EHR Usability Test Report
Lumeris EMR Version 5.0

Date of Usability Test: September 25th and 26th, 2017
Date of Report: October 5, 2017
Report Prepared by: Lumeris Inc.

Anthony Gil, Director Lumeris EMR Product
(314) 209-3026 | Direct
agil@lumeris.com | Email

13900 Riverport Drive
Maryland Heights, MO 63043
www.lumeris.com

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1 – Executive Summary

A usability test of Lumeris EMR, Version 4.0, and complete EHR was conducted on September 25th and September 26th, 2017, in Joliet, IL, by the Lumeris Product 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, 1 practice administrator staff, 1 office manager staff, 6 clinical staff, and 2 medical providers served as participants and used the EHRUT in simulated, but representative tasks.

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

- ☒ Computerized Provider Order Entry Medications
- ☒ Computerized Provider Order Entry Laboratory
- ☒ Computerized Provider Order Entry Radiology
- ☒ Drug-drug, drug-allergy interaction checks
- ☒ Demographics
- ☒ Problem list
- ☒ Medication list
- ☒ Medication allergy list
- ☒ Clinical decision support
- ☒ Implantable device list
- ☒ Clinical information reconciliation
- ☒ Electronic prescribing

During the 120-minute one-on-one usability test, each participant was greeted by the administrator and asked to review and sign an informed consent/release form (included in Appendix 3); they were instructed that they could withdraw at any time. Participants had prior experience with the EHR. The administrator introduced the test and instructed participants to complete a series of tasks (given one at a time) using the EHRUT. During the testing, the administrator timed the test and, along with the data loggers, recorded user performance data on paper and electronically. The administrator did not give the participants assistance in how to complete the task.

The following types of data were collected for each participant:

- Number of tasks successfully completed within the allotted time without assistance
- Time to complete the task
- Number and types of errors

- Path deviations
- Participant's verbalizations
- Participant's satisfaction ratings of the system

All participant data was de-identified – no correspondence could be made from the identity of the participant to the data collected. Following the conclusion of the testing, participants were asked to complete a post-test questionnaire and were compensated with lunch for their time. Various recommended metrics, in accordance with the examples set forth in the *NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records*, were used to evaluate the usability of the EHRUT. Following is a summary of the performance and rating data collected on the EHRUT.

Measure / Task	N	Task Success	Path Deviation	Task Time		Errors	Scenario Ratings 5=Easy
	#	(%)	Deviations (Observed / Optimal)	Mean (SD) Sec	Deviations (Observed/ Optimal)	(%)	Mean (SD)
CPOE – Medications a.1	10	80%	7/7	520 (324)	520 /1026	20%	3.4 (1.4)
CPOE – Laboratory a.2	10	90%	6/6	187 (97)	187 /304	10%	4.1 (0.9)
CPOE – Radiology a.3	10	80%	6/6	175 (124)	175 /249	10%	4.5 (0.7)
Drug-drug, Drug-Allergy Interactions a.4	10	70%	8/8	254 (165)	254 /268	30%	3.7 (1.3)
Demographics a.5	10	80%	14/14	246 (65)	246 /305	20%	3.6 (0.8)
Problem List a.6	10	90%	5/5	84 (20)	84 /111	10%	4.5 (0.7)
Medication List a.7	10	80%	7/7	520 (324)	520 /1026	20%	3.4 (1.4)
Medication Allergy List a.8	10	100%	8/8	194 (57)	194 /319	0%	4.1 (0.9)
Clinical Decision Support a.9	10	70%	9/8	549 (197)	549 /601	30%	2.3 (1.3)
Implantable Device List a.14	10	70%	7/7	253 (188)	253 /234	30%	3.6 (1.1)
Clinical Information Reconciliation b.2	10	60%	10/9	329 (147)	329 /368	40%	3.0 (1.3)
Electronic Prescribing b.3	10	80%	9/8	338 (186)	338 /503	20%	3.9 (1.2)

Table 1

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

- 75.5%.

Major findings

- All core features such as CPOE, Drug to Drug Interactions, Demographics, Problem List, Medication Allergy List, Implantable Devices and e-Prescribe were completed with ease and minor deviations recorded from best practice workflows.

- Clinical Decision Support continues to evolve and there remains an opportunity to enhance the user experience by simplifying configuration which would result in greater adoption of these features, and users benefiting from best practice recommendations embedded within their workflows.

Areas for improvement

- As interoperability takes to the forefront there is a need to:
    - Reduce errors in the exchange of clinical information
    - Make the task of importing and exporting this information as seamless as possible.

2 – Introduction

The EHR Under Test (EHRUT) tested for this study was Lumeris EMR, Version 4.0, and complete EHR. Designed to present medical information to healthcare providers and other healthcare staff working in an ambulatory setting, the EHRUT consists of clinical and billing components for the staff at medical offices in an ambulatory setting to utilize a fully-integrated EHR. The usability testing attempted to represent realistic exercises and conditions.

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

3 - Method

3.1 – Participants

A total of ten (10) participants were tested on the EHRUT. Participants in the test were healthcare providers, clinical staff, a practice administrator and an office manager. Participants were recruited by one of Lumeris' account managers and were compensated with lunch for their time. In addition, participants had no direct connection to the development of or organization producing the EHRUT. Participants were not from the testing or supplier organization.

For the test purposes, end-user characteristics were identified and translated into a recruitment screener used to solicit potential participants; and example of a screen is provided in Appendix 1.

Recruited participants had a mix of backgrounds and demographic characteristics conforming to the recruitment screener. The following is a table of participants by characteristics, including demographics, professional experience, computing experience and user needs for assistive technology (Table 2). Participant names were replaced with Participant IDs so that an individual's data cannot be tied back to individual identities.

Participant Identifier	Participant Gender	Participant Age	Participant Education	Participant Occupation/Role	Participant Professional Experience	Participant Computer Experience	Participant Product Experience	Participant Assistive Technology Needs
ID01	Female	50-59	Master's Degree	Nurse Practitioner	120	240	96	No
ID02	Female	30-39	Some college credit, no degree	Medical Assistant	60	60	60	No
ID03	Female	30-39	Doctorate degree (e.g.,	Physical Therapist/Practice Manager	120	84	24	No

			MD, DNP, DMD, PhD)					
ID04	Female	30-39	Some college credit, no degree	Medical Assistant	36	72	72	No
ID05	Female	30-39	Associate degree	Medical Assistant	4	18	18	No
ID06	Female	30-39	Associate degree	LPN	12	12	12	No
ID07	Female	20-29	Some college credit, no degree	Medical Assistant	10	10	10	No
ID08	Female	40-49	High school graduate, diploma or the equivalent (for example: GED)	Office Manager	36	60	60	No
ID09	Male	30-39	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD/Physician	84	84	48	No
ID10	Female	40-49	Some college credit, no degree	Clinical Supervisor	18	120	120	No

Table 2

Ten participants (matching the demographics in the section on Participants) were recruited, and ten participants participated in the usability test. Zero participants failed to show for the study.

Participants were scheduled for 2 hours in order for the lead administrator's introduction and testing process review, for the participants to complete each task, for the participants to debrief after each task, and for the data loggers to retest systems to proper test conditions.

See Appendix 2 for additional participants' demographics.

3.2 – Study Design

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

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

☒ Number of tasks successfully completed within the allotted time without assistance

☒ Time to complete the tasks

☒ Number and types of errors

☒ Path deviations

☒ Participant's verbalizations (comments)

☒ Participant's satisfaction ratings of the system

Additional information about the various measures can be found in Section 3.9 on Usability Metrics.

We have four general principles that characterize user-centered design, and that are not bound to any specific phase of development cycle:

- The active involvement of users and a clear understanding of user and task requirements
- An appropriate allocation of functions between users and technology
- Iteration of design solutions
- Multi-disciplinary design

Planning:

The planning part provides guidance in fitting user-centered design activities into the overall system development process. Among other things, we plan and reserve time and resources for iteration and user feedback. The importance of teamwork and communication is also considered in this phase.

Activities:

The core of the standard – stated explicitly– is the description of user-centered design activities. Our standard identifies four main activities of UCD.

The activities can be briefly described as follows:

- Understand and Specify Context of Use.

- Know the user, the environment of use, and the tasks that he or she uses the product for.
- Specify the User and Organizational Requirements. Determine the success criteria of usability for the product in terms of user tasks, e.g. how quickly a typical user should be able to complete a task with the product.
- Determine the design guidelines and constraints. Produce Design Solutions. Incorporate HCI knowledge (of visual design, interaction design, and usability) into design solutions.
- Evaluate Designs against Requirements. The usability of designs is evaluated against user tasks.

3.3 - Tasks

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

- Computerized Provider Order Entry Medications
- Computerized Provider Order Entry Laboratory
- Computerized Provider Order Entry Radiology
- Drug-drug, drug-allergy interaction checks
- Demographics
- Problem List
- Medication list
- Medication allergy list
- Clinical Decision support
- Implantable Device List
- Clinical information reconciliation
- Electronic prescribing

To identify risks, all tasks and user workflows were designed in accordance with the with NISTIR 7804 Technical Evaluation, Testing and Validation of the Usability of Electronic Health Records as outlined by the ONC 2015 Edition Companion Guide for Safety-Enhanced Design.

Tasks were selected based on their frequency of use, criticality of function, and possibility of being the most troublesome for users.

3.4 – Procedures

Upon arrival, participants were greeted; their identities were 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 3). A representative from the test team witnessed the participant's signature.

To ensure that the test ran smoothly, the usability testing staff included a lead administrator/data logger and 4 other administrators/data loggers. The usability testing staff conducting the test was experienced usability practitioners with the following backgrounds:

- Average years of experience = 15
- Usability practitioners' education ranges from associate degree to college degree
- Qualifications range from work in the healthcare industry to technology to Project Management to Business Analyst to Product Management to Software Training

The lead administrator moderated each session including administering instructions and tasks. All administrators monitored task times; obtained post-task rating data; took notes on participants' comments; 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 lead administrator finished reading the question. The task time was stopped once the participant indicated they had successfully completed the task. Scoring is discussed below in Section 3.9.

Following the session, the administrators gave the participant the post-test questionnaire (the System Usability Scale; see Appendix 5), compensated them for their time with lunch, and thanked each individual for their participation.

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

Participants were thanked for their time and compensated with lunch.

3.5 – Test Location

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

3.6 – Test Environment

The EHRUT would be typically be used in a healthcare office or facility. In this instance, the testing was conducted in a conference room. For testing, each participant used a laptop computer running Windows 7 Professional / Internet Explorer 8. The participants used both mouse and keyboard when interacting with the EHRUT.

The EHRUT used a 15-inch colored monitor with a 1600 x 900 screen resolution. The application was set up by the vendor according to the vendor's documentation describing the system set-up and preparation. The application itself was running on a platform using a test database on a WAN connection. Technically, the system performance (i.e. response time) was representative to what actual users would experience in a field implementation. Additionally, participants were instructed not to change any of the default system settings (such as control of font size).

3.7 – Test Forms and Tools

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

- Informed Consent (see Appendix 3)
- Moderator's Guide (see Appendix 4)
- Post-test Questionnaire (see Appendix 4)
- System Usability Scale (see Appendix 5)

The Moderator's Guide was devised so as to be able to capture required data.

3.8 – Participant Instructions

The administrator reads the following instructions aloud to each participant (see also the full moderator's guide in Appendix 4).

> *Thank you for participating in this study. Your input is very important. Our session today will last 120 minutes. During that time you will take a look at an electronic health record system.*
>
> *I will ask you to complete a few tasks using this system and answer some questions. We are interested in how easy (or how difficult) this system is to use, what in it would be useful to you, and how we could improve it. You will*

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

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. Are there any questions?

Once this task was complete and no questions were asked, 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 do not talk aloud or verbalize while you are doing the tasks. I will ask you your impressions about the task once you are done.

Participants were then given 12 tasks to complete. Tasks are listed in the moderator's guide in Appendix 4.

3.9 – 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 access the following:

- Effectiveness of EHRUT by measuring participant success rates and errors
- Efficiency of EHRUT by measuring the average task time and path deviations
- Satisfaction with EHRUT by measuring ease of use rating.

3.10 – Data Scoring

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

Measures	Rationale and Scoring
Effectiveness: Task Success	A task was counted as a "Success" if the participant was able to achieve the correct outcome, without assistance, within the time allotted on a per task basis. The total number of successes were calculated for each task and then divided by the total number of times that task was attempted. The results are provided as a percentage. Tasks times were recorded for successes. Observed task times divided by the optimal time for each task is a measure of optimal efficiency. The standard deviation for each percent success was a required calculation by the ONC. It is not appropriate to calculate a mean or standard deviation for a percentage in the way we are reporting task success. Therefore we have entered a "0" (zero) for task success in the standard deviation cells of the CHPL (Certified Health IT Product List) Spreadsheet. Note, a zero standard deviation typically represents a possible but unlikely standard deviation value. Zeroes were entered into these spreadsheet cells to represent no value.
Effectiveness: Task Failures	If the participant abandoned the task, did not reach the correct answer or performed it incorrectly, or reached the end of the allotted time before successful completion, the task was counted as a "Failure." No task times were taken for errors. The total number of errors was calculated for each task and then divided by the total number of times that task was attempted. Not all deviations would be counted as errors. This should also be expressed as the mean number of failed tasks per participant. The standard deviation for each percent success was a required calculation by the ONC. It is not appropriate to calculate a mean or standard deviation for a percentage in the way we are reporting task success. Therefore we have entered a "0" (zero) for task success in the standard deviation cells of the CHPL (Certified Health IT Product List) Spreadsheet. Note, a zero standard deviation typically represents a possible but unlikely standard deviation value. Zeroes were entered into these spreadsheet cells to represent no value.
Efficiency: Task Deviations	The participant's path (i.e. steps) through the application was recorded. Deviations occur if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control. This path was compared to the optimal path. The number of steps in the observed path is divided by the number of optimal steps to provide a ratio of path deviation.
Efficiency: Task Time	Each task was timed from when the administrator said "Begin" until the participant said "Done." If he or she failed to say "Done" the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task. Variance measures (standard deviation and standard error) were also calculated.
Satisfaction	Participant's subjective impression of the ease of use of the application was measured by administering both a simple post-task as well as a post-sessional questionnaire. After each

	task, the participant was asked to rate "overall this task was" on a scale of 1 (very difficult) to 5 (very easy). These data are averaged across participants. To measure participants' confidence in and likeability of the EHRUT overall, the testing team administered the System Usability Scale (SUS) post-test questionnaire. Questions included, "I think I would like to use this system frequently" and "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 5.5: System Usability Scale Questionnaire.

4 – Results

4.1 – Data Analysis and Reporting

The results of the usability test were calculated according to the methods specified in the Usability Metrics above. Participants who failed to follow session and task instructions had their data excluded from the analyses. Details are provided if there are data exclusions. Any details of testing irregularities or issues that affected data collection or interpretation of the results are provided.

The usability testing results for the EHRUT are detailed below (see Table 3).

The results should be seen in light of the objectives and goals outlined in Section 3.2 Study Design. The data should yield actionable results that, if corrected, yield material, positive impact on user performance.

Measure / Task	N	Task Success	Path Deviation	Task Time		Errors	Scenario Ratings 5=Easy
	#	(%)	Deviations (Observed / Optimal)	Mean (SD) Sec	Deviations (Observed/ Optimal)	(%)	Mean (SD)
CPOE – Medications a.1	10	80%	7/7	520 (324)	520 /1026	20%	3.4 (1.4)
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Clinical Decision Support a.9	10	70%	9/8	549 (197)	549 /601	30%	2.3 (1.3)
Implantable Device List a.14	10	70%	7/7	253 (188)	253 /234	30%	3.6 (1.1)
Clinical Information Reconciliation b.2	10	60%	10/9	329 (147)	329 /368	40%	3.0 (1.3)
Electronic Prescribing b.3	10	80%	9/8	338 (186)	338 /503	20%	3.9 (1.2)

Table 3

The results from the System Usability Scale (SUS) scored the subjective satisfaction with the system based on performance with these tasks to be: 75.5.

4.2 – Discussion of the Findings

Effectiveness

The participants were able to complete all tasks error free with the correct outcome, with minimal assistance.

Efficiency

Overall the efficiency was completed within the optimal timing recorded and optimal path of tasks completed. The minor deviation was not part of errors or risks.

Satisfaction

The participants were confident and satisfied in using the system. The overall performance for the application can be improved with minor enhancements to optimize intuitive features.

Results: Critical Use Risks for Patient Safety

- Medications
  - The ability to free text a medication poses a risk for patient safety. Instead of free texting the medications, users must be sure to add the medication from the database as the medications are linked with NDC's and will trigger a drug to drug interaction/alert, whereas free texting will not.

- Allergies
  - The ability to free text an allergy poses a risk for patient safety. Instead of free texting the allergies, users must be sure to add the allergies from the database as the medications are linked by NDC and drug classification and will trigger a drug to allergy alert.

Major Findings

- All core features such as CPOE, Drug to Drug Interactions, Demographics, Problem List, Medication Allergy List, Implantable Devices and e-Prescribe were completed with ease and minor deviations recorded from best practice workflows.

- Clinical Decision Support continues to evolve and there remains an opportunity to enhance the user experience by simplifying configuration which would result in greater adoption of these features, and users benefiting from best practice recommendations embedded within their workflows.

Areas For Improvement

- As interoperability takes to the forefront there is a need to:
  - Reduce errors in the exchange of clinical information
  - Make the task of importing and exporting this information as seamless as possible.

5 – Appendices

5.1 – Appendix 1: Recruiting Screening Form

Recruiting Screening Form

Hello, my name is _____, calling from *Lumeris*. We are recruiting individuals to participate in a usability study for an electronic health record. We would like to ask you a few questions to see if you qualify and if would like to participate. This should only take a few minutes of your time. This is strictly for research purposes. If you are interested and qualify for the study, you will be paid to participate. Can I ask you a few questions?

1. Are you male or female?
2. Have you participated in a focus group or usability test in the past *12* months? [If yes, Terminate]
3. Do you, or does anyone in your home, work in marketing research, usability research, web design […etc.]? [If yes, Terminate]
4. Do you, or does anyone in your home, have a commercial or research interest in an electronic health record software or consulting company? [If yes, Terminate]
5. Which of the following best describes your age? [23 to 39; 40 to 59; 60 - to 74; 75 and older]
6. Which of the following best describes your race or ethnic group? [e.g., Caucasian, Asian, Black/African-American, Latino/and or Hispanic, etc.]
7. Do you require any assistive technologies to use a computer? [if so, please describe]

Professional Demographics

8. What is your current position and title? (Must be healthcare provider)
   ☐RN: Specialty _____
   ☐Physician: Specialty _____
   ☐Resident: Specialty _____
   ☐Administrative Staff
   ☐Other [Terminate]

9. How long have you held this position?
10. Describe your work location (or affiliation) and environment? (Recruit according to the intended users of the application) [e.g., private practice, health system, government clinic, etc.]
11. Which of the following describes your highest level of education? [e.g., high school graduate/GED, some college, college graduate (RN, BSN), postgraduate (MD/PhD), other (explain)]

Computer Expertise

12. Besides reading email, what professional activities do you do on the computer? [e.g., access EHR, research; reading news; shopping/banking; digital pictures; programming/word processing, etc.] [If no computer use at all, Terminate]
13. About how many hours per week do you spend on the computer? [Recruit according to the demographics of the intended users, e.g., 0 to 10, 11 to 25, 26+ hours per week]
14. What computer platform do you usually use? [e.g., Mac, Windows, etc.]
15. What Internet browser(s) do you usually use? [e.g., Firefox, IE, AOL, etc.]
16. In the last month, how often have you used an electronic health record?
17. How many years have you used an electronic health record?
18. How many EHRs do you use or are you familiar with?
19. How does your work environment patient records? [Recruit according to the demographics of the intended users]

    ☐On paper

    ☐Some paper, some electronic

    ☐All electronic

Contact Information *If the person matches your qualifications, ask*
Those are all the questions I have for you. Your background matches the people we're looking for.

Would you be able to participate on [date, time]? [If so collect contact information]

May I get your contact information?

- Name of participant:
- Address:
- City, State, Zip:
- Daytime phone number:
- Evening phone number:
- Alternate [cell] phone number:
- Email address:

This study will take place at _____. I will confirm your appointment a couple of days before your session and provide you with directions to our office. What time is the best time to reach you?

5.2 – Appendix 2: Participant Demographics

The following is a high-level overview of the participants in this study:

Gender	
Men	1
Women	9
Total (participants)	10

Age	
20 to 29 yrs	1
30 to 39 yrs	6
40 to 49 yrs	2
50 to 59 yrs	1
60 to 74 yrs	0
≥ 75 yrs	0
Total (participants)	10

Occupation/Role	
RN/BSN/LPN/MA	6
Physician/Nurse Practitioner/Physician Assistant	2
Practice Administrator	1
Office Manager	1
Total (participants)	10

Years of Experience with EHRs	
0 to 4 yrs	3
5 to 9 yrs	5
≥ 10 yrs	2
Total (participants)	10

Work Environment – Patient Records	
On paper	0
Some paper, some electronic	1
All electronic	9
Total (participants)	10

5.3 – Appendix 3: Informed Consent Sample

Informed Consent

Consent Form

I agree to participate in the study conducted by Lumeris.

I understand that participation in this usability study is voluntary and I agree to immediately raise any concerns or areas of discomfort during the session with the study administrator.

Please sign below to indicate that you have read and you understand the information on this form and that any questions you might have about the session have been answered.

Date:_____

Please print your name: _____

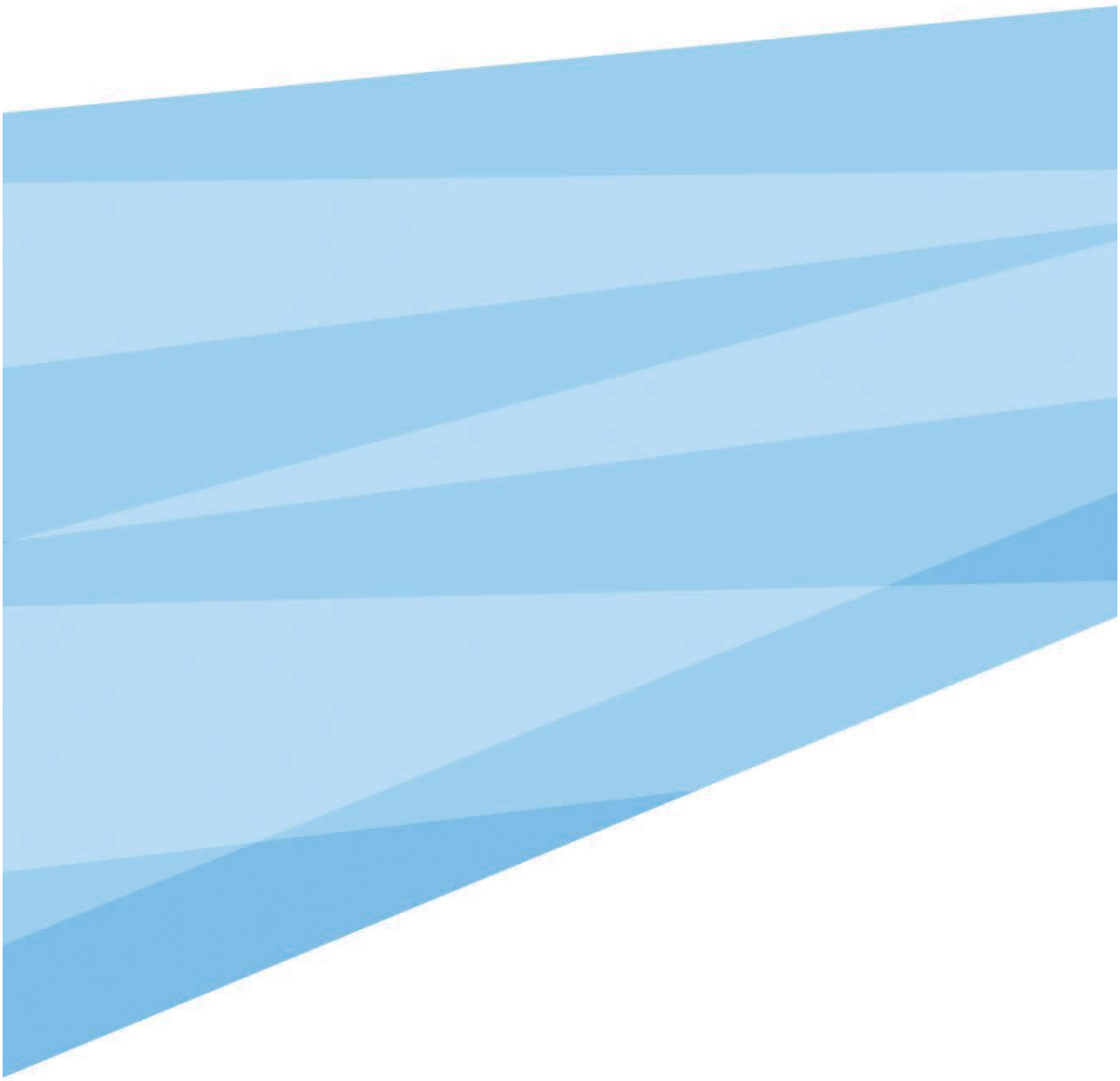
Please sign your name: _____

Thank you!

We appreciate your participation.

5.4 – Appendix 4: Moderator's Guide

EHRUT Usability Test



Moderator's Guide

Lead Administrator:
Data Logger:
Date:
Time:
Location:

Administration and data logger notes:

Prior to testing
☐Confirm schedule with Participants
☐Ensure EHRUT lab environment is running properly
☐Ensure lab and data recording equipment is running properly

Prior to each participant:
☐Reset application
☐Start session with stop watch

Prior to each task:
☐Logout and login into the application to starting point for next task

After each participant:
☐Note down all necessary data for analysis

Orientation (*3* minutes)

Thank you for participating in this study. Your input is very important. Our session today will last 120 minutes. During that time you will take a look at an electronic health record system.

I will ask you to complete a few tasks using this system and answer some questions. We are interested in how easy (or how difficult) this system is to use, what in it would be useful to you, and how we could improve it. You will be asked to complete these tasks on your own trying to do them as quickly as possible with the fewest possible errors or deviations. Do not do anything more than asked. If you get lost or have difficulty I cannot answer or help you with anything to do with the system itself. Please save your detailed comments until the end of a task or the end of the session as a whole when we can discuss freely.

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. Are there any questions?

Preliminary Questions (*2* minutes)

What is your job title / appointment?
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

170.315.g.3 SAFETY ENHANCED DESIGN
PARTICIPANT TEST PROCEDURES

Participant #

Username: XXX
Password: XXX
Patient Name: One, Participant

TASK #1
Record Demographics (enter a new patient): (315.a.5)
Path>Chart Module>search for patient>register patient

- Name: Demographic One
- Date of Birth : **8/31/1938**
- Sex : **Male**
- Race :
    - *Black or African American*
        - **Haitian**
            - **Dominica Islander**
- Ethnicity : **Not Hispanic or Latino**
- Preferred Language : **French**
- Sexual Orientation : **Straight or heterosexual**
- Gender Identity : **Identifies as Male**

- **Change sex to:**
    - **Female**
- **Change race to:**
    - **Native Hawaiian or Other Pacific Islander**
- **Change Preferred language to:**
    - **English**

Rating:
Overall, this task was: _____
Scale: "Very Difficult" (1), "Difficult" (2), "Moderate" (3), "Easy" (4), "Very Easy" (5)

TASK #2
Record CPOE Medication Orders: (315.a.1 and 315.a.7)
Path: Front office>patient>Screening tab>Medications

- Record Medication
    - Ceftriaxone 250 MG/ML twice daily
    - ES Tylenol 500 MG one tablet by mouth as needed for 10 days
    - Amoxicillin 500 MG one capsule by mouth every 12 hours
- Change Medication – Changes are in bold
    - Ceftriaxone **500 MG**/ML twice daily
    - ES Tylenol 500 MG **One tablet twice daily for 3 days**
    - Amoxicillin 500 MG once capsule by mouth **every 6 hours**

    - **Discontinue Lisinopril**
- Access Medication History
    - View Medication History

Rating:
Overall, this task was: _____
Scale: "Very Difficult" (1), "Difficult" (2), "Moderate" (3), "Easy" (4), "Very Easy" (5)

TASK #3
Medication Allergy List (315.a.8)
Path: Front Office>Patient>Screening Tab>Allergies

- Record Medication allergy List
    - Add allergy to Codeine with reaction of rash
- Change Medication Allergy List
    - Inactivate – Sulfasalazine
    - Change Penicillin G to Penicillin V
- Access Medication Allergy List
    - Active only
- Access Medication Allergy List
    - Historical and Active

Rating:
Overall, this task was: _____
Scale: "Very Difficult" (1), "Difficult" (2), "Moderate" (3), "Easy" (4), "Very Easy" (5)

TASK #4
Drug-drug, Drug-allergy Interaction Checks for CPOE: (315.a.4)
Path: Administration>Prescribe Setup Options>choose user>set severity level

- Set drug to drug (DDI) severity level to ***2*** for user – One, PCJ
- Set drug to drug (DDI) severity level to ***all*** for user – Smith, John

Path: Front Office>Patient>Prescriptions

- Review the DDI link and detailed information in your patient chart showing the drug-drug and drug-allergy interaction was triggered from previous information entered/prescribed.

Rating:
Overall, this task was: _____
Scale: "Very Difficult" (1), "Difficult" (2), "Moderate" (3), "Easy" (4), "Very Easy" (5)

TASK #5
Record CPOE Laboratory Orders: (315.a.2)
Path: Diagnostic dropdown>order type

- Record Laboratory Order
    - HDL Cholesterol
- Access Laboratory Order
    - Access the pending lab order
- Change Laboratory Order

- Change HDL Cholesterol to LDL Cholesterol with Risk

Rating:
Overall, this task was: _____
Scale: "Very Difficult" (1), "Difficult" (2), "Moderate" (3), "Easy" (4), "Very Easy" (5)

TASK #6
Record CPOE Imaging Orders: (315.a.3)
Path: Diagnostic dropdown>order type

- Record Radiology Order
  - Order MRI chest w/o contrast
- Access Radiology Order
  - Access the pending radiology order
- Change Radiology Order
  - Change to MRI chest w & w/o contrast

Rating:
Overall, this task was: _____
Scale: "Very Difficult" (1), "Difficult" (2), "Moderate" (3), "Easy" (4), "Very Easy" (5)

TASK #7
Problem List (315.a.6)
Path: Front Office>Patient>Problem List

- Access patient problem list
- Resolve Hypothyroidism
- Change Diabetes date first observed to one month prior

Rating:
Overall, this task was: _____
Scale: "Very Difficult" (1), "Difficult" (2), "Moderate" (3), "Easy" (4), "Very Easy" (5)

TASK #8

Clinical Decision Support (315.a.9)
Path for set up: Administration>Health Maintenance Setup>create new rule for Clinical Decision Support

Configure CDS to enable interventions and reference resources for the following:

Clinical Decision Support (314.A.8) Start time _____ End time _____ Total time_____

Problem List Intervention *(Acute Pharyngitis in children)*

Parameters:

- Frequency

- 1 time every year

- Demographics
  - Age: 2-18
  - Gender: Male and Female
- Problem
  - Diagnosis Code: 462
- CDS Guideline
  - URL: http://www.guideline.gov/content.aspx?id=47107&search=children+pharyngitis#Section420
- Diagnostic and Therapeutic e Reference Information
  - URL: http://www.guideline.gov/content.aspx?id=47107&search=children+pharyngitis#Section424
- CDS Guidelines Source Attributes
  - **Bibliographic Source(s)**: Michigan Quality Improvement Consortium Guideline. Acute pharyngitis in children 2-18 years old. Southfield (MI): Michigan Quality Improvement Consortium Guideline; 2013 Jan. 1 p.
  - **Guideline Developer(s)**: Michigan Quality Improvement Consortium - Professional Association
  - **Source(s) of Funding**: Michigan Quality Improvement Consortium
  - Release/Revison Date(s): 2004 Apr (revised 2013 Jan)
  - Global Citations: All Drug-Drug, Drug-Allergy alerts are part of the product First Data Bank RxNorm Cross Reference Module licensed by First Data Bank, Inc.

Medication List Intervention *(Diagnosis and management of asthma)*

Parameters:

- Frequency
  - 1 time every year

- Demographics
  - Age: 5-110
  - Gender: Male and Female

- Medication
  - Albuterol
- CDS Guideline
  - URL: http://www.guideline.gov/content.aspx?id=38255&search=asthma#top
- Diagnostic and Therapeutic e Reference Information
  - URL: http://www.guideline.gov/content.aspx?id=38255&search=asthma#Section424
- CDS Guidelines Source Attributes
  - **Bibliographic Source(s)**: Sveum R, Bergstrom J, Brottman G, Hanson M, Heiman M, Johns K, Malkiewicz J, Manney S, Moyer L, Myers C, Myers N, O'Brien M, Rethwill M, Schaefer K, Uden D. Diagnosis and management of asthma. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2012 Jul. 86 p. [81 references]
  - **Guideline Developer(s)**: Institute for Clinical Systems Improvement - Nonprofit Organization
  - **Source(s) of Funding**: The Institute for Clinical Systems Improvement's (ICSI's) work is funded by the annual dues of the member medical groups and five sponsoring health plans in Minnesota and Wisconsin.
  - **Release/Revison Date(s)**: 1998 Jun (revised 2012 Jul)
  - **Global Citations**: All Drug-Drug, Drug-Allergy alerts are part of the product First Data Bank RxNorm Cross Reference Module licensed by First Data Bank, Inc.

Medication Allergy List Intervention *(Drug allergies -drug-induced allergic reactions)*

Parameters:

- Frequency
  - 1 time every year
- Demographics
  - Age: 1-110
  - Gender: Male and Female
- Medication
  - Amoxicillin
  - Reaction type - anaphylaxis
- CDS Guideline
  - URL: http://www.guideline.gov/content.aspx?id=38446&search=medication+allergy#top
- Diagnostic and Therapeutic e Reference Information
  - URL: http://www.guideline.gov/content.aspx?id=38446&search=medication+allergy#Section424
- CDS Guidelines Source Attributes
  - **Bibliographic Source(s)**: Joint Task Force on Practice Parameters, American Academy of Allergy, Asthma and Immunology, American College of Allergy, Asthma and Immunology, Joint Council of Allergy, Asthma and Immunology. Drug allergy: an updated practice parameter. Ann Allergy Asthma Immunol. 2010 Oct;105(4):259-273.e78. [682 references]
  - **Guideline Developer(s)**: American Academy of Allergy, Asthma and Immunology - Medical Specialty Society
    American College of Allergy, Asthma and Immunology - Medical Specialty Society
    Joint Council of Allergy, Asthma and Immunology - Medical Specialty Society
  - **Source(s) of Funding**: American Academy of Allergy, Asthma and Immunology (AAAAI), the American College of Allergy, Asthma and Immunology (ACAAI), and the Joint Council of Allergy, Asthma and Immunology (JCAAI)
  - **Release/Revison Date(s)**: 2010 Oct
  - **Global Citations**: All Drug-Drug, Drug-Allergy alerts are part of the product First Data Bank RxNorm Cross Reference Module licensed by First Data Bank, Inc.

Demographic Intervention *(Falls: assessment and prevention of falls in older people)*

Parameters:

- Frequency
  - 1 time every year
- Demographics
  - Age: 65 +
  - Gender: Male and Female
- CDS Guideline
  - URL: http://www.guideline.gov/content.aspx?id=46931&search=fall+risk#Section420
- Diagnostic and Therapeutic e Reference Information
  - URL: http://www.guideline.gov/content.aspx?id=46931&search=fall+risk#Section424
- CDS Guidelines Source Attributes
  - **Bibliographic Source(s)**: National Institute for Health and Care Excellence (NICE). Falls: assessment and prevention of falls in older people. London (UK): National Institute for Health and Care Excellence (NICE); 2013 Jun. 33 p. (Clinical guideline; no. 161)
  - **Guideline Developer(s)**: National Institute for Health and Care Excellence (NICE) - National Government Agency [Non-U.S.]
  - **Source(s) of Funding**: National Institute for Health and Care Excellence (NICE)

- **Release/Revison Date(s)**: 2004 Jun (revised 2013 Jun)
- **Global Citations**: All Drug-Drug, Drug-Allergy alerts are part of the product First Data Bank RxNorm Cross Reference Module licensed by First Data Bank, Inc.

Lab Tests and Results Intervention *(Diabetes Care)*

Parameters:

- Frequency
  - 1 time every 2 months
- Demographics
  - Age: 18-110
  - Gender: Male and Female

- Subtest
  - Hemoglobin A1-C
  - Less than or equal to 6
- CDS Guideline
  - URL: http://www.guideline.gov/content.aspx?id=38898&search=hemoglobin+a1c#Section420
- Diagnostic and Therapeutic e Reference Information
  - URL: http://www.guideline.gov/content.aspx?id=38898&search=hemoglobin+a1c#Section424
- CDS Guidelines Source Attributes
  - **Bibliographic Source(s)**: Medical Services Commission. Diabetes care. Victoria (BC): British Columbia Medical Services Commission; 2010 Sep 1. 17 p. [33 references]
  - **Guideline Developer(s)**: Medical Services Commission, British Columbia - State/Local Government Agency [Non-U.S.]
  - **Source(s) of Funding**: Medical Services Commission, British Columbia
  - **Release/Revison Date(s)**: 2010 Sep 1
  - **Global Citations**: All Drug-Drug, Drug-Allergy alerts are part of the product First Data Bank RxNorm Cross Reference Module licensed by First Data Bank, Inc.

Vital Signs Intervention *(Hypertension diagnosis and treatment)*

Parameters:

- Frequency
  - 1 time every 3 months
- Demographics
  - Age: 18-110
  - Gender: Male and Female
- Vitals
  - Systolic (sitting)
  - Greater than or equal to 140
  - Diastolic (sitting)
  - Greater than or equal to 90
- CDS Guideline
  - URL: http://www.guideline.gov/content.aspx?id=39321&search=hypertensive+screening#Section420
- Diagnostic and Therapeutic e Reference Information
  - URL: http://www.guideline.gov/content.aspx?id=39321&search=hypertensive+screening#Section424

- CDS Guidelines Source Attributes
    - **Bibliographic Source(s)**: Luehr D, Woolley T, Burke R, Dohmen F, Hayes R, Johnson M, Kerandi H, Margolis K, Marshall M, O'Connor P, Pereira C, Reddy G, Schlichte A, Schoenleber M. Hypertension diagnosis and treatment. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2012 Nov. 67 p. [127 references]
    - **Guideline Developer(s)**: Institute for Clinical Systems Improvement - Nonprofit Organization
    - **Source(s) of Funding**: The Institute for Clinical Systems Improvement (ICSI) provided the funding for this guideline. The annual dues of the member medical groups and sponsoring health plans fund ICSI's work. Individuals on the work group are not paid by ICSI, but are supported by their medical group for this work.

      ICSI facilitates and coordinates the guideline development and revision process. ICSI, member medical groups, and sponsoring health plans review and provide feedback but do not have editorial control over the work group. All recommendations are based on the work group's independent evaluation of the evidence.

    - **Release/Revison Date(s)**: 1995 Jun (revised 2012 Nov)
    - **Global Citations**: All Drug-Drug, Drug-Allergy alerts are part of the product First Data Bank RxNorm Cross Reference Module licensed by First Data Bank, Inc.

- **Path for verifying interventions in chart: front office >patient>clinical reminders**
    - Verify interventions are provided in chart and address those interventions

      ( ) User was able to identify Diagnostic and Therapeutic Reference Information

      ( ) All above CDS Interventions were configured by the user

Rating:
Overall, this task was: _____
Scale: "Very Difficult" (1), "Difficult" (2), "Moderate" (3), "Easy" (4), "Very Easy" (5)

TASK #9
Implantable Device List (315.a.14)
Path: Front Office>Patient chart>Implantable Devices

- Record Unique Device Identifier **(Copy from document sent)**
  - (01)10884521062856(11)141231(17)150707(10)A213B1(21)1234
- Display Implantable Device List
  - View in patient record the UDI is recorded as active.
- Change Status for Unique Device Identifier
  - Change the status for the Unique Device Identifier for a patient to indicate that a UDI is inactive for entry error.
- View the report
  - Inactive vs Full report

Rating:
Overall, this task was: _____
Scale: "Very Difficult" (1), "Difficult" (2), "Moderate" (3), "Easy" (4), "Very Easy" (5)

CHANGE LOG IN TO:
USERNAME: XXX
PASSWORD: XXX

TASK #10 (IMPORT FILE SENT IN EMAIL)
Clinical Information Reconciliation and Incorporation (315.b.2
Path: Front Office>Patient>Patient Documents>CCD/CCR>import file>Import C-CDA 2.1>Reconcile>Chart>Clinical Info Reconciliation>Merge

- Clinical Information Reconciliation
  - Import the CCD R1.1 sample file.
  - Match the file to correct patient
  - Reconcile data into a single, reconciled list for medications, allergies and problems demonstrating that items can be merged, duplicates can be consolidated and removed.
  - Review and confirm the accuracy of the list. Once confirmed accept the reconciled list and update the patient record.

Rating:
Overall, this task was: _____
Scale: "Very Difficult" (1), "Difficult" (2), "Moderate" (3), "Easy" (4), "Very Easy" (5)

CHANGE LOGIN TO:
Username: XXX
Password: XXX

TASK #11
E-Prescribing (315.b.3)

- Refill request

    - Go to dashboard to pharmacy request and approve the refill request. (prescription previously performed in CPOE request)
- New Rx
    - Create new prescription Rx - **Use your patient of Participant One**
        - Zestril 20 mg tablet 1 qd, dispense 30 with 3 refills, no substitutions allowed
        - EDI/Fax to VA Pharmacy 10.6 MU
- Prescription Change Rx Request
    - Go to dashboard to pharmacy request and perform change **(This will be patient Felicia Flounders)**
- Prescription Cancel
    - Go to patient chart **(Participant One)** and cancel the medication that was just sent

CHANGE LOGIN TO:
Username: XXX
Password: XXX

- Pharmacy Cancel response
    - Go back to dashboard to see pharmacy response – **(This will be patient Tim Yellowstone)**

Rating:
Overall, this task was: _____
Scale: "Very Difficult" (1), "Difficult" (2), "Moderate" (3), "Easy" (4), "Very Easy" (5)

Final Questions

1. What was your overall impression of this system?

2. What aspects of the system did you like most?

3. What aspects of the system did you like least?

4. Were there any features that you were surprised to see?

5. What features did you expect to encounter but did not see? This is, is there anything that is missing in this application?

6. Compare this system to other systems you have used.

7. Would you recommend this system to your colleagues?

5.5 – Appendix 5: System Usability Scale

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