



Greenway SuccessEHS / Version 9.0

# EHR Usability Test Report of Greenway SuccessEHS

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

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# 1 | Executive Summary

In March-April of 2017, a usability study of SuccessEHS 9.0 from Greenway Health, an ambulatory electronic health record software for community health centers, was conducted remotely by Greenway User Experience researchers. The purpose of this summative study was to test and validate the usability of the current user interface and provide evidence of usability in SuccessEHS.

During the usability test, 10 physicians/providers and 10 nurses/medical assistants matching the target demographic criteria served as participants in the usability test. Each participant used SuccessEHS in simulated, but representative role-specific tasks.

This study collected performance data on 37 tasks typically conducted on an EHR by physicians/providers and nurses/medical 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 45 minutes for physicians and 30 minutes for nurses. During each usability test, the administrator greeted the participant. Each participant was read a request for informed consent/release and asked to give their verbal consent, which was recorded (see Appendix C | Recording Consent).

All participants were current users of SuccessEHS, so they had prior experience with some version of the EHR. Training videos on two relatively new features were distributed to nurse participants prior to the test. The training videos were consistent with online training provided to actual end users.

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

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. Following the conclusion of the testing, participants were asked to complete a post-test questionnaire and were sent a \$25 gift card in appreciation for their time.

The UCD process used was based on NISTIR 7741<sup>1</sup> 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
- Participant's familiarity, ease-of-use, and 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)<sup>2</sup> scored the subjective satisfaction with the system based on performance with these tasks to be:

- Overall SUS for both providers and nurses: 70.13
- SUS based on provider task performance: 66.36
- SUS based on nurse task performance: 73.41

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<sup>1</sup> National Institute of Standards and Technology. (November 2010). *NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records* (NISTIR 7741). Gaithersburg, MD. [nist.gov/publications/nistir-7741-nist-guide-processes-approach-improving-usability-electronic-health-records](https://www.nist.gov/publications/nistir-7741-nist-guide-processes-approach-improving-usability-electronic-health-records).

<sup>2</sup> 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.

## 2 | Introduction

The EHR Under Test (EHRUT) tested for this study was Greenway SuccessEHS 9.0, an ambulatory electronic health record software. Designed to present medical information to healthcare providers in an outpatient setting for various specialties, Greenway SuccessEHS consists of a comprehensive electronic clinical system used to create, store, and retrieve patient data. Intended users of Greenway SuccessEHS are doctors, nurse practitioners, physician assistants, nurses, medical assistants, and anyone entering or accessing clinical data at an ambulatory medical 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.

## 3 | Method

### Participants

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A total of 20 participants were tested on Greenway SuccessEHS. Greenway Health User Experience researchers 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.

Participants in the test were physicians, physician assistants, nurse practitioners, nurses, and medical assistants. All participants were current end users of Success EHS working in ambulatory settings, varying in specialty, and ranging in years of experience with Greenway SuccessEHS. Users with clinical decision-making privileges were scheduled as physician/provider participants and users with non-provider care privileges were scheduled as nurse/medical assistant participants.

Participants were sent a \$25 gift card in appreciation for their participation. Participants had no direct connection to the development organization producing the Greenway SuccessEHS system. Participants were not from the testing or supplier organization. For relatively new features being tested, nurse 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.

## Total Number and Description of Participants

The total number of participants was 20. Their descriptions are indicated in the table below:

Participant Identifier	Gender	Age	Education	Occupation/ Role	Professional Experience (months)	Computer Experience (months)	Product Experience (months)	Assistive Technology Needs
ID01	Female	30-39	Associate degree	RN	120	216	48	No
ID02	Female	50-59	Some college credit, no degree	LPN	480	120	42	No
ID03	Female	30-39	Master's degree	PA	96	276	144	No
ID04	Female	40-49	Trade/technical/vocational training	LPN	204	204	28	No
ID05	Female	40-49	Doctorate degree (e.g., MD, DNP, DMD, PhD)	Physician	228	324	72	No
ID06	Male	50-59	Doctorate degree (e.g., MD, DNP, DMD, PhD)	Physician	300	420	132	No
ID07	Female	40-49	Some college credit, no degree	MA	180	240	78	No
ID08	Female	40-49	Master's degree	ARNP	288	348	18	No
ID09	Female	50-59	Bachelor's degree	RN	300	420	84	No
ID10	Female	30-39	Bachelor's degree	RN	168	300	30	No
ID11	Female	30-39	Associate degree	RN	108	240	30	No
ID12	Female	20-29	Bachelor's degree	RN	72	144	72	No
ID13	Female	30-39	Master's degree	PA	120	240	13	No
ID14	Female	30-39	Doctorate degree (e.g., MD, DNP, DMD, PhD)	Physician	96	300	72	No
ID15	Female	30-39	Bachelor's degree	RN	180	96	40	No
ID16	Female	30-39	Master's degree	PA	72	144	72	No
ID17	Male	30-39	Master's degree	ARNP	84	240	30	No
ID18	Male	50-59	Doctorate degree (e.g., MD, DNP, DMD, PhD)	Physician	288	456	48	No
ID19	Female	50-59	Master's degree	ARNP	396	156	156	No
ID20	Female	40-49	Master's degree	NP	264	264	72	No

Table 1: Participants

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

Physician/provider participants were scheduled for 45-minute sessions, and nurse/medical assistant participants were scheduled for 30-minute sessions. A minimum time interval of 15 minutes was scheduled between sessions for debrief by the administrator and data logger, and to reset systems to proper test conditions. A spreadsheet was used to keep track of the participant schedule and included key identification details for each participant.

## 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 GreenwaySuccessEHS. 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 GreenwaySuccessEHS. 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:

- 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 this EHR. Tasks were selected based on the twelve ONC CEHRT2015 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 CEHRT2015 certification criteria included:

Physician Scenario 1: Clinical Decision Support	
Access and Enable CDS Interventions (a9.1)	170.315(a)(9) – Clinical Decision Support
Process a CDS Intervention (a9.2)	170.315(a)(9) – Clinical Decision Support
Locate Reference Information for a CDS Intervention (a9.3)	170.315(a)(9) – Clinical Decision Support
Physician Scenario 2: Problem List	
Access Problem List (a6.1)	170.315(a)(6) - Problem List
Change an Existing Problem (a6.2)	170.315(a)(6) - Problem List
Physician Scenario 3: Medication List	
Access Active Medications List (a7.1)	170.315(a)(7) - Medication List
Access Full Medications List (a7.2)	170.315(a)(7) - Medication List
Change an Existing Medication (a7.3)	170.315(a)(7) - Medication List
Physician Scenario 4: CPOE (Computerized Physician Order Entry)	
Access Orders (a2.1 and a3.1)	170.315(a)(2) - CPOE Laboratory 170.315(a)(3) - CPOE Radiology

Record a New Radiology Order (a3.2)	170.315(a)(3) - CPOE Radiology
Record a New Problem (a6.3)	170.315(a)(6) - Problem List
Record a New Laboratory Order (a2.1)	170.315(a)(2) - CPOE Laboratory
Access Medication Orders (a1.1)	170.315(a)(1) - CPOE Medications
Record and Change Medication Orders (a1.2)	170.315(a)(1) - CPOE Medications
Perform a Drug Interaction Check (a4.1)	170.315(a)(4) - Drug-drug, Drug-allergy Interaction Checks
Process a Drug-Drug, Drug-Allergy Interaction Alert (a4.2)	170.315(a)(4) - Drug-drug, Drug-allergy Interaction Checks
<b>Physician Scenario 5: Electronic Prescribing</b>	
Send Electronic Rx Cancellation to the Pharmacy (b3.1)	170.315(b)(3) - E-Prescribing
Request and Receive Medication History Information Electronically (b3.2)	170.315(b)(3) - E-Prescribing
View Details of Medication from Medication History (b3.3)	170.315(b)(3) - E-Prescribing
Create New Electronic Prescription (b3.4)	170.315(b)(3) - E-Prescribing
Check the Fill Status of an Electronic Prescription (b3.5)	170.315(b)(3) - E-Prescribing
Process Electronic Rx Change Request from Pharmacy (b3.6)	170.315(b)(3) - E-Prescribing
Process an Electronic Rx Request from the Pharmacy (b3.7)	170.315(b)(3) - E-Prescribing
<b>Physician Scenario 6: Drug Interaction Checks</b>	
Adjust Severity Level of Interventions - Limited Permissions (a4.3)	170.315(a)(4) - Drug-drug, Drug-allergy Interaction Checks
<b>Nurse Scenario 1: Demographics</b>	
Access and Record Demographics (a5.1)	170.315(a)(5) - Demographics
Change Demographics (a5.2)	170.315(a)(5) - Demographics
<b>Nurse Scenario 2: Medication Allergy List</b>	
Access Active Medication Allergies (a8.1)	170.315(a)(8) - Medication Allergy List
Change an Existing Medication Allergy (a8.2)	170.315(a)(8) - Medication Allergy List
170.315(a)(8) - Medication Allergy List	170.315(a)(8) - Medication Allergy List
Access Full Medication Allergy List (a8.4)	170.315(a)(8) - Medication Allergy List
<b>Nurse Scenario 3: Implantable Device List</b>	
Access Implantable Device List (a14.1)	170.315(a)(14) – Implantable Device List
Change an Existing Implantable Device (a14.2)	170.315(a)(14) – Implantable Device List
Record a New Implantable Device (a14.3)	170.315(a)(14) – Implantable Device List
<b>Nurse Scenario 4: Clinical Information Reconciliation &amp; Incorporation</b>	
Access C-CDA Document (b2.1)	170.315(b)(2) - Clinical Information Reconciliation and Incorporation

Import Data from C-CDA Document into Chart (b2.2)	170.315(b)(2) - Clinical Information Reconciliation and Incorporation
Reconcile Data Imported from C-CDA (b2.3)	170.315(b)(2) - Clinical Information Reconciliation and Incorporation
Check for Clinical Alerts Generated by Reconciled Medications (a9.4)	70.315(a)(9) – Clinical Decision Support

## 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 oral 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 over a conference call. The data logger started the conference call from a conference room. The test administrator joined the conference call from an office. Each participant joined the conference call 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

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Greenway SuccessEHS would typically be used in a physician's office or community health center setting. This usability testing was conducted remotely, with participants interacting with the SuccessEHS software over Citrix GoToMeeting online conferencing software. Using remote testing allowed the participants to use the EHRUT 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 EHRUT is a client-server (cloud-based) application, each participant was accessing the database utilized for testing using Remote Desktop Protocol (RDP) to the servers hosted at SuccessEHS.

SuccessEHS staff set up the application per the product documentation describing the system setup and configuration. The application ran on an Oracle Solaris platform using an RDP connection. Technically, the system performance (i.e., response time) was representative to what actual users would experience in a field implementation.

SuccessEHS staff set up the database used for testing (including user preferences and other configuration options). A "snapshot" and "rollback" of the database was used to 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

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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. Citrix GoToMeeting software
4. Techsmith Morae Recorder software

Examples of these documents can be found in the Appendices. The Usability Test Protocol was devised to be able to capture required data.

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 and Morae Recorder. 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

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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 based on their role(s) in their healthcare organization, as follows:

- Physician/ Provider: 24 tasks
- Nurse/ Medical Assistant: 13 tasks

Tasks in the Usability Protocol are listed in Appendix E | Protocol Tasks.

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

## 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
<b>Effectiveness:</b> Task Success	<p>Task success was determined by assigning numeric weights for various levels of task success, as follows:</p> <ul style="list-style-type: none"> <li>• Success (without assistance) = 1.0</li> <li>• Partial success = 0.5</li> <li>• Failure = 0.0</li> </ul> <p>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.</p> <p>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.</p> <p>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.</p>
<b>Effectiveness:</b> Task Failures	<p>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.</p>

	Rationale and Scoring
	<p>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.</p> <p>A qualitative account of the observed errors and error types was collected.</p>
<p><b>Efficiency:</b> Task Deviations</p>	<p>The participant’s navigation path (i.e., steps) through the application was recorded.</p> <p>Deviations occur if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control. This path was compared to the optimal path. The number of steps in the observed path is divided by the number of optimal steps to provide a ratio of path deviation.</p> <p>Path deviations are reported on a qualitative level for use in recommendations for improvement.</p>
<p><b>Efficiency:</b> Task Time</p>	<p>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.</p>
<p><b>Satisfaction:</b> Task Rating</p>	<p>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.</p> <p>To measure participants’ confidence in and likeability of Greenway SuccessEHS 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.</p>

## 4 | 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 Greenway SuccessEHS 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.

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

#### 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)
Access Medications Orders	20	1.00	0.00	10.26	4.00	0.52	0.20	0.10	0.31
Record & Change Medication Orders	20	1.00	0.00	7.43	5.21	0.43	0.30	0.00	0.00

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

Task Scenario Ratings	Mean	(SD)
Task Group Familiarity Ratings (5=very familiar)	3.53	1.46
Task Group Satisfaction Ratings (5=very easy)	4.18	0.98

#### Discussion of Findings

Physician/provider participants were given two CPOE—Medications tasks:

- Access Medication Orders (a1.1)
- Record and Change Medication Orders (a1.2)

#### Effectiveness

The success score for each of these tasks was 100%. Participants were easily able to access and change medication orders as well as record new ones.

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## 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 4.36 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

- Generally, participants were able to navigate the medication order tasks with ease.
  - When processing a drug interaction alert, some participants were unaware that the system was set up to require a reason for overriding the alerts. Most participants indicated they had their systems customized to display only severe warnings for drug interaction checks.
- 

## Areas for Improvement

- When a reason for overriding drug interaction alerts is required, show on-screen messaging near the disabled Accept button to indicate it or some similar convention to indicate the requirement.
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## Criteria 170.315(a)(2) CPOE – Laboratory

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### 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	
		Mean	(SD)	Mean	(SD)	Deviations (Observed / Optimal)	(SD)	Mean	(SD)
Access Orders	20	1.00	0.00	10.26	4.00	0.52	0.20	0.10	0.31
Record a New Laboratory Order	20	1.00	0.00	5.05	3.09	0.52	0.32	0.05	0.22

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

Task Scenario Ratings	Mean	(SD)
Task Group Familiarity Ratings (5=very familiar)	4.59	1.00
Task Group Satisfaction Ratings (5=very easy)	4.18	0.98

## Discussion of Findings

Physician/provider participants were given two CPOE—Laboratory tasks:

- Access Orders (a1.1)
- Record a New Laboratory Order (a2.1)

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### 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 4.36 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

- Participants were easily able to record a new laboratory order. This task was easy to complete as the pick lists for this task were clearly defined.
- Participants liked the on-screen highlight search feature for labs. When asked about this task, one participant stated "Once you have that [workflow] down, I would say it's actually very easy: the clicking and the searching is very easy, especially when it highlights it yellow."

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### Areas for Improvement

No significant areas of improvement were identified.

## Criteria 170.315(a)(3) CPOE – Diagnostic Imaging

### Data Analysis and Reporting

Table 7: Computerized Physician Order Entry (CPOE) – Diagnostic Imaging Task Results

Task Scores	N	Task Success		Task Time (sec)		Path Deviation		Errors	
		Mean	(SD)	Mean	(SD)	Deviations (Observed / Optimal)	(SD)	Mean	(SD)
Access Diagnostic Imaging Orders	20	1.00	0.00	10.26	4.00	0.52	0.20	0.10	0.31
Record a New Radiology Order	20	1.00	0.00	19.81	6.71	0.53	0.18	0.10	0.31

Table 8: CPOE (Computerized Physician Order Entry) Diagnostic Imaging Task Scenario

Task Scenario Ratings	Mean	(SD)
Task Group Familiarity Ratings (5=very familiar)	3.65	1.73
Task Group Satisfaction Ratings (5=very easy)	4.18	0.98

## Discussion of Findings

Physician/provider participants were given two CPOE—Diagnostic Imaging tasks:

- Access Orders (a1.1)
- Record a New Radiology Order (a3.2)

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### Effectiveness

The success score for each of these tasks was 100%. Participants were easily able to access diagnostic imaging orders and record a new diagnostic imaging 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 4.36 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

- Participants were easily able to access diagnostic imaging orders and record a new diagnostic imaging order. These tasks were easy to complete as the pick lists for this task were clearly defined.
- When asked about diagnostic imaging tasks, one participant stated "It's all labeled and marked out for you, it's just a matter of using all of the tabs appropriately." Another participant stated that "everything is laid out where it should be and it's easy to get to."

---

### Areas for Improvement

- No significant areas of improvement were identified.

# Criteria 170.315(a)(4) Drug-Drug, Drug-Allergy Interactions Checks

## Data Analysis and Reporting

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

Task Scores	N	Task Success		Task Time (sec)		Path Deviation		Errors	
Task	#	Mean	(SD)	Mean	(SD)	Deviations (Observed / Optimal)	(SD)	Mean	(SD)
Perform a Drug Interaction Check	20	0.95	0.15	23.80	4.36	0.47	0.09	0.20	0.41
Process a Drug-Drug, Drug-Allergy Interaction Alert	20	0.95	0.15	23.80	4.36	0.47	0.09	0.20	0.41
Adjust Severity Level of Interventions - Limited Permissions	20	0.88	0.22	32.37	17.52	0.87	0.47	0.55	0.76

Table 10: Drug-Drug, Drug-Allergy Interaction Task Scenario

Task Scenario Ratings	Mean	(SD)
Task Group Familiarity Ratings (5=very familiar)	2.91	1.58
Task Group Satisfaction Ratings (5=very easy)	4.44	0.88

## Discussion of Findings

Physician/provider participants were given three drug-drug, drug-allergy interactions checks tasks:

- Perform a Drug Interaction Check (a4.1)
- Process a Drug-Drug, Drug-Allergy Interaction Alert (a4.2)
- Adjust Severity Level of Interventions - Limited Permissions (a4.3)

## Effectiveness

All participants were able to successfully perform and process a drug interaction check, yielding a task success score for each of these tasks at 95%. The task success score for adjusting the severity level of an intervention was 88% as some participants were only able to complete the task after being given a hint on how to complete this particular task.

---

## Efficiency

Three participants exceeded the target time for completing the task for adjusting the severity level of an intervention. On average, the number of steps for the adjusting severity levels task was exceeded, due to participants being unfamiliar with the task. Most providers had customized the severity level when they first accessed the product and had not altered the system settings since then.

---

## Satisfaction

Participants had an average satisfaction rating of 4.44 out of 5 points on a Likert scale. Most participants stated that although they were unfamiliar with the tasks, they were still easy to complete, with one participant commenting “if you recognize everything from the home screen, it's pretty user friendly.”

---

## Major Findings

- Providers were able to identify the highest priority drug interaction in the first and second tasks with no difficulty.
- Providers were not familiar with the monograph feature of the drug interaction check and were slightly confused by the steps necessary to enable the Monograph button.
- Providers were not familiar with the configuration of drug interactions, as that task is typically a function of their system administration.

---

## Areas for Improvement

- Several participants seemed confused by the pop-up error message, as they were not familiar with the monograph feature of the drug interaction check. Participants indicated that a better on-screen assistance would have been helpful.
- The low familiarity rating for the configuration of severity levels task seems to indicate that more training on this feature for clinical staff would increase their awareness of the available functionality and improve its adoption.

## Criteria 170.315(a)(5) Demographics

### Data Analysis and Reporting

Table 11: Demographics Task Results

Task Scores	N	Task Success		Task Time (sec)		Path Deviation		Errors	
		#	Mean	(SD)	Mean	(SD)	Deviations (Observed / Optimal)	(SD)	Mean
Access and Record Demographics	20	0.98	0.11	34.95	22.74	0.83	0.54	0.30	0.47
Change Demographics	20	1.00	0.00	18.88	5.47	0.76	0.22	0.40	0.60

Table 12: Demographics Task Scenario

Task Scenario Ratings	Mean	(SD)
Task Group Familiarity Ratings (5=very familiar)	3.00	1.46
Task Group Satisfaction Ratings (5=very easy)	4.55	0.69

## Discussion of Findings

Nurse participants were given two demographics tasks:

- Access and Record Demographics (a5.1)
- Change Demographics (a5.2)

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### Effectiveness

The success score for the Access and Record Demographics task was 98%, due to three participants requiring hints on how to complete the task. On the Change Demographics task, the success score was 100%. All participants were ultimately able to review the patient's demographics and complete the tasks. Because the workflows for these two tasks are similar, the success of the second task by those having trouble completing the first task indicates that the problem is a training issue.

---

### Efficiency

Three participants exceeded the target time for the tasks, due to unfamiliarity. Seven out of ten participants indicated that front desk personnel at their practice, rather than nurses, typically perform demographic tasks or that they were not familiar with the demographic tasks.

---

### Satisfaction

Participants had an average satisfaction rating of 4.55 out of 5 points on a Likert scale. One participant stated "I've never done that before and it wasn't difficult." Most participants agreed, saying if they performed these tasks daily, there would be no issue. In reference to the multiple tabs on the demographics module, another participant commented, "Once I figured out where the little boxes were that tell me which one I needed to pick, it was fairly easy."

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### Major Findings

- Front desk personnel, rather than nursing staff, typically perform demographic data entry tasks.
- Several participants seemed confused by the Gender Identity selection, because gender selection is still required. Participants indicated that a better on-screen assistance would have been helpful.

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### Areas for Improvement

- Improve the on-screen user assistance for the required selection of patient's gender after selection of gender identity.

# 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)
Access Problem List	20	1.00	0.00	8.72	3.87	0.49	0.22	0.05	0.22
Change an Existing Problem	20	0.98	0.11	11.05	5.06	0.40	0.18	0.05	0.22
Record a New Problem	20	1.00	0.00	4.02	2.23	0.63	0.35	0.15	0.49

Table 14: Problem List Task Scenario

Task Scenario Ratings	Mean	(SD)
Task Group Familiarity Ratings (5=very familiar)	3.88	1.05
Task Group Satisfaction Ratings (5=very easy)	4.91	0.30

## Discussion of Findings

Physician/provider participants were given three problem list tasks:

- Access Problem List (a6.1)
- Change an Existing Problem (a6.2)
- Record a New Problem (a6.3)

### Effectiveness

All participants were able to successfully access the problem list and add a new problem, yielding task success scores of 100%. The task success score for changing a problem was 98%.

### Efficiency

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

---

## Satisfaction

Participants had an average satisfaction rating of 4.91 out of 5 points on a Likert scale. Most participants were familiar with these tasks and found them straightforward and easy to complete. One particular participant had positive feedback for the problem list tasks: "It's nice to have that whole problem list, where you can check multiple things at the same time and resolve them, and I like that you can either send it to the Superbill or not. I think that's very, very helpful."

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## Major Findings

- Providers were able to access, change, and record problems with no difficulty.

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## Areas for Improvement

- No significant areas of improvement were identified in working with patient problems.

## 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	
		Mean	(SD)	Mean	(SD)	Deviations (Observed / Optimal)	(SD)	Mean	(SD)
Access Active Medications List	20	1.00	0.00	6.28	1.86	0.40	0.12	0.05	0.22
Access Full Medications List	20	1.00	0.00	3.81	1.83	0.30	0.14	0.00	0.00
Change an Existing Medication	20	0.98	0.11	15.33	4.37	0.58	0.17	0.20	0.41

Table 16: Medication List Task Scenario

Task Scenario Ratings	Mean	(SD)
Task Group Familiarity Ratings (5=very familiar)	4.71	0.77
Task Group Satisfaction Ratings (5=very easy)	4.36	0.67

## Discussion of Findings

Physician/provider participants were given three medication list tasks:

- Access Active Medications List (a7.1)
- Access Full Medications List (a7.2)
- Change an Existing Medication (a7.3)

---

### Effectiveness

The success scores for accessing the active medications list and full medications list tasks were 100%. Participants were easily able to access the medication list. The task to change an existing medication had a success score of 98%.

---

### Efficiency

All participants completed the tasks with either fewer steps or the same number of steps as expert users. All participants completed the medication list access tasks within the optimal time for each task, as suggested by expert timings. Many participants struggled to change an existing medication due to a scrolling issue; however, only one participant was not able to complete the task with the optimal time.

---

### Satisfaction

Participants had an average satisfaction rating of 4.36 out of 5 points on a Likert scale. Most participants were familiar with these tasks and found them easy to complete. One participant stated: “The layout is such that everything appears where it needs to be and the colors popping out on the tabs help you know where to click.”

---

### Major Findings

- The toolbar for editing existing medications in the medication list scrolls, so participants had trouble finding it. Many participants indicated that they were looking for the action bar and that it typically showed on their SuccessEHS system. All participants eventually realized that they had to scroll up to access the toolbar.
- Because the medications list can be accessed from multiple locations in SuccessEHS, some participants gave up on accessing it from the location to which the system navigated them and accessed the medications list from a more familiar location, such as My Next Patient or the Quick Access Toolbar.

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### Areas for Improvement

- The scrollable toolbar is not a patient safety issue, but is still a usability issue that should be considered for improvement.

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

## 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)	
Access Active Medication Allergies	20	1.00	0.00	8.35	4.76	0.44	0.25	0.05	0.22	
Change an Existing Medication Allergy	20	0.98	0.11	3.81	7.21	0.48	0.22	0.25	0.44	
Record a New Medication Allergy	20	1.00	0.00	15.33	8.20	0.59	0.26	0.30	0.47	
Access Full Medication Allergy List	20	1.00	0.00	15.33	1.54	0.62	0.20	0.15	0.37	

Table 18: Medication Allergy List Task Scenario

Task Scenario Ratings	Mean	(SD)
Task Group Familiarity Ratings (5=very familiar)	4.53	0.87
Task Group Satisfaction Ratings (5=very easy)	4.36	0.81

## Discussion of Findings

Nurse participants were given four medication allergy list tasks:

- Access Active Medication Allergies (a8.1)
- Change an Existing Medication Allergy (a8.2)
- Record a New Medication Allergy (a8.3)
- Access Full Medication Allergy List (a8.4)

### Effectiveness

The success score for the access active medication allergy list, access full medication allergy list, and record a new medication allergy tasks was 100%. For the change a medication allergy task, the success score was 98%. Participants were easily able to access, record, and change the medication allergies as needed.

### Efficiency

Most participants exceeded the optimal number of steps for the medication allergy tasks, but 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 4.36 out of 5 points on a Likert scale. Most participants were familiar with these tasks and found the workflows easy to complete.

---

## Major Findings

- The selection lists of allergy reactions are long, and participants had to visually browse these lists to find the pertinent reaction. A free text entry for the allergy reaction is available, but participants did not use it until they had browsed the selection lists.
  - Some participants added the medication allergy twice because they were not sure that it had been added successfully the first time.
  - Some participants indicated that they liked that the reactions are separated into adverse reactions and allergic reactions, making the reactions easier to find.
- 

## Areas for Improvement

- A mechanism to assist providers in finding allergy reactions quickly, such as a search option or search highlight, would improve the usability of this feature.
  - Adding a visual confirmation of the successful entry of a medication allergy would reduce the instance of duplicate entry of medication allergies.
- 

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

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### Data Analysis and Reporting

Table 19: Clinical Decision Support Task Results

Task Scores	N	Task Success		Task Time (sec)		Path Deviation		Errors	
		Mean	(SD)	Mean	(SD)	Deviations (Observed / Optimal)	(SD)	Mean	(SD)
Access and Enable CDS Interventions	20	0.98	0.11	16.07	12.52	0.73	0.57	0.10	0.31
Process and Locate Reference Information for a CDS Intervention	20	0.90	0.21	23.05	16.26	1.41	1.00	0.45	0.83
Check for Clinical Alerts Generated by Reconciled Medications	20	1.00	0.00	17.13	13.25	1.23	0.95	0.60	0.99

Table 20: Clinical Decision Support Task Scenario

Task Scenario Ratings	Mean	(SD)
Task Group Familiarity Ratings (5=very familiar)	2.97	1.51
Task Group Satisfaction Ratings (5=very easy)	4.64	0.67

## Discussion of Findings

Physician/provider participants were given two clinical decision support tasks:

- Access and Enable CDS Interventions (a9.1)
- Process and Locate Reference Information for a CDS Intervention (a9.2 & a9.3)

Nurse participants were given one clinical decision support task:

- Check for Clinical Alerts Generated by Reconciled Medications (a9.4)

---

### Effectiveness

The success score for the Access and Enable CDS Interventions task was 98%, indicating that providers could complete this task easily. Providers had more trouble with the Process and Locate Reference Information for a CDS Intervention task, as evidenced by the success score of 90%. Nurses successfully completed the Check for Clinical Alerts Generated by Reconciled Medications task with a success score of 100%.

---

### Efficiency

Two out of ten participants were unable to complete the Access and enable CDS Interventions task within the optimal time, as suggested by expert timings. Of the ten participants, all completed the task with the same number of steps as the experts.

Five out of ten participants were unable to complete the Process and Locate Reference Information for a CDS Intervention task within the optimal time, but all completed the task with the same number of steps as the experts.

Four out of ten nurses were unable to complete the Check for Clinical Alerts Generated by Reconciled Medications task within the optimal time and most exceeded the optimal number of steps, as determined by expert performance.

---

### Satisfaction

Participants had an average satisfaction rating of 4.64 out of 5 points on a Likert scale. Although most participants were unfamiliar with these tasks, they thought the workflows were easy to complete after having done so successfully.

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### Major Findings

- Most participants were familiar with checking the patient's clinical alerts.
- The participants had no remarkable problem in running the Clinical Event Manager to generate clinical alerts. However, many participants had difficulty recalling how to navigate to the Clinical Event Manager.

- Participants had difficulty finding the reference information for the clinical alerts, although some indicated that they regularly use the reference information for patient education.
- Not many participants were aware that they had access to Medline through the Clinical Alert reference, even though it is free and easily available to use for clinical staff.

## Areas for Improvement

- Improving the visibility of the reference information for clinical alerts would make the CDS features more useable. In addition, providing access to the reference information from places where users are used to viewing the clinical alerts would also be a notable improvement.
- Providers seemed to be familiar with the patient education feature, and some providers indicated that they would like the ability to link patient education to specific clinical alerts.
- The low familiarity rating for this task scenario seems to indicate that more training on this feature for clinical staff would increase their awareness of the available functionality and improve its adoption.

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

### Data Analysis and Reporting

Table 21: Implantable Device List Task Results

Task Scores	N	Task Success		Task Time (sec)		Path Deviation		Errors	
		Mean	(SD)	Mean	(SD)	Deviations (Observed / Optimal)	(SD)	Mean	(SD)
Access Implantable Device List	20	1.00	0.00	11.96	4.55	0.57	0.22	0.10	0.31
Change an Existing Implantable Device	20	1.00	0.00	22.77	7.09	0.67	0.31	0.40	0.60
Record a New Implantable Device	20	1.00	0.00	20.20	6.78	0.56	0.19	0.10	0.31

Table 22: Implantable Device List Task Scenario

Task Scenario Ratings	Mean	(SD)
Task Group Familiarity Ratings (5=very familiar)	1.24	0.44
Task Group Satisfaction Ratings (5=very easy)	4.64	0.50

## Discussion of Findings

Nurse participants were given three implantable device list tasks:

- Access Implantable Device List (a14.1)
- Change an Existing Implantable Device (a14.2)
- Record a New Implantable Device (a14.3)

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### Effectiveness

The success score for each of these tasks was 100%. Participants were easily able to access, change, and record implantable devices.

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### Efficiency

Although the implantable device feature was a relatively new feature for Success EHS, all participants were able to complete the tasks within the optimal time for each task, as suggested by expert timings. On average, participants exceeded the optimal number of steps for the tasks due to unfamiliarity with this new feature.

---

### Satisfaction

Participants had an average satisfaction rating of 4.64 out of 5 points on a Likert scale. Although unfamiliar with these relatively new tasks, most participants found them easy to complete. One participant stated that “once you know where to go, it’s really easy to access and navigate,” and another participant was so excited about the ease of use, she exclaimed “Can I do this all my life? ... We need more of these things. Everybody who comes in should get an implantable device!”

---

### Major Findings

- When entering a body site for the implanted device, many participants searched for ‘knee’, a term that returned too many results. A more direct search of ‘left knee’ returned better results.
- Part of the success with using this new feature may be attributable to the training provided to participants.

---

### Areas for Improvement

- Search improvements, such as favorites or search suggestions, would improve the usability of this feature.
- Participants indicated that they would also like the ability to note implanted devices reported by the patient or referring provider, even when the device ID is not available.

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

## Data Analysis and Reporting

Table 23: Clinical Information Reconciliation and Incorporation Task Results

Task Scores	N	Task Success		Task Time (sec)		Path Deviation		Errors	
Task	#	Mean	(SD)	Mean	(SD)	Deviations (Observed / Optimal)	(SD)	Mean	(SD)
Access C-CDA Document	20	0.98	0.11	10.31	8.19	0.66	0.52	0.30	0.57
Import Data from C-CDA Document into Chart	20	1.00	0.00	18.23	7.62	1.78	0.26	0.35	0.59
Reconcile Data Imported from C-CDA	20	1.00	0.00	4.34	2.01	0.35	0.16	0.10	0.31

Table 24: Clinical Information Reconciliation and Incorporation Task Scenario

Task Scenario Ratings	Mean	(SD)
Task Group Familiarity Ratings (5=very familiar)	1.88	1.50
Task Group Satisfaction Ratings (5=very easy)	4.00	0.77

## Discussion of Findings

Nurse participants were given three clinical information reconciliation and incorporation tasks:

- Access C-CDA Document (b2.1)
- Import Data from C-CDA Document into Chart (b2.2)
- Reconcile Data Imported from C-CDA (b2.3)

### Effectiveness

The success score for these tasks varied between 98% and 100%, due to a participant requiring hints on how to complete the Access C-CDA Document task. All participants were ultimately able to review the patient’s clinical information, reconcile the data, and complete the tasks.

### Efficiency

As the CCD features were unfamiliar to many Success EHS users, some participants exceeded that target time and optimal number of steps for these tasks. However, all participants were ultimately able to complete these tasks, with some participants requiring a hint on how to navigate to the feature.

---

## Satisfaction

Participants had an average satisfaction rating of 4.00 out of 5 points on a Likert scale. Although unfamiliar with these tasks, most participants found them easy to complete. One participant stated that “it's not anything I've done before, but it wasn't difficult once I knew what to do.” Another participant stated “as long as you know where to look for these [features], and the training is available, it should be very easy.”

---

## Major Findings

- Participants indicated that they do not use these features and some were not aware of this functionality.
- After importing the C-CDA data, several participants attempted to select the Mark as Reconcile setting. However, the setting can only be selected before the import occurs, so participants seemed confused.
- After importing the C-CDA data, participants hesitated, indicating that they were not certain that the import was successful. This hesitation may be due to being unfamiliar with the workflow. The data displays in gray text once it is imported, and the import option displays as unavailable when all data in a section is imported.

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## Areas for Improvement

- When importing data from the C-CDA document, a Select All option is available in each section; however, a Select All option for all data would improve this feature's usability.
- Workflow improvement to the Mark as Reconcile setting or on-screen assistance would make performing these tasks less confusing.
- After importing data from the C-CDA, a confirmation that the action was done would be an improvement that would mitigate confusion.

## Criteria 170.315(b)(3) Electronic Prescribing

### Data Analysis and Reporting

Table 25: Electronic Prescribing Task Results

Task Scores	N	Task Success		Task Time (sec)		Path Deviation		Errors	
		Mean	(SD)	Mean	(SD)	Deviations (Observed / Optimal)	(SD)	Mean	(SD)
Create New Electronic Prescription	20	1.00	0.00	10.14	3.60	0.73	0.26	0.00	0.00
Process Electronic Rx Change Request from Pharmacy	20	0.95	0.15	28.06	19.21	0.57	0.39	0.25	0.55
Send Electronic Rx Cancellation to the Pharmacy	20	0.95	0.15	19.71	8.83	0.70	0.31	0.15	0.37
Process an Electronic Rx Request from the Pharmacy	20	0.98	0.11	16.28	6.37	0.54	0.21	0.05	0.22

Task Scores	N	Task Success		Task Time (sec)		Path Deviation		Errors	
		Task	#	Mean	(SD)	Mean	(SD)	Deviations (Observed / Optimal)	(SD)
Check the Fill Status of an Electronic Prescription	20	0.98	0.11	23.81	11.18	0.55	0.26	0.25	0.44
Request and receive medication history information	20	0.95	0.22	28.71	10.59	0.60	0.23	0.05	0.22

Table 26: Electronic Prescribing Task Scenario

Task Scenario Ratings	Mean	(SD)
Task Group Familiarity Ratings (5=very familiar)	2.58	1.48
Task Group Satisfaction Ratings (5=very easy)	3.27	1.01

## Discussion of Findings

Physician/provider participants were given seven electronic prescribing tasks:

- Send Electronic Rx Cancellation to the Pharmacy (b3.1)
- Request and Receive Medication History Information Electronically (b3.2)
- View Details of Medication from Medication History (b3.3)
- Create New Electronic Prescription (b3.4)
- Check the Fill Status of an Electronic Prescription (b3.5)
- Process Electronic Rx Change Request from Pharmacy (b3.6)
- Process an Electronic Rx Request from the Pharmacy (b3.7)

---

### Effectiveness

The success score for these tasks varied between 95% and 100%, due to participants requiring hints on how to complete some of the tasks. All participants were ultimately able to complete the electronic prescription tasks.

---

### Efficiency

Three tasks testing electronic prescribing features were relatively new and unfamiliar to most Success EHS users. For two of these new electronic prescribing tasks, two out of ten participants exceeded that optimal time. All participants completed these tasks with one to seven additional steps compared to the expert users, with the highest number of additional steps attributed to the relatively new electronic prescribing features. All participants were ultimately able to complete these tasks with some requiring a few hints.

---

## Satisfaction

Participants had an average satisfaction rating of 3.27 out of 5 points on a Likert scale, the lowest satisfaction rating of the task scenarios tested. Although unfamiliar with these tasks, most participants were able to complete them successfully. One participant stated that “I don’t usually use electronic prescribing but I was able to figure it out.”

---

## Major Findings

- Most participants indicated use of electronic prescribing functionality daily, although one participant indicated not using it.
- Many participants stated that they were not aware of the existence of the three relatively new electronic prescribing features, as well as some of the existing features tested.
- Participants seemed to be confused when looking for the monograph reference information for the drug alerts. Although the button was visible, a certain selection had to be made to enable it.
- Prescription details from pharmacy benefit manager (PBM) or C-CDA sources were shown in a horizontal display that participants found difficult to browse. Participants suggested information and terminology changes regarding the data that displayed.
- In processing a medication change request from the pharmacy, many participants were confused by two buttons with similar labels.
- In processing a medication change request from the pharmacy, the drug name was farther down in the details, causing participants to take additional time to find this information. Most participants, however, pointed out that the order of information in prescription details is customizable, so they would have it display differently in a real practice.
- After completing a medication change request, participants seemed confused that a manual refresh was required to remove the request from the list.
- The fill status for issued prescriptions was viewable from a list of issued electronic prescriptions; however, the default filter for this list has a short timeframe, which confused many users. It took most users some time to realize that they needed to set the filter to a longer timeframe or display all electronic prescriptions.
- When processing a drug interaction alert, some participants were unaware that the system was set up to require a reason for overriding the alerts. Most participants indicated they had their systems customized to display only severe warnings for drug interaction checks.

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## Areas for Improvement

- In the prescription details, the ICD-10 code was provided for the diagnosis. Participants indicated that it would be more usable to have the ICD-10 description provided or both the ICD-10 code and description provided.
- In the prescription details, the label ‘PBM Name’ was used to indicate the prescriber. However, participants suggest that the label ‘Prescriber’ would be more intuitive.
- Even though, this issue of the similarly named buttons did not pose a patient safety concern when processing a medication change request from the pharmacy, improving it would mitigate confusion in this workflow and be a good enhancement for the software.

- Programmatically removing the medication change request after it is completed would mitigate confusion in the workflow.
- Research on the typical timeframe in which patients pick up a prescription should inform the default value for filtering issued electronic prescriptions or some other method for optimization of this value should be employed.
- When a reason for overriding drug interaction alerts is required, show on-screen messaging near the disabled Accept button to indicate it or some similar convention.

## Overall Results

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In addition to the specific findings and areas for improvement in specific features, several overall areas for improvement recurred throughout this usability study.

Low familiarity ratings with certain functionality, along with participants' lack of awareness of the existence of some functionality, may indicate a need for training and documentation that is accessible within common workflows and provided in formats that are easily consumable by busy clinical professionals.

Another recurring feedback from participants was that workflows could better streamlined and optimized. These comments were directed mostly at CCD and prescription workflows. Participants were pleased with the ease of use of the ordering and implantable device workflows. This feedback identifies opportunities to make refinements to the user interface to reduce click-counts and enhance efficiency for clinicians.

Participants repeatedly stated that their systems were different from the test system due to customization based on user preferences. Many participants stated this customization capability as a very strong feature of the system. Another strength that was cited by many participants was the ability to access key features from multiple locations in the software, so that they were accessible where it was logical and convenient.

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be 70.13. The average SUS score for physicians/providers was 66.36 and for nurses/medical assistants was 73.41. Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

Through the user-centered design and usability testing processes, opportunities to refine and enhance the user experience were identified. Some of these enhancements have been prioritized for release in upcoming release cycles. Still others will be revisited in more depth in future studies.

## 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

# Appendix A | Sample Recruiting screener

Participants were asked to complete an online recruiting screener prior to the test session. If they did not complete the test screener 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. Name

2. Gender

- Male
- Female
- Other

3. Age

- 0-9
- 10-19
- 20-29
- 30-39
- 40-49
- 50-59
- 60-69
- 70-79
- 80-89
- 90-99
- 100+

4. Level of Education

- No high school degree
- High school graduate, diploma or equivalent (ex: GED)
- Trade/technical/vocational training
- Some college credit, no degree
- Associate degree
- Bachelor's degree
- Master's degree
- Doctorate degree (e.g., MD, DNP, DMD, PhD)

5. How long have you been working in healthcare? Please specify whether your answer is in years, months, or days (example: 10 years).

6. What is your practice specialty?

7. How long have you been using computers? Please specify whether your answer is in years, months, or days (example: 10 years).

8. How long have you been using SuccessEHS? Please specify whether your answer is in years, months, or days (example: 10 years).

9. Which features do you use most frequently? Please list your top 2 or 3 (for instance, orders, prescriptions, labs, notes, flow sheets, tasks, etc.).

1.

2.

3.

10. On a scale of 1 to 5 with 5 being 'Most Familiar', how would you rate your level of familiarity with these workflows in SuccessEHS:

	1	2	3	4	5
a. Maintaining Medication Allergies	<input type="radio"/>				
b. Maintaining Problem Lists	<input type="radio"/>				
c. Reviewing and Satisfying Clinical Alerts	<input type="radio"/>				
d. Setting Up Clinical Alerts	<input type="radio"/>				
e. Maintaining Medication Lists	<input type="radio"/>				
f. Creating Radiology Orders	<input type="radio"/>				
g. Creating Orders (using the Orders System)	<input type="radio"/>				
h. Ordering Lab Tests	<input type="radio"/>				
i. Reviewing Drug Interactions	<input type="radio"/>				
j. Configuring the Drug Interactions	<input type="radio"/>				
k. Reviewing and Retrieving CCDAs	<input type="radio"/>				
l. Entering Demographic Data	<input type="radio"/>				
m. Maintaining Implantable Device Lists	<input type="radio"/>				
n. Checking the Fill Status of an e-Rx from the Pharmacy	<input type="radio"/>				
o. Processing an e-Rx Change Request from the Pharmacy	<input type="radio"/>				
p. Sending a Cancel Notice to the Pharmacy on e-Rx Discontinue	<input type="radio"/>				

11. Do you require any assistive technology to participate in this usability test?

- Yes
- No

*Assistive technology (AT) is any item, piece of equipment, software program, or product system that is used to increase, maintain, or improve the functional capabilities of persons with disabilities.*

## Appendix B | Participant demographics

Below is a summary of participant demographics for this study.

### PARTICIPANT GENDER

	n (N=20)	%
Male	3	15.8
Female	17	89.5
Other	0	0

### PARTICIPANT AGE

	n (N=20)	%
20-29	1	5.0%
30-39	9	45.0%
40-49	5	25.0%
50-59	5	25.0%

### PARTICIPANT EDUCATION

	n (N=20)	%
No high school degree	0	0.0%
High school graduate, diploma or equivalent	0	0.0%
Trade/technical/vocational training	1	5.0%
Some college credit, no degree	2	10.0%
Associate degree	2	10.0%
Bachelor's degree	4	20.0%
Master's degree	7	35.0%
Doctorate degree (e.g., MD, DNP, DMD, PhD)	4	20.0%

## PARTICIPANT ROLES

	n (N=20)	%
Physician	4	20.0%
Nurse Practitioner	1	5.0%
Physician Assistant	3	15.0%
RN	6	30.0%
LPN	2	10.0%
ARNP	3	15.0%
Medical Assistant	1	5.0%

## PARTICIPANT SPECIALTIES

	n (N=20)	%
Family Practice	8	40.0%
Women's Health	2	10.0%
Pediatrics	2	10.0%
Reproductive Health	2	10.0%
Infectious Disease	1	5.0%
General Practice	2	10.0%
Internal Medicine	1	5.0%
HIV	1	5.0%
Adult Medicine	1	5.0%

### PARTICIPANT PROFESSIONAL EXPERIENCE

N=20	Months		Years	
Mean	198.9		16.6	
	Min	Max	Min	Max
Range	72.0	480.0	6.0	40.0

### PARTICIPANT COMPUTER EXPERIENCE

N=20	Months		Years	
Mean	257.1		21.4	
	Min	Max	Min	Max
Range	96.0	456.0	8.0	38.0

### PARTICIPANT EXPERIENCE WITH SUCCESSEHS

N=20	Months		Years	
Mean	63.6		5.3	
	Min	Max	Min	Max
Range	13.0	156.0	1.1	13.0

## Appendix C | Recording Consent

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

### **Recording Consent Statement**

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

## 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 SuccessEHS. I'll be taking notes and so will <note taker>.

As you go through the workflows, please keep in mind that it is SuccessEHS 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.

Also, I want to ask you to hold your questions until the end since the workflows are being timed.

I would like to video record this session to help me later with my report. I'm going to start the recording now.

<BEGIN NOW recording the session.>

Do you grant GreenwayHealth 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/NO.

Do you have any questions before we get started?

### User Questionnaire

Were you able to complete the online User Questionnaire?

<If Yes – continue. If No – ask participant questions on the Questionnaire.>

### Instructions

What you will be looking at today is SuccessEHS populated with a mock patient's information. I will be asking you to perform some workflows that a <role> might perform with SuccessEHS. Please keep in mind that the data may not be clinically accurate, and we understand that it may not be applicable to your specialty.

I will ask you to start when I say "BEGIN NOW", and please tell me when you think you've completed the workflow by saying "DONE".

## Appendix E | Protocol Tasks

### Physician Scenario 1: Clinical Decision Support

Kara Whiteside has come in today for a follow-up visit for Hypertension and Coronary Artery Disease, but she also complains of a recurrence of Sinusitis. Your nurse has updated Kara's chart, so you are ready to proceed.

1. Please open Kara's chart and review Kara's CDS Alerts. Verbally inform the patient of information of what is due, such as a lipid panel. **BEGIN NOW** (a9.1)
2. Show me how you would review the CDS pop up alert to find the Medline Plus patient education and reference information for the CDS alert **Hypertension-Lipid Panel Due**. **BEGIN NOW** (a9.2)

### Physician Scenario 2: Problem List

Your MA has already updated Kara's allergies, so you are ready to proceed with her problem list.

1. Access Kara's problem list and view her active problems. **BEGIN NOW** (a6.1)
2. Kara is no longer experiencing **Migraines**. Access Kara's migraine diagnosis and update it to 'Resolved'. **BEGIN NOW** (a6.2)

### Physician Scenario 3: Medication List

After reviewing the problems, you are now ready to review Kara's meds with her.

1. Access Kara's active Medication list. **BEGIN NOW** (a7.1)
2. Kara is complaining of cold sores on her lips and nose. She said she took something that helped before but it was for a different problem.  
Look in Kara's inactive medications list to find out what the medication was. **BEGIN NOW** (a7.2)
3. Kara states that she has heard bad things about Tylenol and decided not to take it anymore.  
Discontinue Acetaminophen. **BEGIN NOW** (a7.3)

### Physician Scenario 4: CPOE (Computerized Physician Order Entry)

You have finished examining Kara, and you are now ready to create orders. Kara complains of a recurrence of sinusitis and because of high cholesterol, you will treat her for hyperlipidemia. You'll be adding the next items to Kara's eSuperbill, but please stop before you submit the superbill.

1. Open Kara's Superbill. **BEGIN NOW** (a3.1)
2. Order a **Nasal Endoscopy** for Kara's sinusitis. **BEGIN NOW** (a3.2)
3. Add a problem of **Hyperlipidemia**. **BEGIN NOW** (a6.3)
4. Order a Lipid Panel. **BEGIN NOW** (a2.1)
5. After discussing her sinusitis, order **Biaxin 500 mg Oral** to be taken every 12 hours for 14 days. **BEGIN NOW** (a1.1)

6. Review the drug interactions for this medication.
  - a. Locate the highest priority warnings and describe the alert message to me. **BEGIN NOW** (a4.1)
  - b. Navigate to the full monograph of the Biaxin-Zocor interaction. **BEGIN NOW** (a4.2)
7. You decide to continue to with the prescription.
  - a. Prescribe the Biaxin as Kara is under medical supervision. **BEGIN NOW**
  - b. Send the prescription electronically. **BEGIN NOW**

## Physician Scenario 5: Electronic Prescribing

1. Kara states that she never picked up her Abilify prescription from the last visit because it was sent to the wrong pharmacy.  
Discontinue the **Abilify** prescription and show me where to mark to ensure that a cancellation request is sent to the pharmacy when you discontinue. **BEGIN NOW** (b3.1)
2. You want to see what other medications Kara has been prescribed by outside providers.
  - a. Check to see if any medication history is available from Kara's Pharmacy Benefit Manager. **BEGIN NOW** (b3.2)
  - b. Show me how you would find further information about these prescriptions, such as diagnosis or prescriber information. **BEGIN** (b3.3)
3. Kara is complaining that her allergies are acting up. Prescribe Clarinex Syrup for her and send the prescription electronically. **BEGIN NOW** (b3.4)

After this last visit, you have some time before your next appointment. You decide to work some of your Medications tasks.

4. You previously prescribed Crestor for Frank Notch. He came in earlier and you want to check whether he had that prescription filled. Click on Frank Notch's tab in Chart and go to his medications. **BEGIN NOW**  
Check his e-Rx history to see whether he had the Crestor prescription you issued at the last visit filled. **BEGIN NOW** (b3.5)
5. You decide to look at the Medication Change Requests sent by the pharmacy for other patients.
  - a. Go to your Medication Requests to see if you have any medication requests. **BEGIN NOW**
  - b. Review the Medication Change Requested information for Sophia Biscayne and select the new medication. Accept the new medication to send it to the pharmacy. **BEGIN NOW** (b3.6)
6. You remember that there was a Refill Request for Elizabeth Itasca that you were supposed to review.  
Authorize the Lanoxin prescription for Elizabeth Itasca that the pharmacy requested. **BEGIN NOW** (b3.7)

## Physician Scenario 6: Drug Interaction Checks

Now we will review the settings for Drug Interaction Warnings.

1. Your practice providers complain that the Drug Interactions window is reporting insignificant drug interactions.  
How would you configure your prescription alerts so that only Severe and Contraindicated warnings appear? **BEGIN NOW** (a4.3)

## Nurse Scenario 1: Demographics

Your patient, Kara Whiteside has come in today for a follow up visit. Kara's chart is already open in SuccessEHS. You will begin by reviewing Kara's demographic data. As you are reviewing her data with her, you see that you need to add and edit some information.

1. Add **Not Hispanic or Latino** to Kara's ethnicity section and apply the changes. **BEGIN NOW** (a5.1)
2. While taking the patient history, Kara indicates she doesn't want her gender identity recorded.  
Change this patient's **Gender Identity** in demographics from **'Female'** to **'Refused to Report'**. **BEGIN NOW** (a5.2)

Those are all the demographics changes today. Please save them.

## Nurse Scenario 2: Medication Allergy List

Kara has come in today for a follow-up visit for her Hypertension and Coronary Artery Disease, but she also complains of a recurrence of Sinusitis.

1. Access Kara's allergies. **BEGIN NOW** (a8.1)
2. You notice that Kara has an allergy to Sulfa, but it does not say what the reaction was.  
Update the **Sulfa allergy** to change the reaction to rash. **BEGIN NOW** (a8.2)
3. Kara says that she went to a walk-in clinic and was given penicillin for her Sinusitis. She experienced itchiness after taking it.  
Add **Penicillin** as a new allergy for Kara. **BEGIN NOW** (a8.3)
4. You want to confirm that everything is in order with Kara's allergy list.  
Access and view Kara's **Inactive** allergies. **BEGIN NOW** (a8.4)

## Nurse Scenario 3: Implantable Device List

Kara previously had a knee replacement on her left knee. This information has already been entered to SuccessEHS. During her current exam, Kara also indicates she has had a cataract surgery. You will need to review and add implantable device information for Kara in the Implantable Devices feature.

1. Access Kara's implantable device information and review the details of the knee replacement implantable device. **BEGIN NOW** (a14.1)
2. You notice that the Body Site has not been entered. Enter 'left knee' as the Body Site for the knee replacement. **BEGIN NOW** (a14.2)
3. Add Kara's **lens implant** to the device list. Use the Unique Device Identifier provided in the GoToMeeting Chat. Add an implant date of 3/16/2017. **BEGIN NOW** (a14.3)

## Nurse Scenario 4: Clinical Information Reconciliation & Incorporation

Now we are going to talk about Interoperability. Part of the Meaningful Use measures is about interoperability and exchanging clinical data.

Your next patient, Steven Carlson, has arrived for his annual exam, and he brought a CCD from another provider. A medical assistant has already retrieved the CCD document from the patient's flash drive and put it into Steven's chart as a document.

1. Go to your My Next Patient list and open Steven Carlson's chart. **BEGIN NOW**
2. Locate the inbound HIE document named **Greenway Community Health Center - SCarlson** from the HIE Document section. **BEGIN NOW** (b2.1)
3. Now go to Steven's medications and import the PBM/CDA information. **BEGIN NOW** (b2.2)
4. Reconcile the medications list. **BEGIN NOW** (b2.3)
5. One of the meaningful use measures is that the patient alerts would auto update once the CCD has been imported.

Show me where you would go to review Steven's Patient Alerts and run the CEM rules to see if anything new was triggered for the patient. **BEGIN NOW** (a9.3)

# 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