

EHR Usability Test Report of Aprima PRM

Product Version: 18

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

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Executive Summary

A usability test of Aprima PRM version 18 was conducted on October 29-November 19, 2018 in Richardson, Texas by Aprima Medical Software's User Experience Team. The purpose of this test was to test and validate the usability of the current user interface and provide evidence of usability in the EHR Under Test (EHRUT). During the usability test, 15 healthcare providers and other intended users matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

The study, based upon the ISO-9241-11 standard, focused on measuring the effectiveness of, efficiency of, and satisfaction with Aprima PRM among a sample of participants representing potential users of the system. Performance data was collected on 33 tasks typically conducted on an EHR. Tasks created were based upon the criteria specified within the test procedure structure for evaluating conformance of Electronic Health Record (EHR) technology to the certification criteria defined in certification criteria identified in 45 CFR Part 170 Subpart C of the Health Information Technology: 2015 Edition Health Information Technology (Health IT) Certification Criteria¹.

§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

¹ 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)(14) Implantable Device List

§170.315(b)(2) Clinical Information Reconciliation and Incorporation

§170.315(b)(3) Electronic Prescribing

Results of the study indicated that the Aprima PRM system was satisfactory with regards to effectiveness and efficiency and that the participants were very satisfied with the system.

Introduction

The Electronic Health Record System Under Test (EHRUT) tested for this study, Aprima PRM version 18, was specifically designed to present medical information to healthcare providers on desktop computers in standard healthcare settings. This study tested and validated the usability of the Aprima PRM version 18 user interface and provides evidence of the usability of Aprima PRM with representative exercises and in realistic user conditions. To this end, measures of effectiveness and efficiency, such as time on task, number of errors made, and completion rates were captured during usability testing. Satisfaction was assessed, and participant comments were collected using the industry-standard questionnaire: The System Usability Scale (SUS) (See Appendix C).

Method

Participants

Fifteen individuals (9 women and 6 men) participated in the EHRUT (Aprima PRM version 18). Participants were recruited from contacts obtained from employees of Aprima Medical Software. Participants in the study were contacted and scheduled via email, telephone, and text messaging. Each participant confirmed their testing session prior to actual testing.

Participants in the usability test of Aprima PRM had a variety of healthcare backgrounds and demographic characteristics.

Table 1 presents participant characteristics, including demographics, professional experience, computing experience, and previous EHR experience. Participant characteristics reflect the audience of current and future users and meet the criteria designated in the 2015 Edition Certification Companion Guide for Safety-enhanced design - 45 CFR 170.315(g)(3). All participants were compensated for their time.

Table 1. Participant Characteristics

Part ID	Gender	Age	Education	Role /Title	Professional Experience (Months)	EHR Experience (Months)	Experience with Aprima PRM (Months)	Assistive Tech Needs
U01	Male	50-59	Doctorate degree	Radiologist	36	240	0	No
U02	Male	40-49	Doctorate degree	Gen Pediatrician	24	144	0	No
U03	Female	50-59	Bachelor's Degree	Registered Nurse	240	132	0	No
U04	Female	40-49	Doctorate degree	Psychologist	72	72	0	No
U05	Female	50-59	Master's Degree	Registered Nurse	420	240	0	No
U06	Female	30-39	Doctorate degree	Critical Care Physician	84	120	0	No
U07	Male	40-49	Doctorate degree	Director of Research	216	156	0	No
U08	Female	30-39	Doctorate degree	Dentist	84	108	0	No
U09	Female	30-39	Master's Degree	Physician Assistant	120	132	0	No
U10	Female	20-29	High school	Account Manager	72	84	6	No
U11	Male	70-79	Doctorate degree	Professor of Medicine	509	360	0	No
U12	Male	50-59	Doctorate degree	Professor of Medicine	300	144	0	No
U13	Female	50-59	Master's Degree	Registered Nurse	372	96	0	No
U14	Male	50-59	Doctorate degree	Plastic Surgeon	312	96	0	No
U15	Female	50-59	Doctorate degree	Radiologist	300	144	0	No

Study Design

The overall objective of this usability test was to uncover areas where the Aprima PRM system performed well – that is, effectively, efficiently, and with satisfaction – and areas where the system failed to serve the clinical documentation and workflow needs of users. Data from this test may be used as a baseline for future tests of updated versions of Aprima PRM and/or for comparing Aprima PRM with other EHRs presenting the same tasks. In short, this testing serves as both a means to record or benchmark current usability and to identify areas where improvements must be made.

Participants had a range of experience with EHRs in general, and they had little or no direct experience and/or training with the Aprima PRM system. Participants completed the test of Aprima PRM usability during individual 60-minute remote sessions or individual 60-minute onsite sessions. Each participant was provided with the same instructions.

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). Participants were notified that their performance was not under test, but that the software interface was being tested for its effectiveness.

During each test, the participant's screens and audio were recorded electronically and the data logger recorded notes on paper and electronically.

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 given compensation in appreciation for their time. Some participants were not able to complete all tasks in a single session. These individuals were scheduled for another date to complete the testing to allow all participants to go through all tasks.

The UCD process used was based on NISTIR 7741 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 without assistance
- Time to complete the tasks
- Number and description of errors
- Path deviations
- Participant's verbalizations (comments)
- Participant's satisfaction ratings of the *system*

Tasks

The Aprima User Experience Team constructed a total of 33 tasks to be realistic and representative of the clinical documentation and workflow activities a user might engage with the Aprima PRM system in an actual medical setting. The 33 tasks were created based upon the criteria specified within the test procedure structure for evaluating conformance of Electronic Health Record (EHR) technology to the certification criteria as defined in 45 CFR Part 170 Subpart C of the Health Information Technology: Standards, Implementation Specifications, and Certification Criteria for Electronic Health Record Technology.

The tasks focused on the following 2015 Edition certification criteria specified by ONC:

- §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

A copy of the tasks presented to participants in the usability test of Aprima PRM can be found in Appendix B.

Procedures

Upon arrival, participants were greeted, and their identity was verified and matched with a name on the participant schedule. Participants were then assigned a participant ID. Each participant reviewed and signed an informed consent and release form (See Appendix A). A representative from the test team witnessed the participant's signature. To ensure that the test ran smoothly, two staff members participated in this test, the test administrator and

the data logger. The test administrator conducting the test was an experienced usability practitioner with three years of usability experience at GE Healthcare and additional experience at other facilities. The test administrator moderated the session including administering instructions and tasks. The administrator also monitored task times, obtained post-task rating data, and ensured notes on participant comments were recorded. 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 (see specific instructions below):

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

For each task, the participants were given a written copy of the task. Task timing began once the administrator finished reading the question. The task time was stopped once the participant indicated they had successfully completed the task. Scoring is discussed below in section on Data Scoring on page 15. Following the session, the administrator gave the participant the post-test questionnaire (e.g., the System Usability Scale, see Appendix C).

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

Participants were thanked for their time and compensated. Participants signed a receipt and acknowledgement form indicating that they had received the compensation.

Test Location

Participants were tested on the Aprima PRM system during remote conferencing sessions using remote conferencing software or onsite individual sessions. During a given session, only the test administrator and participant communicated with one another.

For remote sessions, each participant was requested in advance to secure a quiet room with minimal distractions and a desktop or laptop computer that could connect to the Internet for the remote conferencing session. Each participant was provided with a PDF of the participant script and requested to print out a copy to have available during the testing. The test administrator proctored the test from a private office with an ambient sound suppression system. The proctor utilized a Plantronics high definition microphone headset for communication with each participant.

The test facility included a waiting area and a quiet testing room with a table, computer for the participant, and recording computer for the administrator. A paper copy of the participant script was provided. To ensure that the environment was comfortable for participants, the meeting room utilized an ambient sound suppression system and external noise levels were kept to a minimum. The ambient temperature was kept within a normal range. All of the safety instruction and evacuation procedures were valid, in place, and visible to the participants.

The test session was conducted by a test administrator from Aprima Medical Software's User Experience Team. Seated near the test administrator, a data logger also took detailed notes on each session, including participant comments and other ratings following each task.

Test Environment

The EHRUT would be typically be used in a healthcare office or facility. In this instance, the testing was conducted during remote conferencing sessions using remote conferencing software or onsite individual sessions.

Although the type of computer, operating system and display resolution of the remote participant system was unknown, the system that was used by the test administrator and controlled by the remote participant was a Dell 7110 Laptop running the Windows 10 operating system at a resolution of 1920x1200 pixels. 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.

Onsite testing sessions were held in private conference rooms with only the participant, the test administrator, and the data logger were present. The computer used for testing was a Dell 7110 laptop running Windows 10 operating system at a resolution of 1920x1200 pixels.

Aprima staff set up the application per the product documentation describing the system setup and configuration. The application ran on a Microsoft Server operating system and a Microsoft SQL Server database platform. Technically, the system performance (i.e., response time) was representative of what actual users would experience in a field implementation.

Aprima 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

As part of the usability test, several documents and instruments were used. Examples of the documents used during the usability test, including an informed consent form and the Moderator guide for the tasks including the post-test questionnaire, can be found in Appendices A and B, respectively.

Participants’ interaction with Aprima PRM was captured and recorded digitally using the remote conferencing software’s screen recording utility. Verbal responses were recorded through either the microphone integrated into the participant’s computer or through a telephone connection. This information was electronically downloaded by the administrator after each test session.

Participant Instructions

The test administrator read the following instructions aloud to each participant (also see the full moderator's guide in the Appendix B):

*Thank you for participating in this study. Our session today will last approximately **one hour today**. During that time, you will take a look at an electronic health record application.*

I will ask you to complete a few tasks using this application and answer some questions. We are interested in how easy (or how difficult) this application 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 help you with anything to do with the application 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.

Please be honest with your opinions.

The version of the application you are using today is a prototype. Also, some of the data may not make sense because it is simply placeholder data.

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?

Following the procedural instructions, participants were shown the EHR, and as their first task, were given time (5 minutes) to explore the system and make comments. Once this task was complete, the administrator gave the following instructions:

For each task, I will read the description to you and say "Begin." At that point, please perform the task and say "Done" once you believe you have successfully completed the task. I would like to request that you not talk aloud or verbalize while you are doing the tasks. I will ask you your impressions about the task once you are done.

Participants were then given test tasks to complete. Tasks are listed in the moderator's guide in the Appendix B.

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

Data Scoring

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

Table 2. Scoring Protocols for Effectiveness, Efficiency, and Satisfaction

Measures	Rational and Scoring
Effectiveness:	
Task Success	<p>A task was counted as “Success” if the participant was able to achieve the correct outcome, without assistance, within the time allotted on a per task basis.</p> <p>The total number of Successes was calculated for each task and then divided by the total number of times that task was attempted. Results are provided as a percentage.</p> <p>For administrative tasks (i.e Task 33) users that do not have administrative rights were successfully kept from completing the task. In this case the users were defined as successful in completing the task. This occurred for 3 users.</p>
Task Failures	<p>If the participant abandoned the task, did not reach the correct answer or performed it incorrectly, or reached the end of the allotted time before</p>

Measures		Rational and Scoring	
		successful completion, the task was counted as “Fail.” Maximum time allowed for the task was used as time taken.	
		The total number of errors was calculated for each task and divided by the total number of times that task was attempted. Results are presented as the average error rate. Note: Not all deviations are counted as errors. Aprima PRM allows multiple ways to complete a task.	
Prompted Successes		Because some tasks are dependent upon the successful completion of previous tasks, participants may receive a limited number of “prompts” to help prepare the system data for the pre-requisites for subsequent tasks. When a participant was able to complete the data entry on a task with three or fewer prompts, the task was counted as an “Assisted” competition. No task times were recorded for assisted completions.	
Efficiency:			
Task Deviations		The participant's path (i.e., steps) through the application was recorded. Deviations occurred 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.	
Task Time		Each task was timed from when the administrator said "Begin" until the participant said, "Done." If he or she failed to say "Done," the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task. Variance measures (standard deviation and standard error) were also calculated.	
Satisfaction:			
Ease of Use ratings		Participant’s subjective impression of the ease of use of the application was measured by administering both a single post-task question as well as post-session questionnaire.	
System Satisfaction		After each task, the participant determined on a scale of 1 to 5 their subjective satisfaction with performance on the task. These data are averaged across participants. To measure participants’ confidence in and likeability of the EHR overall, the testing team administered electronic versions of the System Usability Scale (SUS). See the SUS questionnaire in Appendix C.	

Results

Data Analysis and Reporting

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above. The usability testing results for the EHRUT are detailed below. The results should be seen in light of the objectives and goals outlined in the Study Design section. The data should yield actionable results that, if corrected, yield material, positive impact on user performance.

Reliability

During the entire data collection phase, it was observed that the system provided a consistent and reliable interface to each participant as they completed their tasks. As each participant completed their assigned tasks, the system provided the same information and responded to their input with the same verbiage and using the same mode of communication (e.g., pop-up message or embedded assistance).

Effectiveness and Efficiency

Table 3 below presents a summary of overall task performance showing task, mean time on task, task completion rates, mean path deviations and mean task satisfaction:

Table 3. Usability Test Results

Task	Mean Task Time	SD	Completion Rate (%)	Mean # Path Deviations	SD	Mean Task Satisfaction	SD
Task 1 - Enter Demographic Information	4:04	0:53	100%	1.4	7.9	3.7	0.7
Task 2 - Change Demographic Information	1:47	0:20	100%	1.3	3.1	4.7	0.6
Task 3 - Trigger Drug—Drug Interaction	2:08	0:47	100%	1.3	4.8	4.1	0.7
Task 4 - Start the Visit Note	2:24	1:00	100%	1.3	4.8	3.9	1.1

Task	Mean Task Time	SD	Completion Rate (%)	Mean # Path Deviations	SD	Mean Task Satisfaction	SD
Task 5 - Create a Lab Order	0:34	0:17	100%	1.5	1.4	4.6	0.9
Task 6 - Change a Lab Order	0:31	0:14	100%	1.1	0.5	4.9	0.2
Task 7 - Review and Action CDS Rules	1:23	0:34	100%	1.5	8.9	3.8	0.9
Task 8 - Enter Information for a Medical Device	1:48	1:18	93%	1.5	4.3	4.5	0.8
Task 9 - Review the Medication List and Enter a Medication	1:19	0:20	100%	1.2	2.6	4	0
Task 10 - Create an Order for Diagnostic Imaging	0:26	0:12	100%	1.3	1.8	4.7	0.9
Task 11 - Change an Image Order	0:15	0:10	100%	1.2	2.6	5	0
Task 12 - Review and Action CDS Rules	2:27	0:49	93%	2.5	21	3.3	1
Task 13 - Review the Medication Allergies	0:55	0:31	100%	1.4	8.2	4.4	0.9
Task 14 - Change the Medication Allergies	0:30	0:11	100%	1	0.5	4.7	0.6
Task 15 - Review the Problem List	1:36	0:27	100%	1.5	1.9	3.9	1.4
Task 16 - Change an Entry in the Problem List	0:49	0:34	100%	1.3	1.2	4.3	1
Task 17 - Trigger Drug Allergy Alert	1:50	0:38	100%	1.4	13.9	4.7	0.6
Task 18 - Order a Medication	0:58	0:30	100%	1.2	3.9	4.9	0.2
Task 19 - Change a Medication Order	0:27	0:12	100%	1.2	1.8	4.9	0.2
Task 20 - Review and Action CDS Rules	3:42	0:40	93%	1.9	23.1	3.6	0.7
Task 21 - Modify CDS Rules	5:08	1:36	87%	1.4	22.3	4	1.5
Task 22 - Modify Drug Screening Severity Level	0:39	0:27	100%	1.3	6	4.7	0.6

Task	Mean Task Time	SD	Completion Rate (%)	Mean # Path Deviations	SD	Mean Task Satisfaction	SD
Task 23 - Request and Process Medication History Information	0:59	0:43	100%	1.6	4.1	4.1	1.2
Task 24 - Send a Prescription by ePrescribing	2:02	0:35	100%	1.3	6.1	4.1	1
Task 25 - Verification of ePrescribing	0:52	0:30	100%	1.3	1.3	4.3	0.9
Task 26 - Cancel a Prescription	1:01	0:27	100%	1.3	2.9	4.6	0.6
Task 27 - Refill a Prescription	1:34	0:15	100%	1.3	1.3	4.3	0.9
Task 28 - Deny a Prescription Refill Request	0:19	0:08	100%	1	0.8	4.9	0.3
Task 29 - Accept an Electronic Prescription Change Request	0:30	0:32	93%	1	1.3	4.7	0.6
Task 30 - Process Prescription Fill Information	1:32	0:22	100%	1.4	2.9	3.5	0.9
Task 31 - Incorporate and Reconcile Information from a CCDA	2:10	0:35	100%	2.1	20.5	3.3	0.7
Task 32 - Generate a CCDA	0:32	0:09	100%	1	0.6	5	0
Task 33 - Action CDS Rule from CCD Data	3:09	0:26	100%	0.7	9.5	3.4	1.2

As Table 3 shows, relative to optimal performance standards as defined by Aprima, participant performance in the Aprima PRM usability test was quite satisfactory. The overall average task completion rate was above 98 percent.

Satisfaction

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be 85. Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average. Table 4 show the SUS by participant.

Table 4. System Usability Scale by Participant

Participant	SUS Score
Participant 1	75
Participant 2	78
Participant 3	100
Participant 4	83
Participant 5	90
Participant 6	85
Participant 7	88
Participant 8	80
Participant 9	83
Participant 10	88
Participant 11	85
Participant 12	75
Participant 13	93
Participant 14	95
Participant 15	83

Discussion of the Findings

In general, the participants performed very well and felt satisfied with the Aprima PRM system. A few of the participants struggled initially with some portions of a few tasks but in general most were able to successfully complete a majority of the tasks with little or no difficulty. Participants were mostly able to perform all tasks successfully on their own with no assistance or external documentation. The participant average performance rate was very high, as were the overall participant satisfaction rates. The Aprima PRM system appears to be a highly usable EHR.

Effectiveness

Of the 33 tasks presented, a large majority of the tasks were successfully completed by all of the participants. Over all of the participants, the mean successful task completion rate was very high with an overall average rate of above 98 percent indicating that in general the participants had little or no difficulty completing the tasks.

The amount of prior experience with EHR systems and with specific Aprima PRM functions had little relation to successful task performance. Participants without prior experience were no more likely to successfully complete tasks than those more experience.

Efficiency

Participants who successfully completed tasks generally completed those tasks within an acceptable time. The first task was completed more slowly than expected. This appears to be a testing artifact. The participant with six months of experience on the system was able to complete the first task 121 seconds faster than the average of the other participants. On subsequent tasks, the familiarity did not show a significant delta on efficiency. The tasks that took the longest required the participants to navigate to a particular unfamiliar portion of a page, interact with a workflow, locate and select specific actions. Those tasks may be performed more quickly with more familiarity or a minor update to the user interface.

Some participants made errors when attempting to navigate toward solving their assigned tasks. These errors may be associated with those participants not being familiar with and not understanding the presented information in the Aprima PRM system. Prior experience with EHR systems was related to successful task completion. Similarly, experience and practice with the given system may have positive effects with regard to user efficiency.

Satisfaction

The results from the System Usability Scale (SUS) scored the subjective satisfaction with the system based on performance with these tasks to be 85. Broadly interpreted, scores

under 60 represent systems with poor usability; scores over 80 would be considered above average.

Summary of Major Findings

This evaluation demonstrated that the Aprima PRM system is a usable system with a relatively short learning curve. Participants with minimal amounts of experience using unfamiliar portions of the Aprima PRM system before the study experienced little initial difficulty understanding the navigation and information architecture. Participants with more experience were able to solve most tasks without difficulty or error.

Areas for Improvement

- Several participants commented that the icons were too small, as they were not familiar with the product. In a future release, Aprima will address this with a full ribbon with configurable icon size and text labels.
- Modification of CDS rules made participants comment that the function was not intuitive and as a result, participants spent several seconds while they paused to figure out where to begin. In a future release Aprima should make the workflow clearer to simplify and improve the speed of this task.

Appendices

Appendix A: Informed Consent Form

Informed Consent

We would like to thank you for participating in this study. The purpose of this study is to evaluate an electronic health records system. If you decide to participate, you will be asked to perform several tasks using the prototype and give your feedback. The study will last about 3 hours. At the conclusion of the test, you will be compensated for your time.

Agreement

I understand and agree that as a voluntary participant in the present study conducted by Aprima Medical Software. I am free to withdraw consent or discontinue participation at any time. I understand and agree to participate in the study conducted and recorded by the Company.

I understand and consent to the use and release of the recording by Aprima. I understand that the information and videotape is for research purposes only and that my name and image will not be used for any purpose other than research. I relinquish any rights to the recordings and understand the recording may be copied and used by Aprima without further permission.

I understand and agree that the purpose of this study is to make software applications more useful and usable in the future.

I understand and agree that the data collected from this study may be shared outside of Aprima Medical Software. I understand and agree that data confidentiality is assured, because only de-identified data - i.e., identification numbers not names, and not images - will be used in analysis and reporting of the results.

I agree to immediately raise any concerns or areas of discomfort with the study administrator. I understand that I can leave at any time.

Please check one of the following:

- YES, I have read the above statement and agree to be a participant.
- NO, I choose not to participate in this study.

Signature: _____ **Date:** _____

Appendix B: Example Moderator's Guide

Only three tasks are presented here for illustration.

EHRUT Usability Test
Moderator's Guide

Administrator _____

Data Logger _____

Date _____ Time _____

Participant # _____

Location _____

Prior to testing

- Confirm schedule with participants.
- Ensure EHRUT lab environment is running properly.
- Ensure Consent forms are complete for all participants.
- Ensure lab and data recording equipment is running properly.

Prior to each participant:

- Reset application.
- Restore application to base state using script restoredb.bat.
- Start session recordings with GTM Recording.

Prior to each task:

- Reset application to starting point for next task.

After each participant:

- End session recordings with tool.
- Fill out all paper work and acknowledgement form.

After all testing

- Scan all forms and shred originals.
- Back up all video and data files.

Orientation (5 minutes)

Thank you for participating in this study. Our session today will last approximately **one hour today**. During that time, you will take a look at an electronic health record application.

I will ask you to complete a few tasks using this application and answer some questions. We are interested in how easy (or how difficult) this application 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 help you with anything to do with the application 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.

Please be honest with your opinions.

The version of the application you are using today is a prototype. Also, some of the data may not make sense because it is simply placeholder data.

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?

Preliminary Questions (5 minutes)

What is your job title?

How long have you been working in this role?

What are some of your main responsibilities?

Tell me about your experience with electronic health records.

Preview: First Impressions (6 Minutes)

This is the application you will be working with. Have you heard of it? Yes ___ No ___
If so, tell me what you know about it.

Show test participant the EHRUT.

Please don't click on anything just yet.

What do you notice?

What are you able to do here?

Please be specific.

Notes / Comments:

Task 1: Enter Demographic Information – Norman Wood (5 Minutes)

Take the participant to the starting point for the task: Patient Demographics.

Tell the participant to read the scenario, and then to find the appointment already on the calendar. Have them select the name link for Norman Wood.

A new patient, Norman Wood, made an appointment by phone. Now that he is in the office, you need to enter the following information into his patient record.

- Gender: Male
- Gender Identity: Male
- Sexual Orientation: Straight
- Birth Date: January 12, 1998
- Race: African American
- Ethnicity: African American
- Preferred Language: English

Success: (Yes / No) Easily completed Completed with difficulty or help Not completed

Comments:

Task Time: _____

Optimal Path: Correct Minor Deviations / Cycles Major Deviations

1. In the Patient Demographics window, select the name link for Norman Wood.
2. Enter the following information:
 - Gender: Male
 - Gender Identity: Male
 - Sexual Orientation: Straight
 - Birth Date: January 12, 1998
 - Race: African American
 - Ethnicity: African American
 - Preferred Language: English
3. Select the OK button.

Comments:

Observed Errors and Verbalizations:

Comments:

Rating: Overall, this task was: _____

Show participant written scale: "Very Easy " (1) to "Very Difficult" (5)

Task Rating

Very Easy						Very Difficult
1	2	3	4	5		

Administrator / Note taker Comments:

Task 2: Change Demographic Information – Norman Wood (2 Minutes)

*Take the participant to the starting point for the task: Patient Demographics.
Patient Demographics for this patient should still be open.*

Norman wants to make some changes to the demographic information he gave you. The new information is:

- Gender Identity: Other
- Sexual Orientation: Bisexual
- Birth Date: January 12, 1999, not 1998
- Race: Declined to specify
- Ethnicity: Not provided
- Preferred Language: Spanish

Once you have entered and saved the new information, verify that it is correct.

Success: (Yes / No) Easily completed Completed with difficulty or help Not completed

Comments:

Task Time: _____

Optimal Path: Correct Minor Deviations / Cycles Major Deviations

1. Select the name link for John Doe.
2. In the Patient Demographics window, select the name link for Norman Wood.
3. Enter the following information:
 - Gender Identity: Other
 - Sexual Orientation: Bisexual
 - Birth Date: January 12, 1999, not 1998
 - Race: Declined to specify
 - Ethnicity: Not provided
 - Preferred Language: Spanish
4. Select the OK button.
5. In the Patient Demographics window, on the Demographics window, verify that the information is correct.

Comments:

Observed Errors and Verbalizations:

Comments:

Rating: Overall, this task was: _____

Show participant written scale: "Very Easy " (1) to "Very Difficult" (5)

Task Rating

Very Easy					Very Difficult
1	2	3	4	5	

Administrator / Note taker Comments:

Task 3: Trigger Drug—Drug Interaction – Norman Wood (7 Minutes)

Take the participant to the starting point for the task: Full Note Composer.

Tell the participant to locate the appointment for Norman Wood on the Desktop calendar. Then have them click on Open/Create Note icon.

Norman is agitated and wants you to prescribe Prozac immediately. Please prescribe Prozac 20mg one time per day by mouth for 5 days.

If while prescribing, you receive any kind of drug screening alert, then stop writing the prescription and close the visit note.

Success: (Yes / No) Easily completed Completed with difficulty or help Not completed

Comments:

Task Time: _____

Optimal Path: Correct Minor Deviations / Cycles Major Deviations

1. In Full Note Composer, go to the Rx tab.
2. On the RX tab, click the + on the Medication SIG bar to open Drug Search.
3. In the Drug field, enter Prozac.
4. Select Prozac 20mg tablet.
5. SIG Writer window opens.
6. On SIG writer screen, click on the Drug Screening pane in upper right corner to view the information. (If this is done, then process ends at step 8. If this is not done, then process skips steps 7 and 8, and continues with step 9).
 - a. Receive Drug Screening Warning: Duplicate Therapy: The use of Prozac is a duplicate therapy with Zoloft 50 mg. Do you want to continue?
 - b. Click No
7. In the SIG Writer, select the Cancel button.
8. In the FNC window, select the OK to save and exit the visit note.

Alternate workflow when drug warning not seen initially.

9. On SIG writer screen, click in the Dosage box to open the Dosage window.
10. For Dosage, enter 1.
11. For form, enter Tablet.
12. For frequency, enter once per day.
13. For number of days, enter 5.
14. Click the OK button to close the Dosage window.

15. Click the Save button on the SIG Writer window.
 - a. The Drug Screening window displays with the warning for: Duplicate Therapy: The use of Prozac is a duplicate therapy with Zoloft 50 mg. Do you want to continue?
 - b. Click No.
16. In the SIG Writer, select the Cancel button.
17. In the FNC window, select the OK to save and exit the visit note.

Comments:

Observed Errors and Verbalizations:

Comments:

Rating: Overall, this task was: _____
 Show participant written scale: "Very Easy " (1) to "Very Difficult" (5)

Task Rating

Very Easy					Very Difficult
1	2	3	4	5	

Administrator / Note taker Comments:

Appendix C: System Usability Scale Questionnaire

SYSTEM USABILITY SCALE QUESTIONNAIRE

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

Appendix D: Risk Analysis of Tasks

Risk management for each task was calculated by assessing the frequency of use, the material changes to the feature and the impact of errors on end users. The scale is Low, Medium, High, and Very High.

Table 5: Risk Analysis of Tasks

Task	Risk
Task 1 - Enter Demographic Information	Medium
Task 2 - Change Demographic Information	Medium
Task 3 - Trigger Drug—Drug Interaction	Very High
Task 4 - Start the Visit Note	Low
Task 5 - Create a Lab Order	Medium
Task 6 - Change a Lab Order	High
Task 7 - Review and Action CDS Rules	Medium
Task 8 - Enter Information for a Medical Device	High
Task 9 - Review the Medication List and Enter a Medication	Very High
Task 10 - Create an Order for Diagnostic Imaging	High
Task 11 - Change an Image Order	High
Task 12 - Review and Action CDS Rules	Medium
Task 13 - Review the Medication Allergies	High
Task 14 - Change the Medication Allergies	High
Task 15 - Review the Problem List	Medium
Task 16 - Change an Entry in the Problem List	Medium
Task 17 - Trigger Drug Allergy Alert	Very High
Task 18 - Order a Medication	Very High
Task 19 - Change a Medication Order	Very High
Task 20 - Review and Action CDS Rules	Medium
Task 21 - Modify CDS Rules	High
Task 22 - Modify Drug Screening Severity Level	Very High

Task	Risk
Task 23 - Request and Process Medication History Information	High
Task 24 - Send a Prescription by ePrescribing	High
Task 25 - Verification of ePrescribing	High
Task 26 - Cancel a Prescription	High
Task 27 - Refill a Prescription	High
Task 28 - Deny a Prescription Refill Request	High
Task 29 - Accept an Electronic Prescription Change Request	High
Task 30 - Process Prescription Fill Information	Medium
Task 31 - Incorporate and Reconcile Information from a CCDA	High
Task 32 - Generate a CCDA	Medium
Task 33 - Action CDS Rule from CCD Data	Medium