an ambulatory electronic health record software. Designed to be easy to record, change and access patient medical information to healthcare providers in an outpatient setting for various specialties. StreamlineMD EHR consists of a comprehensive electronic clinical system used to create, store, and retrieve patient data from anywhere anytime. Intended users of StreamlineMD EHR are physicians, ultrasound technician, nurse practitioners, physician assistants, nurses, medical assistants, and anyone entering or accessing clinical data in an ambulatory practice. The usability testing attempted to represent realistic exercises and conditions that occur in a typical medical practice environment.

The purpose of this study was to test and validate the usability of the current user interface, and provide evidence of usability in the EHRUT. To this end, measures of effectiveness, efficiency, and user satisfaction were captured during the usability testing, such as task success, time on task, and task group ratings.

# Method

## Participants

A total of 10 participants were tested on StreamlineMD EHR. StreamlineMD, LLC implementation team coordinated the recruiting of participants with the administrators of healthcare organizations. The request to the administrators described end-user roles and the administrators identified matching participants. For the test purposes, end-user characteristics were identified and translated into a recruitment screener used to solicit potential participants; an example of a screener is provided in Appendix A **|** Sample Recruiting screener.

All participants were current end users of StreamlineMD EHR working in ambulatory settings, varying in specialty, and ranging in years of experience with StreamlineMD EHR.

Participants were not from the StreamlineMD, LLC organization. For relatively new features being tested, all participants were given the opportunity to have the same orientation and level of training as the actual end users would have received.

Recruited participants had a mix of backgrounds and demographic characteristics conforming to the recruitment screener. Table 1 lists participants by characteristics, including occupation/role and product experience. Participant names were replaced with Participant IDs so that an individual’s data cannot be tied back to individual identities.

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# Total Number and Participants Details

The total number of participants was 10. Their details are indicated in the below table:

*Table 1: Participants Details*

| Participant Identifier | Gender | Age | Education | Occupation/ Role | Professional Experience (months) | Computer Experience (months) | Product Experience (months) | Assistive Technology Needs |
|---|---|---|---|---|---|---|---|---|
| ID01 | Male | 30-39 | Master's Degree | Nurse Practitioner | *48* | *180* | *36* | *No* |
| ID02 | Female | 40-49 | Doctorate degree (e.g., MD, DNP, DMD, PhD) | MD | *168* | *240* | *12* | *No* |
| ID03 | Female | 30-39 | Bachelor's Degree | Clinical Assistant | *24* | *84* | *60* | *No* |
| ID04 | Female | 30-39 | Associate Degree | Clinical Assistant | *60* | *36* | *60* | *No* |
| ID05 | Male | 20-29 | High school graduate, diploma or the equivalent (for example: GED) | Clinical Assistant | *24* | *180* | *24* | *No* |
| ID06 | Male | 20-29 | High school graduate, diploma or the equivalent (for example: GED) | Clinical Assistant | *60* | *60* | *12* | *No* |
| ID07 | Female | 20-29 | High school graduate, diploma or the equivalent (for example: GED) | Clinical Assistant | *108* | *108* | *12* | *No* |
| ID08 | Female | 30-39 | Doctorate degree (e.g., MD, DNP, DMD, PhD) | Nurse Practitioner | *48* | *194* | *12* | *No* |
| ID09 | Female | 20-29 | High school graduate, diploma or the equivalent (for example: GED) | Clinical Assistant | *36* | *36* | *36* | *No* |
| ID10 | Female | 20-29 | High school graduate, diploma or the equivalent (for example: GED) | Clinical Assistant | *24* | *24* | *24* | *No* |

Ten participants matching the demographics in the Participants section were recruited and all ten participated in the usability test. (See Appendix B | Participant demographics.)

All participants were scheduled for 60-minute sessions.

## 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 StreamlineMD EHR. In short, this testing serves as both a means to record or benchmark current usability and identify areas for improvement.

During the usability test, participants interacted with StreamlineMD, LLC's StreamlineMD EHR. Each participant 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:

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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 the Usability Metrics section of this report.

### Tasks

A number of tasks were constructed that would be realistic and representative of the kinds of activities a user might perform with the EHR. Tasks were selected based on the twelve ONC CEHRT 2015 certification criteria, considering frequency of use, potential for risk to patient safety, and criticality of function. The Safety-Enhanced Design tasks for the twelve ONC CEHRT 2015 certification criteria included:

#### Criteria 170.315(a)(1) CPOE – Medications

A.1.1 Record medication order via CPOE
A.1.2 Change medication order via CPOE
A.1.3 Display changed CPOE medication order

#### Criteria 170.315(a)(2) CPOE – Laboratory

A.2.1 Record Lab Order via CPOE
A.2.2 Change Lab Order via CPOE
A.2.3 Display changed CPOE Lab order

#### Criteria 170.315(a)(3) CPOE – Radiology

A.3.1 Record Diagnostic Imaging Order via CPOE
A.3.2 Change Diagnostic Imaging Order via CPOE
A.3.3 Display changed CPOE Diagnostic Imaging Order

#### Criteria 170.315(a)(4) Drug-Drug, Drug-Allergy Interaction Check

A.4.1 Using CPOE, trigger a drug-drug interaction by entering a new medication order
A.4.2 Using CPOE, trigger a drug-allergy interaction by entering a new medication order
A.4.3 Adjust the severity level of a displayed drug-drug interaction

#### Criteria 170.315(a)(5) Patient Demographics

A.5.1 Record a patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity
A.5.2 Change the patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity

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A.5.3 Display the patient's changed preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity

## Criteria 170.315(a)(6) Problem List

A.6.1 Record a problem to the problem list
A.6.2 Change a problem on the problem list
A.6.3 Display the active problem list
A.6.4 Display the historical problem list

## Criteria 170.315(a)(7) Medication List

A.7.1 Record a medication to the medication list
A.7.2 Change a medication to the medication list
A.7.3 Display the active medication list

## Criteria 170.315(a)(8) Medication Allergy List

A.8.1 Record a medication allergy
A.8.2 Change a medication allergy
A.8.3 Display the active medication allergy list
A.8.4 Display the historical medication allergy list

## Criteria 170.315(a)(9) Clinical Decision Support

A.9.1 Add a CDS intervention and/or reference resource for each of the required elements
1. Problem list
2. Medication list
3. Medication Allergy List
4. At least one Demographic
5. Laboratory Test
6. Vital Signs
7. And a combination of at least 2 of the elements listed above

A.9.2 Trigger the CDS interventions/resources added using the applicable data elements from each of the required elements
A.9.3 View the intervention/resource information using the Info-button standard for data elements in the problem list, medication list, and demographics
A.9.4 Trigger the CDS interventions/resources based on data elements in the problem list, medication list, and medication allergy list by incorporating patient information from a transition of care/referral summary
A.9.5 Access the following attributes for one of the triggered CDS interventions/resources: bibliographic citation, developer, funding source, release/revision date

## Criteria 170.315(a)(14) Implantable Device List

A.14.1 Record UDI
A.14.2 Change UDI Status
A.14.3 Access UDI, device description, identifiers, and attributes

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## Criteria 170.315(b)(2) Clinical Information Reconciliation and Incorporate

B.2.1 Incorporate a CCDA and conduct reconciliation of the medications, medication allergies, and problems in the CCDA with the information currently in the patient's record
B.2.2 Generate a new CCDA with reconciled data

## Criteria 170.315(b)(3) E-Prescribing

B.3.1 Create new prescription
B.3.2 Change prescription (dosage or duration)
B.3.3 Cancel prescription
B.3.4 Refill Prescription
B.3.5 Receive fill status notification

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## Procedure

Upon arrival, participants were greeted; their identity was verified and matched with a name on the participant schedule. Participants were then assigned a participant ID. Each participant was read a request for informed consent/release and asked to give their consent verbally, which was recorded (see Appendix C | Recording Consent). A representative from the test team witnessed the participant's verbal consent.

To ensure that the test ran smoothly, two staff members participated in this test, the usability administrator and the data logger. The usability testing staff conducting the test were experienced usability practitioners.

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. A second person served as the data logger and took notes on task success, path deviations, number and type of errors, and comments. Participants were instructed to perform the tasks:

- as quickly as possible making as few errors and deviations as possible
- without assistance; administrators could give immaterial guidance and clarification on tasks, but not instructions on use
- withholding questions until the end of the test

For each task, the participants were given verbal directions. Task timing began once the administrator finished reading the task and said, "Begin now." The task time was stopped once the participant indicated he or she had successfully completed the task (see Appendix D | Sample Orientation).

Following the session, the administrator gave the participant the post-test questionnaire (see Appendix F | System Usability Scale Questionnaire). Scoring is discussed below in the Data Scoring section. Participants were thanked for their time.

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

## Test Location

Usability tests were conducted remotely using online meeting tool Gotomeeting. Each participant joined the meeting from his/her location. Both the test administrator and the data logger could see the participant's screen and listen to the audio of the session. Participants were asked to join from a location that was relatively quiet and free from distraction.

## Test Environment

StreamlineMD EHR would typically be used in a physician's office or ambulatory surgical center setting. This usability testing was conducted remotely, with participants interacting with the StreamlineMD EHR software over Citrix GoToMeeting online conferencing software. Using remote testing allowed the participants to use the StreamlineMD EHR from their normal office location. Participants were given instructions on how to access the meeting online. Once in the meeting, they were given keyboard and mouse control of the test system by the administrator. Because the StreamlineMD EHR is a client-server application, each participant was accessing the application utilized for testing using Remote Desktop Protocol (RDP) to the servers hosted by StreamlineMD, LLC.

StreamlineMD EHR staff set up the application per the product documentation describing the system setup and configuration. Technically, the system performance (i.e., response time) was representative to what actual users would experience in a field implementation.

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StreamlineMD EHR staff set up the database used for testing (including user preferences and other configuration options). Different user and patient were used for each participant performing the task ensure that the database was in the exact same configuration at the beginning of each participant's test. Participants did not change any of the default system settings. The usability test setup provided a uniform experience to all participants.

### Test Forms and Tools

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

1. Recording Consent Statement
2. Usability Protocol, including the SUS and post-test questionnaire
3. GoToMeeting

Examples of these documents can be found in the Appendices. The Usability Test Protocol was designed capture required data for each scenario.

The test administrator and data logger were logged into the GoToMeeting session so that each could observe the test session. The screen and audio of each participant interacting with the EHRUT were recorded using the GoToMeeting recording tool. This recording provided an opportunity to replay the test for later evaluation to ensure the accuracy of timings, performance against the optimal path, etc.

### Participant Instructions

The administrator read scenarios and task directions from the Usability Test Protocol to each participant.

Following the procedural instructions, participants were then given a selection of the 37 tasks to complete.

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

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## Data Scoring

The table (Table 2) below details how tasks were scored, errors evaluated, and the time data analyzed.

*Table 2: Details of how observed data were scored.*

| **Rationale and Scoring** | |
|---|---|
| **Effectiveness**: Task Success | Task success was determined by assigning numeric weights for various levels of task success, as follows:<br><br>Success (without assistance) = 100%<br><br>Partial success = 50%<br><br>Failure = 0%<br><br>A task was counted as a "Success" if the participant was able to achieve the correct outcome within the time allotted on a per task basis and a 'Partial success' if the participant was able to achieve the correct outcome with minimal assistance. A success score for each task was calculated by averaging the scores for each task. The results are provided as a percentage.<br><br>Task times were recorded for successes. Observed task times divided by the optimal time for each task were calculated as a measure of optimal efficiency.<br><br>Optimal task performance time, as benchmarked by expert performance under realistic conditions, was recorded when constructing tasks. Target task times were operationally derived by multiplying a benchmarked expert performance by a factor of 2.0, allowing for some time buffer because (1) participants were not trained to expert performance, (2) some features were new, and (3) some tasks had multiple valid paths to a successful outcome. Thus, if expert, optimal performance on a task was 10 seconds then allotted task time performance was [10 * 2.0] seconds. This ratio was 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, performed it incorrectly, or reached the end of the allotted time before successful completion, the task was counted as a Failure. No task times for failed tasks or tasks that exceeded the target task time were used in calculations. |
| **Rationale and Scoring** | The total number of errors was calculated by averaging the number of errors counted for each task. Not all deviations were counted as errors. Task failures were also expressed as the mean number of failed tasks per participant.<br><br>A qualitative account of the observed errors and error types was collected. |

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| | |
|---|---|
| **Efficiency:** Task Deviations | The participant's navigation path (i.e., steps) through the application was recorded.<br><br>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.<br><br>Path deviations are reported on a qualitative level for use in recommendations for improvement. |
| **Efficiency:** Task Time | Each task was timed from when the administrator said "Begin" until the participant said "Done." If the participant failed to say "Done," the time was stopped when the participant ceased performing the task. Only task times for tasks that were successfully completed and tasks that were completed at or under the target time were included in the average task time analysis. Average time per task and variance measures were calculated for each task for use in the results analysis. |
| **Satisfaction:** Task Rating | Participant's subjective impression of the ease of use of the application was measured by administering both a simple question on completion of each scenario and a post-session questionnaire. After each scenario, the participant was asked to rate "Overall, these tasks were:" on a scale of 1 (Very Difficult) to 5 (Very Easy). These data were averaged across participants.<br><br>To measure participants' confidence in and likeability of StreamlineMD EHR 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 F \| System Usability Scale Questionnaire. |

## Results

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.

The usability testing results for StreamlineMD EHR are detailed below. The results should be seen in light of the objectives and goals outlined in Study Design section. The data yielded actionable results that, when corrected, will yield a material, positive impact on user performance.

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# Data Analysis and Reporting

*Table 3: Computerized Physician Order Entry (CPOE) – Medications Task Results*

| Task Scores | N | Task Success | | Task Time (sec) | | Path Deviation | | Errors | |
|---|---|---|---|---|---|---|---|---|---|
| Task | # | Mean | (SD) | Mean | (SD) | Deviations (Observed / Optimal) | (SD) | Mean | (SD) |
| Record medication order via CPOE | 10 | 100 | 0.00 | 48.3 | 11.75 | 1.37 | 0.58 | 0.00 | 0.00 |
| Change medication order via CPOE | 10 | 100 | 0.00 | 12.7 | 1.49 | 1.00 | 0.11 | 0.00 | 0.00 |
| Display changed CPOE medication order | 10 | 100 | 0.00 | 4.4 | 2.87 | 0.6 | 0.51 | 0.00 | 0.00 |

*Table 4: CPOE (Computerized Physician Order Entry) Medications Task Scenario*

| Task Scenario Ratings | Mean | (SD) |
|---|---|---|
| Task Group Satisfaction Ratings (5=very easy) | 4.96 | 0.05 |

### Discussion of Findings

The participants were given the following CPOE—Medications tasks:

A.1.1 Record medication order via CPOE
A.1.2 Change medication order via CPOE
A.1.3 Display changed CPOE medication order

## Effectiveness

The success scores for each of these tasks were 100%. Participants were easily able to access medication order tasks.

### Efficiency

All participants completed the task with either fewer steps or the same number of steps as expert users. All participants completed the task within the optimal time for each task, as suggested by expert timings.

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**Satisfaction**

Participants had an average satisfaction rating of 4.96 out of 5 points on a Likert scale. Most participants were familiar with these tasks and found them straightforward and easy to complete.

**Major Findings**

- All participants found that the system was very easy to adapt and did not require much training.

**Areas for Improvement**

No significant areas of improvement were identified.

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Criteria 170.315(a)(2) CPOE – Laboratory

# Data Analysis and Reporting

*Table 5: Computerized Physician Order Entry (CPOE) – Laboratory Task Results*

| Task Scores | N | Task Success | | Task Time (sec) | | Path Deviation | | Errors | |
|---|---|---|---|---|---|---|---|---|---|
| Task | # | Mean | (SD) | Mean | (SD) | Deviations (Observed / Optimal) | (SD) | Mean | (SD) |
| Record Lab Order via CPOE | 10 | 100 | 0.00 | 36.8 | 12.49 | 1.33 | 0.45 | 0.00 | 0.00 |
| Change Lab Order via CPOE | 10 | 100 | 0.00 | 16.2 | 3.04 | 1.12 | 0.25 | 0.00 | 0.00 |
| Display changed CPOE Lab order | 10 | 100 | 0.00 | 7 | 7.14 | 1.1 | 1.52 | 0.00 | 0.00 |

*Table 6: CPOE (Computerized Physician Order Entry) Laboratory Task Scenario*

| Task Scenario Ratings | Mean | (SD) |
|---|---|---|
| Task Scenario Satisfaction Ratings (5=very easy) | 4.93 | 0.11 |

# Discussion of Findings

The participants were given the following CPOE - Laboratory tasks:

A.2.1 Record Lab Order via CPOE
A.2.2 Change Lab Order via CPOE
A.2.3 Display changed CPOE Lab order

## Effectiveness

The success scores for each of these tasks were 100%. Participants were easily able to access lab orders and record a new lab order.

## Efficiency

All participants completed the tasks with either fewer steps or the same number of steps as expert users. All participants completed the tasks within the optimal time for each task, as suggested by expert timings.

## Satisfaction

Participants had an average satisfaction rating of 4.93 out of 5 points on a Likert scale. Most participants were familiar with these tasks and found them straightforward and easy to complete.

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## Major Findings

- All participants found that the system was very easy to adapt and did not require much training.

## Areas for Improvement

No significant areas of improvement were identified.

### Criteria 170.315(a)(3) CPOE – Radiology

# Data Analysis and Reporting

*Table 7: Computerized Physician Order Entry (CPOE) – Radiology Task Results*

| Task Scores | N | Task Success | | Task Time (sec) | | Path Deviation | | Errors | |
|---|---|---|---|---|---|---|---|---|---|
| Task | # | Mean | (SD) | Mean | (SD) | Deviations (Observed / Optimal) | (SD) | Mean | (SD) |
| Record Diagnostic Imaging Order via CPOE | 10 | 100 | 0.00 | 29.6 | 8.65 | 1.21 | 0.35 | 0.00 | 0.00 |
| Change Diagnostic Imaging Order via CPOE | 10 | 100 | 0.00 | 16.4 | 10.36 | 1.76 | 0.54 | 0.00 | 0.00 |
| Display changed CPOE Diagnostic Imaging Order | 10 | 100 | 0.00 | 4.5 | 2.54 | 0.9 | 0.73 | 0.00 | 0.00 |

*Table 8: CPOE (Computerized Physician Order Entry) Radiology Task Scenario*

| Task Scenario Ratings | Mean | (SD) |
|---|---|---|
| Task Scenario Satisfaction Ratings (5=very easy) | 5.00 | 0.00 |

# Discussion of Findings

The participants were given the following CPOE - Radiology tasks:

A.3.1 Record Diagnostic Imaging Order via CPOE
A.3.2 Change Diagnostic Imaging Order via CPOE
A.3.3 Display changed CPOE Diagnostic Imaging Order

## Effectiveness

The success scores for each of these tasks were 100%. Participants were easily able to access radiology orders and record a new radiology order.

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## Efficiency

All participants completed the tasks with either fewer steps or the same number of steps as expert users.
All participants completed the tasks within the optimal time for each task, as suggested by expert timings.

## Satisfaction

Participants had an average satisfaction rating of 5 out of 5 points on a Likert scale. Most participants were familiar with these tasks and found them straightforward and easy to complete.

## Major Findings

- All participants were able to navigate the imaging order tasks with ease.
- All participants found that the system was very easy to adapt and did not require much training.

## Areas for Improvement

No significant areas of improvement were identified.

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# Data Analysis and Reporting

*Table 9: Drug-Drug, Drug-Allergy Interaction Check Task Results*

| Task Scores | N | Task Success | | Task Time (sec) | | Path Deviation | | Errors | |
|---|---|---|---|---|---|---|---|---|---|
| Task | # | Mean | (SD) | Mean | (SD) | Deviations (Observed / Optimal) | (SD) | Mean | (SD) |
| Using CPOE, trigger a drug-drug interaction by entering a new medication order | 10 | 100 | 0.00 | 56.7 | 19.79 | 1.17 | 0.38 | 0.00 | 0.00 |
| Using CPOE, trigger a drug-allergy interaction by entering a new medication order | 10 | 100 | 0.00 | 67.9 | 37.34 | 1.08 | 0.43 | 0.00 | 0.00 |
| Adjust the severity level of a displayed drug-drug interaction | 10 | 100 | 0.00 | 41.1 | 21.75 | 0.88 | 0.18 | 0.00 | 0.00 |

*Table 10: Drug-Drug, Drug-Allergy Interaction Check Task Results*

| Task Scenario Ratings | Mean | (SD) |
|---|---|---|
| Task Scenario Satisfaction Ratings (5=very easy) | 4.93 | 0.05 |

# Discussion of Findings

The participants were given the following Drug-Drug, Drug-Allergy Interaction Check tasks:

A.4.1 Using CPOE, trigger a drug-drug interaction by entering a new medication order
A.4.2 Using CPOE, trigger a drug-allergy interaction by entering a new medication order
A.4.3 Adjust the severity level of a displayed drug-drug interaction

## Effectiveness

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The success scores for each of these tasks were 100%. Participants were easily able to access drug-drug, drug-allergy interactions.

## Efficiency

All participants completed the tasks with either fewer steps or the same number of steps as expert users. All participants completed the tasks within the optimal time for each task, as suggested by expert timings.

## Satisfaction

Participants had an average satisfaction rating of 4.93 out of 5 points on a Likert scale. Most participants were familiar with these tasks and found them straightforward and easy to complete.

## Major Findings

- All participants found that the system was very easy to adapt and did not require much training.

## Areas for Improvement

No significant areas of improvement were identified.

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Criteria 170.315(a)(5) Patient Demographics

# Data Analysis and Reporting

*Table 11: Patient Demographics Task Results*

| Task Scores | N | Task Success | | Task Time (sec) | | Path Deviation | | Errors | |
|---|---|---|---|---|---|---|---|---|---|
| Task | # | Mean | (SD) | Mean | (SD) | Deviations (Observed / Optimal) | (SD) | Mean | (SD) |
| Record a patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity | 10 | 100 | 0.00 | 119.5 | 57.12 | 1.29 | 0.23 | 0.00 | 0.00 |
| Change the patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity | 10 | 100 | 0.00 | 65.4 | 74.5 | 4.5 | 3.71 | 0.00 | 0.00 |
| Display the patient's changed preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity | 10 | 100 | 0.00 | 40 | 15.9 | 2.3 | 15.9 | 0.00 | 0.00 |

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*Table 12: Patient Demographics Task Results*

| Task Scenario Ratings | Mean | (SD) |
|---|---|---|
| Task Scenario Satisfaction Ratings (5=very easy) | 4.93 | 0.05 |

# Discussion of Findings

The participants were given the following Patient Demographics tasks:

A.5.1 Record a patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity

A.5.2 Change the patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity

A.5.3 Display the patient's changed preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity

## Effectiveness

The success scores for each of these tasks were 100%. Participants were able to access Patient Demographics.

## Efficiency

Few participants took a little longer to enter data as normally they do not use Patient Demographics function.

## Satisfaction

Participants had an average satisfaction rating of 4.93 out of 5 points on a Likert scale. Most participants were familiar with these tasks and found them straightforward and easy to complete.

## Major Findings

- All participants found that the system was very easy to adapt and did not require much training.

## Areas for Improvement

No significant areas of improvement were identified.

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Criteria 170.315(a)(6) Problem List

# Data Analysis and Reporting

*Table 13: Problem List Task Results*

| Task Scores | N | Task Success | | Task Time (sec) | | Path Deviation | | Errors | |
|---|---|---|---|---|---|---|---|---|---|
| Task | # | Mean | (SD) | Mean | (SD) | Deviations (Observed / Optimal) | (SD) | Mean | (SD) |
| Record a problem to the problem list | 10 | 100 | 0.00 | 22.7 | 5.37 | 1.08 | 0.13 | 0.00 | 0.00 |
| Change a problem on the problem list | 10 | 100 | 0.00 | 15.4 | 6.32 | 0.98 | 0.14 | 0.00 | 0.00 |
| Display the active problem list | 10 | 100 | 0.00 | 4.4 | 2.27 | 0.6 | 0.84 | 0.00 | 0.00 |
| Display the historical problem list | 10 | 100 | 0.00 | 4.6 | 2.36 | 1.2 | 0.42 | 0.00 | 0.00 |

*Table 14: Problem List Task Results*

| Task Scenario Ratings | Mean | (SD) |
|---|---|---|
| Task Scenario Satisfaction Ratings (5=very easy) | 5.00 | 0.00 |

# Discussion of Findings

The participants were given the following Problem List tasks:

A.6.1 Record a problem to the problem list
A.6.2 Change a problem on the problem list
A.6.3 Display the active problem list
A.6.4 Display the historical problem list

## Effectiveness

The success scores for each of these tasks were 100%. Participants were easily able to access problem list.

## Efficiency

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All participants completed the tasks with either fewer steps or the same number of steps as expert users.
All participants completed the tasks within the optimal time for each task, as suggested by expert timings.

## Satisfaction

Participants had an average satisfaction rating of 5 out of 5 points on a Likert scale. Most participants were familiar with these tasks and found them straightforward and easy to complete.

## Major Findings

- All participants found that the system was very easy to adapt and did not require much training.

## Areas for Improvement

No significant areas of improvement were identified.

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Criteria 170.315(a)(7) Medication List

# Data Analysis and Reporting

*Table 15: Medication List Task Results*

| Task Scores | N | Task Success | | Task Time (sec) | | Path Deviation | | Errors | |
|---|---|---|---|---|---|---|---|---|---|
| Task | # | Mean | (SD) | Mean | (SD) | Deviations (Observed / Optimal) | (SD) | Mean | (SD) |
| Record a medication to the medication list | 10 | 100 | 0.00 | 30.0 | 7.80 | 1.16 | 0.26 | 0.00 | 0.00 |
| Change a medication to the medication list | 10 | 100 | 0.00 | 28.1 | 40.83 | 1.1 | 0.27 | 0.00 | 0.00 |
| Display the active medication list | 10 | 100 | 0.00 | 5.8 | 4.26 | 0.7 | 0.82 | 0.00 | 0.00 |
| Display the historical medication list | 10 | 100 | 0.00 | 7.1 | 5.40 | 1.1 | 0.56 | 0.00 | 0.00 |

*Table 16: Medication List Task Results*

| Task Scenario Ratings | Mean | (SD) |
|---|---|---|
| Task Group Satisfaction Ratings (5=very easy) | 4.97 | 0.05 |

# Discussion of Findings

The participants were given the following Medication List tasks:

A.7.1 Record a medication to the medication list
A.7.2 Change a medication to the medication list
A.7.3 Display the active medication list

## Effectiveness

The success scores for each of these tasks were 100%. Participants were easily able to perform task for medication list very effectively.

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## Efficiency

All participants completed the tasks with either fewer steps or the same number of steps as expert users. All participants completed the tasks within the optimal time for each task, as suggested by expert timings.

## Satisfaction

Participants had an average satisfaction rating of 4.97 out of 5 points on a Likert scale. Most participants were familiar with these tasks and found them straightforward and easy to complete.

## Major Findings

- All participants found that the system was very easy to adapt and did not require much training.

## Areas for Improvement

No significant areas of improvement were identified.

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# Data Analysis and Reporting

*Table 17: Medication Allergy List Task Results*

| Task Scores | N | Task Success | | Task Time (sec) | | Path Deviation | | Errors | |
|---|---|---|---|---|---|---|---|---|---|
| Task | # | Mean | (SD) | Mean | (SD) | Deviations (Observed / Optimal) | (SD) | Mean | (SD) |
| Record a medication allergy | 10 | 100 | 0.00 | 25.6 | 6.32 | 1.08 | 0.25 | 0.00 | 0.00 |
| Change a medication allergy | 10 | 100 | 0.00 | 16.8 | 8.49 | 1.5 | 0.58 | 0.00 | 0.00 |
| Display the active medication allergy list | 10 | 100 | 0.00 | 5.9 | 3.10 | 0.9 | 0.7 | 0.00 | 0.00 |
| Display the historical medication allergy list | 10 | 100 | 0.00 | 6.8 | 4.21 | 1.1 | 0.3 | 0.00 | 0.00 |

*Table 18: Medication Allergy List Task Results*

| Task Scenario Ratings | Mean | (SD) |
|---|---|---|
| Task Scenario Satisfaction Ratings (5=very easy) | 5.00 | 0.00 |

# Discussion of Findings

The participants were given the following Medication Allergy List tasks:

A.8.1 Record a medication allergy
A.8.2 Change a medication allergy
A.8.3 Display the active medication allergy list
A.8.4 Display the historical medication allergy list

## Effectiveness

The success scores for each of these tasks were 100%. Participants were easily able to perform the medication allergy list task effectively.

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## Efficiency

All participants completed the tasks with either fewer steps or the same number of steps as expert users. All participants completed the tasks within the optimal time for each task, as suggested by expert timings.

## Satisfaction

Participants had an average satisfaction rating of 5 out of 5 points on a Likert scale. Most participants were familiar with these tasks and found them straightforward and easy to complete.

## Major Findings

- All participants found that the system was very easy to adapt and did not require much training.

## Areas for Improvement

No significant areas of improvement were identified.

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Criteria 170.315(a)(9) Clinical Decision Support

# Data Analysis and Reporting

*Table 19: Clinical Decision Support Task Results*

| Task Scores | N | Task Success | | Task Time (sec) | | Path Deviation | | Errors | |
|---|---|---|---|---|---|---|---|---|---|
| Task | # | Mean | (SD) | Mean | (SD) | Deviations (Observed / Optimal) | (SD) | Mean | (SD) |
| Add a CDS intervention and/or reference resource for each of the required elements<br>1. Problem list<br>2. Medication list<br>3. Medication Allergy List<br>4. At least one Demographic<br>5. Laboratory Test<br>6. Vital Signs<br>7. And a combination of at least 2 of the elements listed above | 10 | 100 | 0.00 | 22 | 11.13 | 0.94 | 1.50 | 0.00 | 0.00 |
| Trigger the CDS interventions/resources added using the applicable data elements from each of the required elements | 10 | 100 | 0.00 | 15.4 | 5.18 | 0.98 | 0.28 | 0.00 | 0.00 |
| View the intervention/resource | 10 | 100 | 0.00 | 18.3 | 13.35 | 1.5 | 1.59 | 0.00 | 0.00 |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| information using the Info-button standard for data elements in the problem list, medication list, and demographics | | | | | | | | | |
| Trigger the CDS interventions/resources based on data elements in the problem list, medication list, and medication allergy list by incorporating patient information from a transition of care/referral summary | 10 | 100 | 0.00 | 107.7 | 20.60 | 1.10 | 0.12 | 0.00 | 0.00 |
| Access the following attributes for one of the triggered CDS interventions/resources: bibliographic citation, developer, funding source, release/revision date | 10 | 100 | 0.00 | 12.1 | 4.62 | 0.8 | 0.24 | 0.00 | 0.00 |

*Table 20: Clinical Decision Support Task Results*

| Task Scenario Ratings | Mean | (SD) |
|---|---|---|
| Task Scenario Satisfaction Ratings (5=very easy) | 4.86 | 0.19 |

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# Discussion of Findings

The participants were given the following Clinical Decision Support tasks:

A.9.1 Add a CDS intervention and/or reference resource for each of the required elements
1. Problem list
2. Medication list
3. Medication Allergy List
4. At least one Demographic
5. Laboratory Test
6. Vital Signs
7. And a combination of at least 2 of the elements listed above

A.9.2 Trigger the CDS interventions/resources added using the applicable data elements from each of the required elements

A.9.3 View the intervention/resource information using the Info-button standard for data elements in the problem list, medication list, and demographics

A.9.4 Trigger the CDS interventions/resources based on data elements in the problem list, medication list, and medication allergy list by incorporating patient information from a transition of care/referral summary

A.9.5 Access the following attributes for one of the triggered CDS interventions/resources: bibliographic citation, developer, funding source, release/revision date

## Effectiveness

The success scores for each of these tasks were 100%. Participants were easily able to Clinical Decision Support.

## Efficiency

All participants completed the tasks with either fewer steps or the same number of steps as expert users. All participants completed the tasks within the optimal time for each task, as suggested by expert timings.

## Satisfaction

Participants had an average satisfaction rating of 4.86 out of 5 points on a Likert scale. Most participants were familiar with these tasks and found them straightforward and easy to complete.

## Major Findings

- All participants found that the system was very easy to adapt and did not require much training.

## Areas for Improvement

No significant areas of improvement were identified.

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# Data Analysis and Reporting

*Table 21: Implantable Device List Task Results*

| Task Scores | N | Task Success | | Task Time (sec) | | Path Deviation | | Errors | |
|---|---|---|---|---|---|---|---|---|---|
| Task | # | Mean | (SD) | Mean | (SD) | Deviations (Observed / Optimal) | (SD) | Mean | (SD) |
| Record UDI | 10 | 100 | 0.00 | 24.4 | 11.13 | 1.35 | 0.24 | 0.00 | 0.00 |
| Change UDI Status | 10 | 100 | 0.00 | 13.1 | 4.79 | 0.95 | 0.25 | 0.00 | 0.00 |
| Access UDI, device description, identifiers, and attributes | 10 | 100 | 0.00 | 8.6 | 7.53 | 1.7 | 0.94 | 0.00 | 0.00 |

*Table 22: Implantable Device List Task Results*

| Task Scenario Ratings | Mean | (SD) |
|---|---|---|
| Task Group Satisfaction Ratings (5=very easy) | 4.83 | 0.20 |

# Discussion of Findings

The participants were given the following Medication Allergy List tasks:

A.14.1 Record UDI
A.14.2 Change UDI Status
A.14.3 Access UDI, device description, identifiers, and attributes

## Effectiveness

The success scores for each of these tasks were 100%. Participants were easily able to perform the implantation device list task effectively.

## Efficiency

All participants completed the tasks with either fewer steps or the same number of steps as expert users. All participants completed the tasks within the optimal time for each task, as suggested by expert timings.

## Satisfaction

Participants had an average satisfaction rating of 4.83 out of 5 points on a Likert scale. Most participants were familiar with these tasks and found them straightforward and easy to complete.

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## Major Findings

- All participants found that the system was very easy to adapt and did not require much training.

## Areas for Improvement

No significant areas of improvement were identified.

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# Data Analysis and Reporting

*Table 22: Clinical Information Reconciliation and Incorporate Task Results*

| Task Scores | N | Task Success | | Task Time (sec) | | Path Deviation | | Errors | |
|---|---|---|---|---|---|---|---|---|---|
| Task | # | Mean | (SD) | Mean | (SD) | Deviations (Observed / Optimal) | (SD) | Mean | (SD) |
| Incorporate a CCDA and conduct reconciliation of the medications, medication allergies, and problems in the CCDA with the information currently in the patient's record | 10 | 100 | 0 | 78.1 | 34.03 | 1.1 | 0.22 | 0 | 0 |
| Generate a new CCDA with reconciled data | 10 | 100 | 0 | 10.8 | 3.32 | 0.8 | 0.63 | 0 | 0 |

*Table 23: Clinical Information Reconciliation and Incorporate Task Results*

| Task Scenario Ratings | Mean | (SD) |
|---|---|---|
| Task Scenario Satisfaction Ratings (5=very easy) | 4.85 | 0.21 |

# Discussion of Findings

The participants were given the following Medication Allergy List tasks:

B.2.1 Incorporate a CCDA and conduct reconciliation of the medications, medication allergies, and problems in the CCDA with the information currently in the patient's record

B.2.2 Generate a new CCDA with reconciled data

## Effectiveness

The success scores for each of these tasks were 100%. Participants were easily able to access drug-drug, drug-allergy interactions.

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## Efficiency

All participants completed the tasks with either fewer steps or the same number of steps as expert users. All participants completed the tasks within the optimal time for each task, as suggested by expert timings.

## Satisfaction

Participants had an average satisfaction rating of 4.85 out of 5 points on a Likert scale. Most participants were familiar with these tasks and found them straightforward and easy to complete.

## Major Findings

- All participants found that the system was very easy to adapt and did not require much training.

## Areas for Improvement

No significant areas of improvement were identified.

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# Data Analysis and Reporting

*Table 24: E-Prescribing Task Results*

| Task Scores | N | Task Success | | Task Time (sec) | | Path Deviation | | Errors | |
|---|---|---|---|---|---|---|---|---|---|
| Task | # | Mean | (SD) | Mean | (SD) | Deviations (Observed / Optimal) | (SD) | Mean | (SD) |
| Create new prescription | 10 | 100 | 0.00 | 57.3 | 31.18 | 0.83 | 0.24 | 0.00 | 0.00 |
| Change prescription (dosage or duration) | 10 | 100 | 0.00 | 58.66 | 24.43 | 1.1 | 0.25 | 0.00 | 0.00 |
| Cancel prescription | 10 | 100 | 0.00 | 20.2 | 6.66 | 1.05 | 0.38 | 0.00 | 0.00 |
| Refill Prescription | 10 | 100 | 0.00 | 31.4 | 6.68 | 1.2 | 0.32 | 0.00 | 0.00 |
| Receive fill status notification | 10 | 100 | 0.00 | 6.7 | 3.05 | 1.4 | 0.69 | 0.00 | 0.00 |

*Table 25: E-Prescribing Task Results*

| Task Scenario Ratings | Mean | (SD) |
|---|---|---|
| Task Group Satisfaction Ratings (5=very easy) | 4.95 | 0.09 |

# Discussion of Findings

The participants were given the following Medication Allergy List tasks:

B.3.1 Create new prescription
B.3.2 Change prescription (dosage or duration)
B.3.3 Cancel prescription
B.3.4 Refill Prescription
B.3.5 Receive fill status notification

## Effectiveness

The success scores for each of these tasks were 100%. Participants were easily able to perform all e-prescription tasks effectively.

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## Efficiency

All participants completed the tasks with either fewer steps or the same number of steps as expert users. All participants completed the tasks within the optimal time for each task, as suggested by expert timings.

## Satisfaction

Participants had an average satisfaction rating of 4.95 out of 5 points on a Likert scale. Most participants were familiar with these tasks and found them straightforward and easy to complete.

## Major Findings

- All participants found that the system was very easy to adapt and did not require much training.

## Areas for Improvement

No significant areas of improvement were identified.

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## Overall Results

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be 94.5. SUS Scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

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## Appendices

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

Appendix A | Sample Recruiting screener

Appendix B | Participant demographics

Appendix C | Recording Consent

Appendix D | Sample Orientation

Appendix E | Protocol Tasks

Appendix F | System Usability Scale Questionnaire

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# Appendix A | Sample Recruiting screener

Participants were asked to the following questions prior to the test session. The test administrator asked the questions at the beginning of the session and the data logger recorded the responses.

1. What is your age range?
2. What is your education?
3. What is your current job title/role?
4. How many month(s) of professional experience do you have in this role?
5. How many month(s) of computer experience do you have?
6. How long (in months) have you been working in this role?
7. How many month(s) of experience do you have using StreamlineMD EMR?

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# Appendix B | Participant demographics

Below is a summary of participant demographics for this study.

| PARTICIPANT GENDER n (N=10) | | % |
|---|---|---|
| Male | 1 | 10 |
| Female | 9 | 90 |
| Other | 0 | 0 |
| | | |
| PARTICIPANT AGE n (N=10) | | % |
| 20-29 | 5 | 50.0% |
| 30-39 | 4 | 40.0% |
| 40-49 | 1 | 10.0% |
| 50-59 | 0 | 0.0% |

| PARTICIPANT EDUCATION n (N=10) | | % |
|---|---|---|
| High school graduate, diploma or equivalent | 5 | 50.0% |
| Associate degree | 1 | 10.0% |
| Bachelor's degree | 1 | 10.0% |
| Master's degree | 1 | 10.0% |
| Doctorate degree (e.g., MD, DNP, DMD, PhD) | 2 | 20.0% |

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| PARTICIPANT ROLES n (N=10) | | % |
|---|---|---|
| Physician | 1 | 10.0% |
| Nurse Practitioner | 2 | 20.0% |
| Clinical Assistant | 7 | 70.0% |

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# Appendix C | Recording Consent

Participants were asked to give a verbal consent to the statement below:

## Recording Consent Statement

Do you grant StreamlineMD, LLC permission to record this usability test session and use this recording for internal use only for the purpose of improving the products being tested? Yes

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# Appendix D | Sample Orientation

Introduction

Thank you for agreeing to participate in this usability study. Today you will be helping us evaluate workflows pertaining to the ONC's EHR vendor certification requirements.

In a moment, I'll be asking you to complete these workflows using StreamlineMD EHR. I'll be taking notes and so will other StreamlineMD staff members on the phone.

As you go through the workflows, please keep in mind that it is StreamlineMD EHR under review here, not you. You may arrive at a point where you're not sure what you are supposed to do. Just take your best guess, and if you get stuck, let me know. We want to observe how you would expect to use the system if we weren't here.

Our session today will last approximately 60 minutes. During that time; you will take a look at StreamlineMD EHR, Version 15.0, an electronic health records system.

I will ask you to complete a few tasks using this system and answer some questions. 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. You will be asked to complete these tasks on your own trying to do them as quickly as possible, with the fewest possible errors or deviations. Do not do anything more than asked. If you get lost or have difficulty; I cannot answer any questions or help you with anything to do with the system itself. Please save your detailed comments until the end of a task or the end of the session as a whole when we can discuss freely.

We are recording the audio and screenshots of our session today. All of the information that you provide will be kept confidential and your name will not be associated with your comments at any time.

Do you have any questions or concerns? No

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# Appendix E | Protocol Tasks

## Criteria a.5: Demographics

### Task ID: A.5.1 Record Patient's Preferred Language, Date of Birth, Birth Sex, Race, Ethnicity, Sexual Orientation and Gender Identity

**Moderator**: We are going to begin by adding a new patient to the EMR.

Jennifer Smith has called and is interested in scheduling an appointment. Please add this patient and record the patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation and gender identity.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.5.2 Change Patient's Preferred Language, Date of Birth, Birth Sex, Race, Ethnicity, Sexual Orientation and Gender Identity

**Moderator**: Upon arriving to the office, Jennifer Smith has alerted you that some of her demographic information will need to be changed. Please change the patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation and/or gender identity.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.5.3 Display Changed Patient's Preferred Language, Date of Birth, Birth Sex, Race, Ethnicity, Sexual Orientation and Gender Identity

**Moderator**: Please review and display the changes that have been made for Jennifer Smith including the change of patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation and/or gender identity.

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*You may begin now – When completed, please say 'done'.*

## Criteria a.8: Medication Allergy List

### Task ID: A.8.1 Record a Medication Allergy

**Moderator**: **KIMBERLY OLYMPIC** is now in your exam room. This patient has reported to you that they have an allergic reaction to Penicilling G. Please add a medication allergy for Penicillin G with a 'moderate' reaction.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.8.2 Change a Medication Allergy

**Moderator**: The patient has also shared that they experience nausea when taking Penicilling G. Please change the medication allergy for Penicillin G to include the reaction of nausea.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.8.3 Display the Active Medication Allergy List

**Moderator**: To confirm this change has been documented properly, please display the list of active medication allergies for this patient.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.8.4 Display the Historical Medication Allergy List

**Moderator**: To confirm all of the past reported allergies for this patient, please display the list of historical medication allergies.

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*You may begin now – When completed, please say 'done'.*

## Criteria a.7: Medication List

### Task ID: A.7.1 Record Medication to the Medication List

**Moderator**: As you continue speaking to this patient, they have also reported to you that they are taking Cymbalta 20mg qd, which is being prescribed by Dr. Edward Jones. Please add this reported medication to their current medication list.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.7.2 Change Medication on the Medication List

**Moderator**: The patient has corrected the dose that they are taking for Cymbalta 20mg to 40mg. Please modify/change this medication so that it will be correctly documented on the patient's current medication list.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.7.3 Display an Active Medication List

**Moderator**: Please display/review the patients currently 'active' medication list for accuracy.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.7.4 Display a Historical Medication List

**Moderator**: Now, please display the patient's historical current medication list.

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*You may begin now – When completed, please say 'done'.*

## Criteria a.14: Implantable Device

### Task ID: A.14.1 Record UDI

**Moderator**: Your patient has informed you that they have had a cardiopulmonary bypass system filter implanted. Please add the implanted device UDI record number:
+B066000325011NS1/$$420020216LOT123456789012345/SXYZ456789012345678/16D20130202C1

*You may begin now – When completed, please say 'done'.*

### Task ID: A.14.3 Access UDI, Device Description, Identifiers, and Attributes

**Moderator**: Please view this device information.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.14.2 Change UDI Status

**Moderator**: The patient has reported that they provided you the wrong UDI number. Please modify this device and make it inactive.

*You may begin now – When completed, please say 'done'.*

## Criteria a.6: Problem List

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### Task ID: A.6.1 Record a Problem to the Problem List

**Moderator**: Now that you have completed your exam of this patient, please add a diagnosis to the patient's problem list.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.6.2 Change a Problem on the Problem List

**Moderator**: As you are reviewing the patient's diagnosis list, you note a change that needs to be made to one of them. Please make a change to one of the diagnosis on the patient's problem list.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.6.3 Display the Active Problem List

**Moderator**: Please display/review the 'active' problem list for accuracy.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.6.4 Display the Historical Problem List

**Moderator**: Now, please display the 'historical' problem list for your review.

*You may begin now – When completed, please say 'done'.*

## Criteria a.2: CPOE Lab Order

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### Task ID: A.2.1 Record Lab Order via CPOE

**Moderator**: It has been determined that the patient needs to have bloodwork ordered. Please order a CBC as a lab order for this patient.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.2.3 Display Changed Lab Order via CPOE

**Moderator**: Now that you have changed this order, please display this change to confirm it's accuracy.

*You may begin now – When completed, please say 'done'.*

## Criteria a.3: CPOE Diagnostic Imaging Order

### Task ID: A.3.1 Record Diagnostic Imaging Order via CPOE

**Moderator**: It has been determined that the patient needs to have an MRI. Please create an order for an MRI.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.3.2 Change Diagnostic Imaging Order via CPOE

**Moderator**: A change in the MRI location/date has been requested. Please make the appropriate changes to this diagnostic order.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.3.3 Display Changed Diagnostic Imaging Order via CPOE

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**Moderator**: Now that you have changed this order, please display this change to confirm it's accuracy.

*You may begin now – When completed, please say 'done'.*

## Criteria a.1: Computer Provided Order Entry (CPOE)

### Task ID: A.1.1 Record Medication Order via CPOE

**Moderator**: It has been determined that the patient needs to have a prescription filled for Synthroid 125 mcg, Once a day, with 3 refills. Please order this prescription.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.1.2 Change Medication Order via CPOE

**Moderator**: It has been requested to change the prescription for Synthroid to include 5 refills. Please make a modification/change to this prescription order.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.1.3 Display Changed CPOE Medication Order

**Moderator**: Now that you have changed this medication/prescription order, please display this change to confirm it's accuracy.

*You may begin now – When completed, please say 'done'.*

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## Criteria a.4: Drug-Drug, Drug-Allergy Interaction Checks

### Task ID: A.4.1 Trigger Drug-Drug Interaction by Entering New Medication Order via CPOE

**Moderator**: The patient also needs a prescription for Digoxin 125 mcg tablet. Please add a prescription order for this. Also, please determine if there is a drug-drug interaction for this prescription.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.4.2 Trigger Drug-Allergy Interaction by Entering New Medication Order via CPOE

**Moderator**: Next, the patient is also in need of a prescription for Amoxicillin 250 mg capsule. Please verify if there are any drug-allergy interactions.

*You may begin now – When completed, please say 'done'.*

## Criteria a.4: Drug-Drug, Drug-Allergy Interaction Checks

### Task ID: A.4.3 Adjust Severity Level of Displayed Drug-Drug Interaction via CPOE

**Moderator**: You have the ability as a user to manage the various degrees of interactions that you view for drug-drug allergies. Please adjust your severity level from moderate to 'severe'.

Recheck the drug interaction within the prescription module.

*You may begin now – When completed, please say 'done'.*

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# Criteria b.3 Electronic Prescribing

## Task ID: B.3.1 Create a New Prescription

**Moderator**: As part of the treatment plan, this patient needs to have a prescription sent electronically to the pharmacy. Please order a new prescription for Prilosec 40mg capsule, for 30 days take once per day, with one refill.

*You may begin now – When completed, please say 'done'.*

## Task ID: B.3.2 Change a Prescription (Dosage or Duration)

**Moderator**: A modification is needed for this Prilosec prescription. Please change the dosage to Prilosec 20mg capsule. The duration, directions and refills can remain the same. Please sign and transmit your prescription.

*You may begin now – When completed, please say 'done'.*

## Task ID: B.3.5 Receive a Fill Status Notification

**Moderator**: Now that you have sent that prescription electronically, you can access the 'fill status notification' to review.

*You may begin now – When completed, please say 'done'.*

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### Task ID: B.3.3 Cancel a Prescription

**Moderator**: The patient has remembered that they already have a prescription for this medication. Please cancel the prescription that you have sent electronically for Prilosec.

*You may begin now – When completed, please say 'done'.*

### Task ID: B.3.4 Refill Prescription

**Moderator**: On your dashboard, you will notice that you have received a request for a prescription refill. Please refill and send this electronically back to the pharmacy.

*You may begin now – When completed, please say 'done'.*

## Criteria a.9: Clinical Decision Support

### Task ID: A.9.1 Add a CDS Intervention and/or Reference Resource for Each of the Required Elements

1. **Problem List**
2. **Medication List**
3. **Medication Allergy List**
4. **At Least One Demographic**
5. **Laboratory Test**
6. **Vital Signs**
7. **And a Combination of At Least 2 of the Elements Listed Above**

**Moderator**: Please access John Doe's chart. Please click on the clinical alert section within health summary and access your alerts by clicking on the Plus symbol. Please activate the interventions/alerts needed for this patient.

*You may begin now – When completed, please say 'done'.*

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### Task ID: A.9.2 Trigger the CDS Interventions/Resources Added Using the Applicable Data Elements from Each of the Required Elements

1. **Problem List**
2. **Medication List**
3. **Medication Allergy List**
4. **At Least One Demographic**
5. **Laboratory Test**
6. **Vital Signs**
7. **And a Combination of At Least 2 of the Elements Listed Above**

**Moderator**: Now review the triggered alerts by clicking on the modify button.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.9.3 View the Intervention/Resource Information Using the Info Button Standard for Data Elements in the Problem List, Medication List, and Demographics

**Moderator**: Please view the resources that are available for you to review by clicking on the info button.

*You may begin now – When completed, please say 'done'.*

### Task ID: A.9.5 Access the Following Attributes for One of the Triggered CDS Interventions/Resources: Bibliographic Citation, Developer, Funding Source, Release/Revision Date

**Moderator**: Scroll down to the bottom of this resource to review the resource of this particular material.

*You may begin now – When completed, please say 'done'.*

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### Task ID: A.9.4 Trigger the CDS Interventions/Resources Based on Data Elements in the Problem List, Medication List, and Medication Allergy List by Incorporating Patient Information from the Transition of Care/Referral Summary

**Moderator**: Now that you have set the alerts for this patient, please access your interoperability dashboard and import John Doe's information into the patient's chart. Reconcile this information. While you are in the reconciliation screen, you will see a red triangle which you can click to view Mr. Doe's clinical alerts.

*You may begin now – When completed, please say 'done'.*

## Criteria b.2 Clinical Information Reconciliation & Incorporate

### Task ID: B.2.1 Incorporate a CCDA and Conduct Reconciliation of the Medications, Medication Allergies, and Problems in the CCDA with the Information Currently in the Patient's Record

**Moderator**: Access your interoperability dashboard and import the information associated with that patient's CCDA.

*You may begin now – When completed, please say 'done'.*

### Task ID: B.2.2 Generate a New CCDA with Reconciled Data

**Moderator**: Now that this information has been reconciled, please create a clinical summary.

*You may begin now – When completed, please say 'done'.*

Thank you for taking the time to participate in the Safety Enhancement Design User Testing. We appreciate your time.

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# Appendix F | System Usability Scale Questionnaire

**SUS**

Based on your overall experience with all the tasks, please answer the following questions.

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