



**EHR Usability Test Report of GreenApples MedSystems**  
Product Version: *MedGre v 3.0*

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

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## Executive Summary

On August 12-13, 2014 *The Usability People, LLC* conducted a usability test of GreenApples MedSystems' *MedGre EHR*. The test was conducted in the Fairfax, VA office of The Usability People over remote tele-conferencing sessions using *Go To Meeting*. The purpose was to test and validate the usability of the current user interface and provide evidence of usability of *MedGre EHR* as the EHR Under Test (EHRUT). Six (6) healthcare providers matching the target demographic criteria participated in the usability test using the EHRUT in simulated, but representative tasks.

The study focused on measuring the effectiveness of, efficiency of, and satisfaction with *MedGre EHR* among a small sample of participants representing potential users of the system. Performance data was collected on ten (10) tasks typically conducted on an EHR. Tasks created were based upon a sub-set of the criteria specified within the test procedure structure for evaluating conformance of Electronic Health Record (EHR) technology to the certification criteria defined in 45 CFR Part 170 Subpart C of the Health Information Technology: Standards, Implementation Specifications, and Certification Criteria for Electronic Health Record Technology, 2014 Edition; Revisions to the Permanent Certification Program for Health Information Technology, Final Rule as published in the Federal Register on September 4, 2012.

Results of the study indicated that the *MedGre EHR* system was satisfactory with regards to effectiveness and efficiency and some participants were satisfied with the system.

## Introduction

The Electronic Health Record System Under Test (EHRUT) tested for this study, *MedGre EHR*, was specifically designed to present medical information to physicians, nurses and other healthcare practitioners on desktop computers in standard medical care settings. This study tested and validated the usability of the current user interface and provides evidence of the usability of *MedGre EHR* 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 user comments collected using an industry-standard questionnaire.

## Method

### Participants

Six individuals (2 men and 4 women) participated in the EHRUT (*MedGre EHR*). Participants were recruited from a database of potential participants maintained by The Usability People, LLC. The contacts contained within this database were generated via potential participants responses to postings in popular Internet and social media sites, and a link at the bottom of The Usability People website. Those who responded to the invitation to take part in the study were directed to an online questionnaire that served as the participant screener. (The screening questionnaire is provided as Appendix 1.) Participants meeting the criteria for participation in the study were contacted and scheduled via email.

Participants in the usability test of *MedGre EHR* had a variety of healthcare backgrounds and demographic characteristics. Participants did not have any direct experience or training using the *MedGre EHR* system.

Table 1 presents participant characteristics, including demographics, professional experience, computing experience, and number of previous EHR's used. None of the participants were from the vendor organization (GreenApples MedSystems) that produced and supplied the evaluated system nor did any participant have any direct connection to the testing organization (*The Usability People, LLC*). As compensation for their participation all individuals received a gift card. (Additional participant background characteristics are presented in Appendix 2.)

**Table 1. Participant Characteristics**

Part ID	Gender	Age	Education	Role/Title	Work facility	Professional Experience (yrs)	#EHRs worked with	EHR Experience (yrs)	Hrs/Wk with EHRs?
p1	Male	23 to 39	MD	Nephrologist	Public university hospital. Manage and treat patients with renal disease.	7	3	7	50
p2	Female	60 to 74	MD	Gynecologist	Solo practitioner in a free-standing gyn office	29	3	4	30
P3	Female	23 to 39	Nuclear Medicine Technologist	Nuclear Medicine Technologist	Hospital, Nuclear Medicine Technologist	11	2	4	25
p4	Female	40 to 59	CNM	Midwife	Children's Hospital, provide maternity care services	14	2	1	40
p5	Female	40 to 59	RN, MSN	Senior nursing instructor	Large urban teaching facility	22	3	15	15
p6	Male	40 to 59	MAPH	Health IT Instructor	Mt. Hood Community College	4	7	11	35

## Study Design

The overall objective of this usability test was to uncover areas where the *MedGre EHR* application performed well – that is, effectively, efficiently, and with satisfaction--and areas where the application failed to serve the needs of users. Data from this test may be used as a baseline for future tests of updated versions of *MedGre EHR* and/or for comparing *MedGre EHR* 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 wide range of experience with EHRs and general, and none had any direct experience and/or training with the *MedGre EHR* system. Participants completed the test of *MedGre EHR* usability during individual 60-minute *Go To Meeting* sessions. During the test, each participant interacted with various components of the *MedGre EHR*. Each participant was provided with the same instructions.

*MedGre EHR* was evaluated for effectiveness, efficiency and satisfaction as defined by the following measures collected and analyzed 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 Usability People, in close collaboration with a representative of GreenApples MedSystems, created a total of ten (10) tasks to be realistic and representative of the activities a user might engage with *MedGre EHR* in actual medical settings. The ten (10) tasks were created based upon a sub-set of 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 in this study focused on the following issues:

1. Computerized Provider Order Entry System (CPOE) (§ 170.314(a)(1));
2. Medication list (§ 170.314(a)(6));
3. Medication allergy list (§ 170.314(a)(7));
4. Clinical decision support (§ 170.314(a)(8));
5. Clinical information reconciliation (§ 170.314(b)(4)).

A copy of the tasks presented to participants in the usability test of *MedGre EHR* can be found in Appendix 4.

## Test Location

All participants were tested on the *MedGre EHR* system during remote conferencing sessions using *Go To Meeting*. Each participant was requested in advance to secure a quiet room with minimal distractions and a computer that could connect to the Internet with a *Go To Meeting* session. During a given *Go To Meeting* session, only the test administrator and that participant communicated with one another.



The *Go To Meeting* usability test session was conducted by a test administrator from the testing organization (*The Usability People, LLC*) working from a small conference room at The Usability People's Fairfax, VA location. Seated near the administrator, a data logger from the testing organization took detailed notes on each session, including user comments and satisfaction ratings following each task. During a session the test administrator, and the data logger could see only the participant's screen and hear the participant's comments, questions, and responses.

### **Test Environment**

While the EHRUT typically would be used in a healthcare office or ambulatory surgery center facility, testing of the *MedGre EHR* system was conducted via remote connection during individual *Go To Meeting* sessions. Each participant called into a *Go To Meeting* session and was connected by the test administrator to the application.

The *MedGre EHR* application itself ran on a browser platform on a LAN connection using a sample database set up specifically for the test. Participants used a mouse and keyboard when interacting with the EHRUT and were given remote control of the administrator's workstation to perform the tasks.

### **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, the tasks, and post-test questionnaires, can be found in Appendices 3-5, respectively.

Participants' interaction with the *MedGre EHR* was captured and recorded digitally using *Morae* screen capture software running on the test administrator's workstation.

Verbal responses were recorded through either the microphone integrated into the participant's computer or through a telephone connection. This information was electronically transmitted to the administrator and to the data logger during each test session.

### **Participant Instructions**

The administrator read the following instructions aloud to each participant:

*Thank you for participating in this study. Your input is very important. Our session today will last about 60 minutes. During that time you will use an instance of an electronic health record. I will ask you to complete a few tasks using this system and answer some questions.*

*Please note that we are not testing you; we are testing the system. Therefore, if you have any difficulty this may mean that something needs to be improved in the system. I will be here in case you need specific help, but I am not able to instruct you or provide help in how to use the application.*

*Overall, we are interested in how easy (or how difficult) this system is to use, what in it would be useful to you, and how we could improve it. I did not have any involvement in its creation, so please be honest with your opinions. All of the information that you provide will be kept confidential and your name will not be associated with your comments at any time. Should you feel it necessary you are able to withdraw at any time during the testing.*

Participants were then given ten (10) tasks to complete.

## Procedure

Upon connection to the online meeting tool (*Go To Meeting*), each participant was greeted, his or her identity verified, and matched to a name on the participant schedule. Participant names were replaced with participant IDs so that a given individual's data cannot be linked to his/her identity. Prior to beginning testing, each participant reviewed and signed an informed consent form (See Appendix 3) and emailed it to the organization (*The Usability People, LLC*) conducting the test.

Two staff members of the *Usability People*, a usability test administrator and a data logger, administered the test. The administrator moderated the session by providing both verbal and written instructions for the overall usability test and for each of the tasks comprising the test. The administrator also monitored task success, path deviations, number and description of errors, and audio-recorded participant verbal comments. The data logger task times, obtained post-task rating data, and took notes on participant comments and administrator feedback.

For each of the ten (10) tasks, participants were presented written instructions to their computers. Following the administrator's instructions, each participant performed each task by first reading the task out loud then stating in his or her own words his or her interpretation of the task requirements. When the participant's interpretation matched the actual goal of the task, the administrator instructed the participant to begin and task timing began. Task time was stopped and recorded when the test administrator observed on his workstation that the participant had successfully completed the task. If a participant failed to complete a task before the expected amount of time for each task, that task was marked as "Timed Out." After each task, the test administrator asked the participant, "On a scale

from 1 to 5, where 1 is 'Not Satisfied' and 5 is 'Satisfied,' how satisfied were you with this task?" This same procedure was conducted for each of the ten (10) tasks.

Following completion of the ten (10) EHR tasks, the administrator electronically presented to the participant a post-test questionnaire (System Usability Scale (SUS), see Appendix 5). After the participant completed the questionnaire, the administrator thanked each participant for his or her time and allowed the participant to make any comments on or ask any questions about the system and tasks presented. For each session, the participant's schedule, demographic information, task success rate, time on task, errors, deviations, verbal responses, and post-test questionnaire were recorded. The system was then reset to proper test conditions for the next participant.

### **Usability Metrics**

According to the *NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records* (NIST IR 7742, November, 2010) 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:

- Effectiveness of *MedGre EHR* by measuring participant success rates and errors
- Efficiency of *MedGre EHR* by measuring the average task time and path deviations.
- Satisfaction with *MedGre EHR* by measuring ease of use ratings.

## Data Scoring

Table 2 details how tasks were scored, errors evaluated, and the time data analyzed:

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

Measures	Rationale and Scoring
<p><b>Effectiveness:</b></p> <ul style="list-style-type: none"> <li>• Task Success</li> </ul>	<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><b>Effectiveness:</b></p> <ul style="list-style-type: none"> <li>• Task Failures</li> </ul>	<p>If the participant abandoned the task, did not reach the correct answer or performed it incorrectly, or reached the end of the allotted time before successful completion, the task was counted as “Fail.” No task times were taken for failed attempts.</p> <p>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.</p> <p>Note: Not all deviations are counted as errors.</p>
<p><b>Effectiveness:</b></p> <ul style="list-style-type: none"> <li>• Prompted Successes</li> </ul>	<p>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.</p> <p>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” completion. No task times were recorded for Assisted completions.</p>
<p><b>Efficiency:</b></p> <ul style="list-style-type: none"> <li>• Task Deviations</li> </ul>	<p>The participant’s path (i.e., steps) through the application was recorded. Deviations occur if for example, the participant navigated to an incorrect screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control.</p>
<p><b>Efficiency:</b></p> <ul style="list-style-type: none"> <li>• Task Time</li> </ul>	<p>Each task was timed from the administrator’s prompt “Begin” until said, “Done.” If the participant failed to say, “Done,” timing stopped when the participant stopped performing the task.</p> <p>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.</p>

<p><b>Satisfaction:</b></p> <ul style="list-style-type: none"><li>• Ease of Use ratings</li><li>• System Satisfaction</li></ul>	<p>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 a post-session questionnaire.</p> <p>After each task, the participant determined on a “scale of 1 (being “Not Satisfied”) to 5 (being “Very Satisfied”) “their subjective satisfaction with performance on the task. These data are averaged across participants.</p> <p>To measure participants’ confidence in and likeability of the <i>MedGre EHR</i> overall, the testing team administered an electronic version of the System Usability Scale (SUS See the SUS questionnaire as Appendix 5).</p>
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## Results

### Data Analysis and Reporting

The results of the usability test of the *MedGre EHR* were analyzed according to the methods described in the Usability Metrics section above and are detailed below. Note that the results should be evaluated relative the study objectives and goals as outlined in the Design section above. The data should yield actionable results that, if corrected, yield material, positive impact on user performance.

### Effectiveness and Efficiency

Table 3 presents a summary of task performance showing task, average time on task, expected task times, task completion rates, path deviations and task satisfaction:

**Table 3. Usability Test Results**

Task	Mean Task Time	Expected Task Time	Completion Rate (%)	Mean # Path Deviations	Mean Task Satisfaction
Task 1 (Configuration of CDS)	2:18	3:00	67%	2.00	3.33
Task 2 (Patient Medication Allergy List)	n/a	3:00	0%	3.17	1.33
Task 3 (Modify Patient Allergy List/View CDS)	1:08	2:00	83%	0.67	4.17
Task 4 (Modify Patient Medication List)	1:46	3:00	83%	0.83	3.67
Task 5 (Update Vitals Information)	1:59	3:00	100%	1.00	4.33
Task 6 (Demographics CDS Intervention)	2:31	3:30	67%	1.83	3.00
Task 7 (Record Lab Order)	2:33	3:30	67%	0.83	3.17
Task 8 (Record Radiology Order)	1:14	2:00	80%	0.20	3.20
Task 9 (Modify Radiology Order)	2:15	3:00	100%	0.00	4.00
Task 10 (Reconcile Clinical Information)	n/a	4:00	0%	2.67	1.83

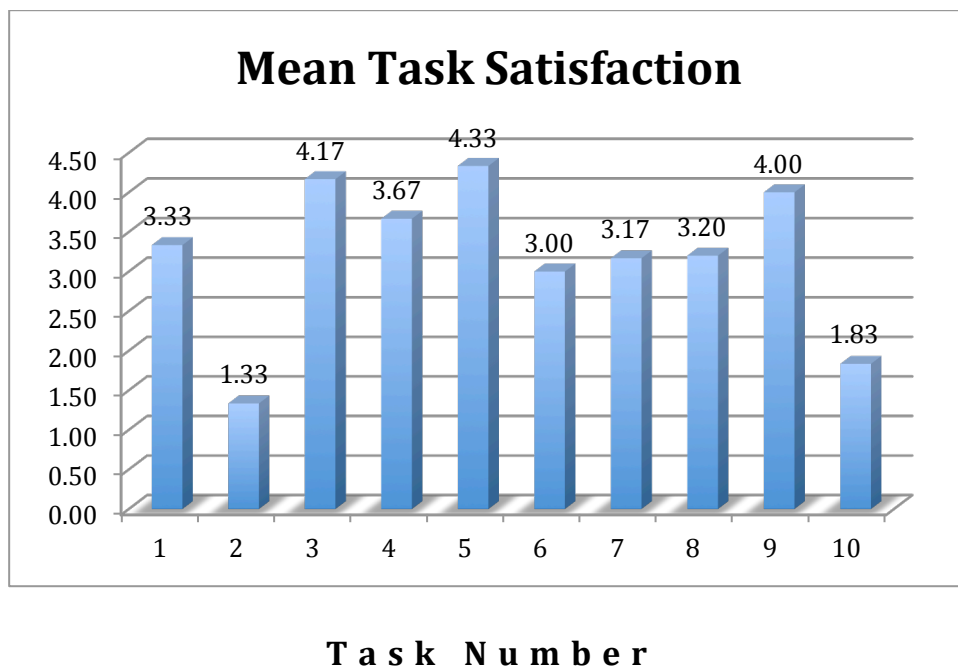
As Table 3 shows, relative to optimal performance standards as defined by GreenApples MedSystems, participants in the *MedGre EHR* usability test performance was weaker than would be expected, particularly for tasks 2 and 10.

## Satisfaction

### *Individual Task Satisfaction*

Participants verbally indicated their satisfaction with each task using a scale of “1” (“Not Satisfied”) to “5,” (“Very Satisfied”). As Figure 1 shows individual task satisfaction ranged from a low of 1.3 out of 5 on Task 2 to a high of 4.33 on Task 5.

**Figure 1. Satisfaction Ratings of Individual Tasks**



### *System Usability Scale*

The System Usability Scale (SUS) is a simple, 10-item Likert-type attitude scale providing a global subjective assessment of usability from the user’s perspective (John Brooke at Digital Equipment Company developed the SUS in 1986). The SUS scale is scored



from 0 to 100; scores under 60 represent systems with less than optimal usability, scores over 80 are considered better than average. See Appendix 5 for a copy of the SUS.

The mean total SUS score for the *MedGre EHR* was 46 and ranged from a low of 18 and a high of 88.

### **Discussion of Findings**

Several of the participants had some difficulty with tasks and were unable to successfully complete a number of them. Several of the participants were not able to complete some tasks given the time constraints of a summative test. Some participants, however, were mostly able to perform tasks successfully with some minor assistance.

In general the participants felt less than totally satisfied with the *MedGre EHR*. The participant performance rate seemed about the same as the participant satisfaction ratings would suggest. When looking the ratings and performance across participants, it is clear that both training and experience of the user is directly tied to the satisfaction, effectiveness and efficiency of the *MedGre EHR*.

#### **Effectiveness**

Of the ten (10) tasks presented, five (5) tasks received task completion rates of eighty (80) percent or higher. Two (2) tasks, Patient Medication Allergy List and Reconcile Clinical Information, were not successfully completed by any participant. Overall participants, the mean successful task competition rate was slightly less than expected (65 percent) indicating that some participants had experienced some difficulty completing some of the tasks.

Prior experience with EHR systems was positively related to successful task performance; participants with prior EHR experience were more likely to successfully complete tasks than those without prior experience.

### **Efficiency**

Participants who successfully completed tasks generally completed those tasks within an acceptable time. Some tasks were complete more quickly than the calculated optimal time, while several tasks were not completed within the expected time. The tasks that took the longest required the participants to navigate to a particular page, interact with a complex workflow, locate and select specific actions. Those tasks could be performed more quickly with an update to the information architecture, an increase in the amount of embedded assistance, and perhaps an enhanced visual indication of primary or secondary actions.

Some participants made a number of errors when attempting to navigate toward solving their assigned tasks. Many of these errors may be associated with those participants not being familiar and not understanding the presented information architecture of the *MedGre EHR* system. As noted above, 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**

Participants were less than fully satisfied with the *MedGre EHR* system; ratings on the SUS (mean=46) demonstrated a less than expected level of satisfaction with the system.

Individual task satisfaction ratings were related to individual user performance. Those participants who were able to successfully complete tasks were also more likely to

rank those tasks as satisfying, while those participants who did poorly or were not able to complete a task ranked those tasks as unsatisfying. Overall however, participant satisfaction with *MedGre EHR* was about what was expected given the performance data.

### **Summary of Major Findings**

This evaluation demonstrated that the *MedGre EHR* system is a fairly usable system with a relatively short learning curve. Participants had never used the *MedGre EHR* system before the study and experienced difficulty understanding the navigation and information architecture. The results suggest that with some minor changes their performance and satisfaction would likely improve.

**Risk Analysis**

The following table presents a prioritized list of tasks prioritized by the risk of error as observed during the testing.

Table 5. Risk Analysis

<b>T A S K</b>	<b>Percent Complete</b>	<b>Risk Status</b>
Task 1 (Configuration of CDS)	67%	Moderate
Task 2 (Patient Medication Allergy List)	0%	High
Task 3 (Modify Patient Allergy List/View CDS)	83%	Low
Task 4 (Modify Patient Medication List)	83%	Low
Task 5 (Update Vitals Information)	100%	None
Task 6 (Demographics CDS Intervention)	67%	Moderate
Task 7 (Record Lab Order)	67%	Moderate
Task 8 (Record Radiology Order)	80%	Low
Task 9 (Modify Radiology Order)	100%	None
Task 10 (Reconcile Clinical Information)	0%	High

## **Areas for Improvement**

The following is a list of potential areas for improvement. Making these and other minor enhancements will improve the overall user experience of the *MedGre EHR* system and increase the effectiveness, efficiency, and satisfaction for both experienced and novice *MedGre EHR* users.

- **Inconsistent location of controls.**
  - The placement of the same or similar controls and/or buttons should be consistent across the application.
- **Layered Messaging.**
  - Participants often had difficulty reading various system messages. Up to three messages were often displayed at the same time in the same/similar location--blocking out the view of potential critical information.
- **Required Fields not always indicated**
  - On several forms required fields were not indicated. This caused participants to receive an error message for not entering required data.
- **GUI Quality Assurance**
  - The system has a number of misspellings, incorrect grammar, button order inconsistencies, and other similar issues that are typically associated with less than adequate quality assurance.

# Appendices

## Appendix 1: Recruiting Screener

1. Are you male or female?
2. Have you participated in a focus group or usability test in the past six months?
3. Do you, or does anyone in your home, work in marketing research, usability research, and/or web design?
4. Do you, or does anyone in your home, have a commercial or research interest in an electronic health record software or consulting company?
5. Which of the following best describes your age?  
 23 to 39;  40 to 59;  60 to 74;  75 or older.
6. Do you require any assistive technologies to use a computer?
7. Please list your medical or nursing credentials
8. How long have you held this position (no. of months)?:
9. What type of facility do you work in and what is your role there?
10. How are medical records handled at your (main) workplace?  
 All Paper  Some Paper/Some Electronic  All Electronic
11. How many EHRs do you use or have you worked with?
12. How many years have you used an electronic health record?
13. About how many hours per week do you spend using a computer?
14. What computer platform(s) do you usually use?
15. In the last month, about how often have you used an electronic health record?  
 Did not use last month  Every day  A few times a week

## Appendix 2: Additional Participant Information

Participant Number	Do you, or does anyone in your home, work in marketing research, usability research, web design or Electronic Health Record software?	Have you participated in a focus group or usability test in the past 3 months?	Do you, or does anyone in your home, have a commercial or research interest in an electronic health record software or consulting company?	About how many hours per week do you spend using a computer?	What computer platform(s) do you usually use?	How are medical records handled at your facility?	Last month, how often used EHR?
p1	No	No	No	60	PC	All Electronic	Every day
p2	No	No	No	50	PC and Apple	All Electronic	Every day
p3	No	No	No	50	PC	Some Paper/Some Electronic	Every day
p4	No	No	No	50	PC	Some Paper/Some Electronic	A few times per week
p5	No	No	No	45	PC, Apple, Unix	Some Paper/Some Electronic	Every day
p6	No	No	No	45	Other	All Electronic	Every day

### Appendix 3: Informed Consent Form

GreenApples MedSystems 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 60 minutes.

#### *Agreement*

I understand and agree that as a voluntary participant in the present study conducted by GreenApples MedSystems. 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 GreenApples MedSystems.

I understand and consent to the use and release of the video recording by GreenApples MedSystems. 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 video and understand the video recording may be copied and used by GreenApples MedSystems 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 with outside of GreenApples MedSystems. I understand and agree that data confidentiality is assured, because only de-identified data, – i.e., identification numbers not name–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 4: Participant Tasks

### **TASK 1:**

*Configuration of CDS interventions by user*

You have a few free minutes before your patient visit and want to view and configure (activate, or deactivate) some of the Clinical Decision Support (CDS) rules.

**Check the status for the following rules and deactivate them, as they are not relevant to your practice:**

**NQF: 0028, CMS: 138** - Preventive Care and Screening: Tobacco Use: Screening and Cessation Intervention

**NQF: 00419, CMS: 68** - Documentation of Current Medications in the Medical Record (Measure)

### **TASK 2:**

*Medication allergy list CDS Intervention.*

*Medication allergy list (access, record).*

During the patient visit, your assistant forgot to record any drug allergies of your patient, (PATIENT6 Test). Now as you are examining the patient record, a CDS intervention alert shows up:

**“Documentation: Medication allergy”**

The patient tells you that after taking Amoxicillin they experience nausea and vomiting, and after taking Codeine they experience some wheezing.

***Add an allergy to Amoxicillin and an allergy to Codeine to their record using the EHR.***

### **TASK 3:**

*Medication allergy list (access, change)*

The patient has told you that instead of wheezing after taking Codeine it results in diarrhea.

**Make the above change to the patient record using the EHR.**

**TASK 4:**

*Medication list (access, change)*

Because of the patient's allergy to Amoxicillin, you need to stop them from taking Amoxicillin.

***Edit this information in the EHR.***

**TASK 5:**

*Vital Signs CDS Intervention*

Your assistant has measured the patient's height, weight and blood pressure, and provided you with following values:

- Height: **60 inches**
- Weight: **170 lbs.**
- Blood pressure: **140/110**

***Enter this information into the EHR.***

*Upon adding the information, notice a CDS intervention alert:*

***"Counseling: Physical activity for above normal BMI"***

**TASK 6:**

*Demographics CDS Intervention*

Your patient complains to you of weight gain, frequent urination, and blurred vision.

You diagnose them with "**Type 2 diabetes mellitus**" (SNOMED code: 190331003).

***Add this new diagnosis into the medical records for this visit.***

*Upon adding the diagnosis note the following CDS intervention alerts:*

- 1. "Measurement: LDL-C"***
- 2. "Measurement: Hgb-a1c"***

**TASK 7:**

*Lab order (record)*

Based on the above intervention, you would like to also order some lab work to be performed.

**Order the following lab:**

***“85025-CBC With Differential/Platelet”***

**TASK 8:**

*Radiology orders (access, record).*

After further examination of your patient, you decide to also create a radiology order:

- **“72195: Magnetic resonance (e.g., proton) imaging, pelvis; without contrast material(s)”.**

***Enter the radiation order into the EHR:***

**TASK 9:**

*Radiology orders (access, change).*

In order to rule out Pyelonephritis you decide to change the recently added radiology order and instead order the following:

- **76775: Ultrasound, retroperitoneal (e.g., renal, aorta, nodes), real time with image documentation; limited.**

**TASK 10:**

*Clinical information reconciliation*

Your patient told you that they have brought summary information report from other provider in a C-CDA file on a thumb-drive (usb-stick). You need to upload the information from the external drive into the system. The following information will be recognized:

- **Problems:**
- **Medications:**
- **Medication Allergies:**

***View and compare the uploaded medical records with the existing records and create a single reconciled list of problems, medications, and medication allergies.***

## Appendix 5: System Usability Scale Questionnaire

	Strongly disagree				Strongly agree
1. I think that I would like to use this system frequently	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5
2. I found the system unnecessarily complex	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5
3. I thought the system was easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<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"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5
5. I found the various functions in this system were well integrated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5
6. I thought there was too much inconsistency in this system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<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"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5
8. I found the system very cumbersome to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5
9. I felt very confident using the system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<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"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5

**Appendix 6: Detailed task performance for each participant.**

Participant Number	Task 1 (Configuration of CDS)			
	Task Time	Outcome	# Path Deviations	Task Satisfaction
p1	2:22	Success	0	4
p2	2:20	Success	0	5
p3	3:32	Time Out	4	1
p4	3:14	Success	3	3
p5	4:03	Fail	5	2
p6	1:19	Success	0	5

Expected time 3:00  
 Average Time on Task 2:18  
 Average Task Satisfaction 3.33  
 Average #Path Deviations 2.00  
 Percent Success 67%

Participant Number	Task 2 (Patient Medication Allergy List)			
	Task Time	Outcome	# Path Deviations	Task Satisfaction
p1	6:15	Fail	6	1
p2	4:37	Time Out	1	2
p3	3:34	Time Out	1	1
p4	3:18	Time Out	3	1
p5	5:02	Time Out	1	2
p6	4:30	Fail	7	1

Expected Time 3:00  
 Average Time on Task 0:00  
 Average Task Satisfaction 1.33  
 Average #Path Deviations 3.17  
 Percent Success 0%

Participant Number	Task 3 (Modify Patient Allergy List/View CDS)			
	Task Time	Outcome	# Path Deviations	Task Satisfaction
p1	2:34	Assisted	1	3
p2	1:59	Success	1	4
p3	0:40	Success	0	5
p4	0:34	Success	0	4
p5	1:03	Success	1	4
p6	1:26	Success	1	5

Expected Time 2:00  
 Average Time on Task 1:08  
 Average Task Satisfaction 4.17  
 Average #Path Deviations 0.67  
 Percent Success 83%

Participant Number	Task 4 (Modify Patient Medication List)			
	Task Time	Outcome	# Path Deviations	Task Satisfaction
p1	2:39	Success	1	3
p2	4:01	Time Out	3	5
p3	1:31	Success	0	4
p4	0:56	Success	0	3
p5	2:21	Success	1	3
p6	1:26	Success	0	4

Expected Time 3:00  
 Average Time on Task 1:46  
 Average Task Satisfaction 3.67  
 Average #Path Deviations 0.83  
 Percent Success 83%

Participant Number	Task 5 (Update Vitals Information)			
	Task Time	Outcome	# Path Deviations	Task Satisfaction
p1	3:26	Success	1	3
p2	2:29	Success	0	5
p3	1:09	Success	0	4
p4	2:56	Success	2	4
p5	0:52	Success	3	5
p6	1:06	Success	0	5

Expected Time 3:00  
 Average Time on Task 1:59  
 Average Task Satisfaction 4.33  
 Average #Path Deviations 1.00  
 Percent Success 100%

Participant Number	Task 6 (Demographics CDS Intervention)			
	Task Time	Outcome	# Path Deviations	Task Satisfaction
p1	3:54	Fail	5	1
p2	7:51	Time Out	1	5
p3	2:00	Success	0	4
p4	1:49	Success	0	2
p5	2:51	Success	2	3
p6	3:27	Success	3	3

Expected Time 3:30  
 Average Time on Task 2:31  
 Average Task Satisfaction 3.00  
 Average #Path Deviations 1.83  
 Percent Success 67%



Participant Number	Task 7 (Record Lab Order)			
	Task Time	Outcome	# Path Deviations	Task Satisfaction
p1	7:04	Time Out	1	1
p2	4:35	Time Out	0	3
p3	3:37	Success	2	4
p4	2:37	Success	1	3
p5	1:35	Success	0	4
p6	2:23	Success	1	4

Expected Time 3:30  
 Average Time on Task 2:33  
 Average Task Satisfaction 3.17  
 Average #Path Deviations 0.83  
 Percent Success 67%

Participant Number	Task 8 (Record Radiology Order)			
	Task Time	Outcome	# Path Deviations	Task Satisfaction
p1	4:02	Time Out	0	1
p2		System Issue		
p3	1:02	Success	0	4
p4	1:12	Success	0	2
p5	1:33	Success	1	4
p6	1:09	Success	0	5

Expected Time 2:00  
 Average Time on Task 1:14  
 Average Task Satisfaction 3.2  
 Average #Path Deviations 0.20  
 Percent Success 80%

Participant Number	Task 9 (Modify Radiology Order)			
	Task Time	Outcome	# Path Deviations	Task Satisfaction
p1	1:25	System Issue		
p2	3:05	System Issue		
p3	2:05	Success	0	4
p4	1:48	Success	0	3
p5	1:57	Success	0	4
p6	3:12	Success	0	5

Expected Time 3:00

Average Time on Task 2:15

Average Task Satisfaction 4.0

Average #Path

Deviations 0.00

Percent Success 100%

Participant Number	Task 10 (Reconcile Clinical Information)			
	Task Time	Outcome	# Path Deviations	Task Satisfaction
p1	4:47	Time Out	0	1
p2	4:07	Assisted	2	3
p3	5:56	Assisted	2	1
p4	5:01	Assisted	1	3
p5	5:04	Time Out	4	2
p6	2:26	Fail	7	1

Expected Time 4:00

Average Time on Task 0:00

Average Task Satisfaction 1.83

Average #Path

Deviations 2.67

Percent Success 0%