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EHR Usability Test Report for LiquidEHR, Version 1.1

LiquidEHR, Version 1.1   1
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1.   Executive Summary

A usability test of LiquidEHR Version 1.1 was conducted between 11/16/17 and 11/28/2017 via Webex sessions. The purpose of this testing was to test and validate the usability of the current user interface, newly implemented tasks and features, and provide evidence of usability in the EHR Usability Test (EHRUT). During the usability test, five healthcare professionals matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

This study collected performance data on 6 tasks conducted on an EHR:

- 170.315(a)(5) Demographics
- 170.315(a)(6) Problem list
- 170.315(a)(14) Implantable device list
- 170.315(b)(2) Clinical information reconciliation and incorporation
- 170.315(a)(9) Clinical decision support
- 170.315(a)(9) Clinical decision support, Configuration of Rules

During the 9 Hours one-on-one usability test, each participant was greeted by the administrator they were instructed that they could withdraw at any time. Some Participants did have prior experience with other electronic health record systems, and with new parts of the system. Training sessions lasting 1 hours, using existing technical documents used for real end user training, were conducted prior to testing.

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 data logger manually timed and recorded user performance data on paper and electronically. The administrator did not give the participant assistance in how to complete the task. The following types of data were collected for each participant:

- Time to complete the tasks
- Number and types of errors
- Number of tasks successfully completed within the allotted time without assistance
- 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 a Lunch. 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 (NISTIR 7741)*, were used to evaluate the usability of the EHRUT. A summary of the performance and rating data collected on the EHRUT is found in Section 4.1, Data Analysis and Reporting.

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be: 30 (Detailed in Section 4.1, Data Analysis and Reporting.)

In addition to the performance data, the following qualitative observations were made:

Major findings:

Participants were overall very pleased with the new version or product. Each stated appreciation for all the work that has gone into the new certified version, although ease of use was an overall theme for what they were looking for.

In the Clinical decision support and Clinical information reconciliation area, we have noticed that there was significant time over the optimum timing, however that was to be expected due be out of scope for an Optometry practice, also this should be reduced over time with more training.

All participants verbally expressed a slight frustration with all the new data that was now required to collect and the extra screens that were displayed to complete the task. We agreed and assured them future versions we be easier to use with less screens, thanks for their feedback.

A few participants commented and expressed a concern over the time it takes to do some of the tasks because they were outside the scope of practice in an Optometry setting.

For all the tasks tested requiring the participant to enter, change or retrieve data, all of these tasks rated were rated as "easy to do" for all participants.

Areas for improvement: -

Comments from participants indicate systems could be easier to use, faster and less data on screen would be helpful Clinical decision support, enhance training and reconsider how the CDS rules are configured

All of the participants requested a message after each rule being saved. This will be addressed during the next R&D development cycle.

2.   Introduction

The EHR tested for this study was LiquidEHR Version 1.1, designed for Optometry. The application is a Modular Electronic Health Record for the Ambulatory setting only. The software is designed to the 2015 Edition of Meaningful Use objectives for the Ambulatory setting. The usability testing attempted to represent realistic exercises and conditions with actuals users of the EHR.

The purpose of this study was to test and validate the usability of the current user interface, and provide evidence of usability in the EHR Usability Test (EHRUT). To this end, measures of effectiveness, efficiency and user satisfaction, such as time on task, deviations from optimal path, and errors were captured during the usability testing.

3.   Method

3.1 PARTICIPANTS

A total of 10 participants, that were representative of our user base, were tested on the EHRUT.. Participants in the test were across the fields of Optometry. Participants were recruited from the current user base and were compensated for their time with a lunch. 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. Participants were given the opportunity to have the same orientation and level of training as they were end users.

For the test purposes, end-user characteristics were identified and translated into a recruitment screener used to solicit potential participants; the recruiting screener is provided in Appendix 5.1.

Recruited participants had a mix of backgrounds and demographic characteristics conforming to the recruitment screener. The following is a table (Table 3.1) containing a high-level overview of participants by gender, occupation and years of experience. A detailed summary of participant characteristics, including demographics, professional experience, computing experience and user needs for assistive technology is found in Appendix 5.2, Participant Demographics. Participant names were replaced with Participant IDs so that an individual's data cannot be tied back to individual identities.

Participant Demographics Overview   Table 3.1

Gender	
Male:	2
Female:	8
Total:	10
Occupation/Role	
Tech/Admin:	9
Physician:	1
Years of Experience	58
Years of Experience:	
Facility Use of EHR:	45
All Paper:	35
Some Paper/EHR	25
All Electronic:	22

Participant Experience

Part ID	Gender	Age	Education	Occupation /Role	Professional Experience	Computer Experience	Product Experience	Assistive Technology Needs
ID 1	Male	30 to 39	Associate degree	Optometry Tech	10 years	Windows	3 years	No
ID 2	Female	40 to 49	Bachelor's Degree	Admin	15 years	Mac	2 years	No
ID 3	Female	20 to 29	Bachelor's Degree	Optometry Tech	3 years	Windows	3 years	No
ID 4	Female	30 to 39	Bachelor's Degree	Admin	9 years	Windows	9 years	No
ID 5	Female	23 to 39	Bachelor's Degree	Office Manager	2 years	Windows	2 years	No
ID 6	Female	30 to 39	Bachelor's Degree	Clinical Assistant	7 years	Windows	7 years	No
ID 7	Male	40 to 49	M.D	Physician	20 years	Windows	7 years	No
ID 8	Female	20 to 29	Associate Degree	Admin	1 year	Windows	1 year	No
ID 9	Female	20 to 29	Associate Degree	Admin	4 years	Windows	4 years	No
ID10	Female	20 to 39	Bachelor's Degree	Billing Tech	7 years	Windows	7 years	No

Ten participants matching the demographics in the section on Participants were recruited and ten participated in the usability test. No participants failed to show for the study.

Participants were scheduled for Three 180 minute session and debriefed by the administrator and data logger. A CRM was used to keep track of the participant schedule, and included each participant's demographic characteristics as provided by the recruiting screen.

3.2 STUDY DESIGN

Overall, the objective of this test was to uncover areas where the application performed well – that is, effectively, efficiently, and with satisfaction – and areas where the application failed to meet the needs of the participants. The data from this test may serve as a baseline for future tests with an updated version of 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, but also to identify areas where improvements must be made.

During the usability test, participants interacted with one EHR. Each participant used the system in a remote setting, 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.

3.3 TASKS

A number of tasks were constructed that would be realistic and representative of the kinds of activities a user might perform with this EHR and **force-ranked based on the risk** as to the potential to cause patient harm if not completed correctly, including:

- 170.315(a)(5) Demographics
- 170.315(a)(6) Problem list
- 170.315(a)(14) Implantable device list
- 170.315(b)(2) Clinical information reconciliation and incorporation
- 170.315(a)(9) Clinical decision support
- 170.315(a)(9) Clinical decision support, Configuration of Rules

Tasks were selected based on their inclusion in 2015 Edition Certification requirements, frequency of use, criticality of function, and those that may be most troublesome for users.

3.4 PROCEDURES

Upon start, participants were greeted; their identity was verified and matched with a name on the participant schedule. Participants were then assigned a participant ID.

To ensure that the test ran smoothly, two staff members participated in this test, the usability administrator and the data logger. The usability testing staff who conducted the test were experienced Information Technology and Health Information Specialists with 2-15 of years of experience, backgrounds in healthcare, health information technology and clinical EHR training, implementation and support.

The administrator moderated the session including administering instructions and tasks. The administrator also obtained post-task rating data, and took notes on participant comments. A second person served as the data logger and monitored task times, 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 in section 3.8 Participant Instructions):

• 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 task instructions. The task time was stopped once the participant indicated they had successfully completed the task. Scoring is discussed below in Section 3.9, Usability Metrics.

Following the session, the administrator gave the participant the post-test questionnaire (the System Usability Scale, see Appendix 5.4), compensated them for their time, and thanked each individual for their participation.

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

3.5 TEST LOCATION

The test facility included a computer for the participant for access, and moderator's guide and paper for the administrator. Only the participant and administrator were included in the test. To ensure that the environment was comfortable for users, noise levels were kept to a minimum. All of the safety instructions and evacuation procedures were current and in place.

3.6 TEST ENVIRONMENT
The EHR would typically be used in an Optometry Office. In this instance, the testing was conducted in a conference room with remote access. For testing, the participants used their personal PC's that are used to access the production application.

The application was set according to internal documentation describing the system set-up and preparation. The application itself was running on the same version as tested for certification, and using a training database. Technically, the system performance 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.

3.7 TEST FORMS AND TOOLS
During the usability test, various documents and instruments were used, including:
1. Moderator's Guide
2. Post-test Questionnaire

Examples of these documents can be found in Appendices 5.3-5.4 respectively. The Moderator's Guide was devised so as to be able to capture required data.

The participant's interaction with the EHRUT was observed and documented via a WebEx session with each participant. Verbal comments were documented. The test sessions were observed by the data logger who documented the test session.

3.8 PARTICIPANT INSTRUCTIONS

The administrator reads the following instructions aloud to each participant (also see the full moderator's guide in Appendix 5.5):

Thank you for participating in this study. Your input is very important. Our session today will last about 180 minutes. During that time, you will use an instance of an electronic health record. I will ask you to complete 6 tasks using this system and answer some questions. You should complete the tasks as quickly as possible making as few errors as possible. Please try to complete the tasks on your own following the instructions very closely. Please note that we are not testing you we are testing the system, therefore if you have difficulty all this means is 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 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.

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.*

Following the procedural instructions, participants were shown the EHR and were given ten minutes to explore the system and make comments. Once this initial overview was complete, the administrator asked five preliminary questions and began the testing. Participants were then given 6 tasks to complete. Tasks are listed in the moderator's guide in Appendix 5.3.

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 assess:

1. Effectiveness of LiquidEHR Version 1.1 by measuring participant success rates and errors
2. Efficiency of LiquidEHR Version 1.1 by measuring the average task time and path deviations
3. Satisfaction with LiquidEHR Version 1.1 by measuring ease of use ratings

3.10 DATA SCORING
The following table (Table 3.2) details how tasks were scored, errors evaluated, and the time data analyzed.

Data Scoring Metrics   Table 3.2

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. Task times were recorded for successes. Observed task times divided by the optimal time for each task is a measure of optimal efficiency. Optimal task performance time, as benchmarked by expert performance under realistic conditions, is recorded when constructing tasks. Target task times used for task times in the Moderator's Guide must be operationally defined by taking multiple measures of optimal performance and multiplying by 2.5 that allows some time buffer because the participants are not trained to expert performance. Thus, if expert, optimal performance on a task was 20 seconds then allotted task time performance was [20 * 2.5] 50 seconds. This ratio is aggregated across tasks and reported with mean and variance scores.
Effectiveness: Task Failures	If the participant abandoned the task, did not reach the correct answer 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 is also expressed as the mean number of failed tasks per participant. On a qualitative level, an enumeration of errors and error types are collected.
Effectiveness: Task Deviations	The participant's path (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. Task deviations are reported. Optimal paths (procedural steps) are recorded when constructing tasks.
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: Task Rating	Participant's subjective impression of the ease of use of the application was measured by administering both a simple post-task question as well as a post-session questionnaire. After each task, the participant was asked to rate "Overall, this task was:" on a scale of 5 (Very Easy) to 1 (Very Difficult). These data are averaged across participants. Common convention is that average ratings for systems judged easy to use should be 3.3 or above. To measure participants' confidence in and likeability of the EHR overall, the testing team administered the System Usability Scale (SUS) post-test questionnaire. Questions included, "I think I would like to use this system frequently," "I thought the system was easy to use," and "I would imagine that most people would learn to use this system very quickly." See full System Usability Score questionnaire in Appendix 5.4.

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 section above. Participants who failed to follow session and task instructions had their data excluded from the analyses.

Data collection and interpretation of the results were successful for all participants. Directions for each task are detailed in Appendix 5.3, Moderators Guide.

The usability testing results for the EHRUT are detailed below (see Table 4.1). 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.

Summary of Performance and Rating Data Collected on the EHRUT   **Table 4.1**

#	Task	Total	Success	Percentage
1	170.315(a)(5) Demographics	10	10	100%
2	170.315(a)(6) Problem list	10	10	100%
3	170.315(a)(14) Implantable device list	10	10	100%
4	170.315(b)(2) Clinical information reconciliation and incorporation	10	10	100%
5	170.315(a)(9) Clinical decision support	10	10	100%
6	170.315(a)(9) Clinical decision support, Configuration of Rules	10	10	100%

Summary of Performance and Rating Data Collected on the EHRUT   **Table 4.2**

Task	Task Success Mean (SD)	Path Deviation Deviations (Observed /Optimal)	Task Time (SEC) Mean (SD)	Deviations (Observed / Optimal)	Errors Mean (SD)	Task Ratings 5=Easy Mean (SD)
1. Demographics	1 / 0	0 / 10	70 / 50	1	0 / 0	5 / 1
2. Problem list	1 / 0	0 / 10	92 / 88	2	0 / 0	5 / 3
3. Implantable device list	1 / 0	0 / 10	121 / 51	2	0 / 0	3/ 1
4. Clinical information reconciliation and incorporation	1 / 0	0 / 10	389 / 310	3	0 / 0	2 / 4
5. Clinical decision support	1 / 0	0 / 10	623/ 444	2	0 / 0	2/4
6. Clinical decision support, Configuration of Rules	1/0	0/10	1148/378	2	0/0	5/1

The results from the SUS (System Usability Scale, found in Appendix 5.4) scored the subjective satisfaction with the system based on performance with these tasks to be: 30 (mean score).

4.2 Discussion of the Findings

Tasks 1-6 were all completed by all participants

All participants rated 3 of the 6 tasks as 'Easy'.

Tasks 1-2 were easily completed by all participants.

Tasks 3-5 were somewhat challenging for some of the participants as this was a complex and new to them. Participants all gave similar feedback that this is outside of scope of an Optometry office, Documentation was done and new training materials were developed to assist actual users in better understand the process and an easier navigation to the process will be implemented in the future.

Tasks 6 completed with 10 participants with no issues.

4.3 Effectiveness

While a software program is functional, successfully performing more complex required tasks needs some improvement in future versions.

Overall of the 6 individual tasks tested, 6 tasks tested successfully, resulting in a 100% success rate across all participants. Path deviations, zero across the 6 individual tasks, were minor, all of which ultimately display the same information to the user. Zero path deviation were major, resulting in failure of the task.

4.4 Efficiency

Based upon observations of task times and deviations, of the 6 instances of successful tasks, 1 was completed within the estimated optimal task performance time. The other 5 varied greatly from the optimal time due to the fact this is was new to the user and outside of the scope of Optometry office. Times were benchmarked by expert performance under realistic conditions,   and multiplied by a 2.5 second time buffer to allow for the fact the participants in this study are not expert users. With more training and usage, efficiency would be drastically improved.

4.5 Satisfaction

Participants were asked to rate each task individually on a scale of 5= Very Easy to 1= Very Difficult. Collectively, 6 of 6 tasks were rated with a medium to high, which will improve with usage over time. After the posttest questionnaire we got 30 SUS

4.6 Major Findings

Participants were overall very pleased with the product. Participants stated the application seemed to have a nice work flow with easy to understand icons, it seemed easy to learn and easy to use, Tasks 3-5 were somewhat challenging for some of the participants as this was a complex and new to them. Participants all gave similar feedback that this is outside of scope of an Optometry office, Documentation was done and new training materials were developed to assist actual users in better understand the process and an easier navigation to the process will be implemented in the future.

4.7 Areas for Improvement

While having access to other data like reconciling, all participants felt the process to getting the data and the speed in which the data was displayed could be improved in future versions. Since there are so many new processes providers and users alike will need more training on how the data should work, and where it comes from for each user operating the system. Overall the participants liked the data coming in our going out, it just needs to be simplified if possible.

5.   Appendices

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 gather participation information. This should only take a few minutes of your time. This is strictly for research purposes. You will be paid to participate in Training and Testing.

Please answer the following questions:

1. Are you male or female? Male_____   Female ____

2. Have you participated in a focus group or usability test in the
past 6 months?   Yes_____   No _____

3. Do you, or does anyone in your home, work in marketing research, usability research, web design, or other computer work?   Yes_____   No _____

4. Do you, or does anyone in your home, have a commercial or research interest in an electronic health record software or consulting company?   Yes_____   No _____

5. Which of the following best describes your age?
    20 to 29_____   30 to 39_____   40 to 49_____50 to 59____60 to 69_____70 or older ____

6. Which of the following best describes your race or ethnic group?
    Caucasian_____   Asian_____   Black/African American_____Latino/a or Hispanic_____Other _____

7. Do you require any assistive technologies to use a computer? Yes_____No _____
    If Yes, Please Describe: _____

Professional Demographics:

8. What is your current position and title? (Must be healthcare related)

        _____RN: Specialty _____

    __ _Physician: Specialty _____

        _____Resident: Specialty _____

        _____Administrative Staff

    __ _Other Medical: Specialty _____

9. How long have you held this position? _____

10. Describe your work location (or affiliation) and environment? [e.g., private practice, health system, government clinic, etc.]   _____

11. Which of the following describes your highest level of education?
    High School/GED____Some College_____College Graduate (RN/BSN)_____Postgraduate (MD/PhD) _____
    Other: Please Describe: _____

Computer Expertise:

12. Besides reading email, what professional activities do you do on the computer?
    Access EHR_____Research_____ News_____ Shopping/Banking____ Digital Pictures _____
    Programming_____ Microsoft Office Products _____

13. About how many hours per week do you spend on the computer?
    0 to 10_____11 to 25_____26 or More _____

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 record/retrieve patient records?
    On Paper,_____Some Paper/Some Electronic_____All Electronic _____

Contact Information:

Name of participant: _____

Address:_____

City:____State: Zip: _____ Daytime phone:

Evening Phone:_____Cell phone: _____

Email address: _____

Before your session starts, we will ask you to sign a release form allowing us to videotape your session. The videotape will only be used internally for further study if needed. Will you consent to be videotaped?
    Yes_____ No _____

This study will take place online using Webex

5.2. Participant Demographics

Participant High Level Overview

Gender	
Male:	0
Female:	0
Total:	0
Occupation/Role	
Admin/Tech:	0
Physician:	0
Admin Staff:	0
Years of Experience	
Years Experience:	0
Facility Use of EHR:	0
All Paper:	0
Some Paper/Some Electronic:	0
All Electronic:	0

Usability Test Moderator's Guide

Administrator: _____

Data Logger: _____

Date:_____   **Time of Testing:** _____

Participant #:_____   **Test Patient:**_____   **Login:** _____

Location: Add location or state if by remote access

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 recordings (if desired)

Prior to each task:
☐ Reset application to starting point for next task

After each participant:
☐ End session

Orientation (*15 minutes*)

Thank you for participating in this study. Your input is very important. Our session today will last about 180 minutes.   During that time you will use an instance of an electronic health record. I will ask you to complete 6 tasks using this system and answer some questions. You should complete the tasks as quickly as possible making as few errors as possible. Please try to complete the tasks on your own following the instructions very closely. Please note that we are not testing you we are testing the system, therefore if you have difficulty all this means is 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 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.

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.

The product you will be using today is LiquidEHR, Version 1.1 an electronic medical records system. Some of the data you will see in patient electronic charts may not make sense as it is placeholder (sample) data.

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 (*15 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:

_____

_____

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 EHR Usability Test.

Please don't click on anything just yet. What do you notice? What are you able to do here? Please be specific.

_____

_____

Tasks

Task 1: Demographics   (60 Seconds)

170.315(a)(5) – Demographics

Things need to be done:

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

Steps to do:

- Open patient

Figure 1

- o On opening page select Birth Sex on radio group; Follow Blue arrow on Figure 1;
- o Top right corner next to button cancel select preferred language; Follow Green arrow on Figure 1;
- o Enter patient date of birth in format MM/DD/YYYY; Follow Red arrow on Figure 1;
- o Change to Extended tab – black arrow on Figure 1

Figure 2

- Select Race (Follow Red arrow on Figure 2) – Combo in the grid give you only OMB top level races. Pressing button in red box will give you option to choose more granular races –
- Select Ethnicity in Ethnicity grid (Follow Green arrow on Figure 2) – Combo in the grid give you only OMB top level Ethnicities. Pressing button in green box will give you option to choose more granular Ethnicity
- Select Sexual orientation (Follow Blue arrow on Figure 2) – Select (Choose not to disclose) if patient decline to talk about his/her sexual orientation
- Select Gender identity (Follow Black Arrow on Figure 2) - Select (Choose not to disclose) if patient decline to talk about his/her gender identity
- Close and save patient record
- Reopen patient record
- Using steps for "Record a patient" above Change the patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, and gender identity
- Close and save patient record
- Reopen patient record
- Display the patient's changed preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, and gender identity

Task 2: Problem List   (45 Seconds)

170.315(a)(6) – Problem list

Steps to do:
- Record a problem to the problem list – How to do:
  - Open patient
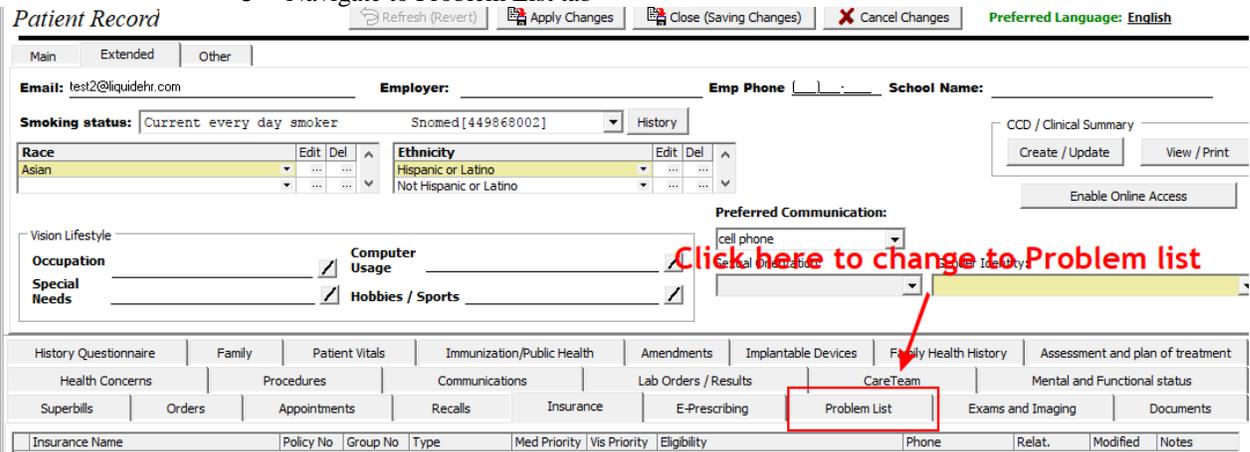 - Navigate to Problem List tab

Figure 3

  - Open patient
  - Navigate to Problem List tab Figure 3

   o Press Add/Remove items to add item to problem list Figure 4
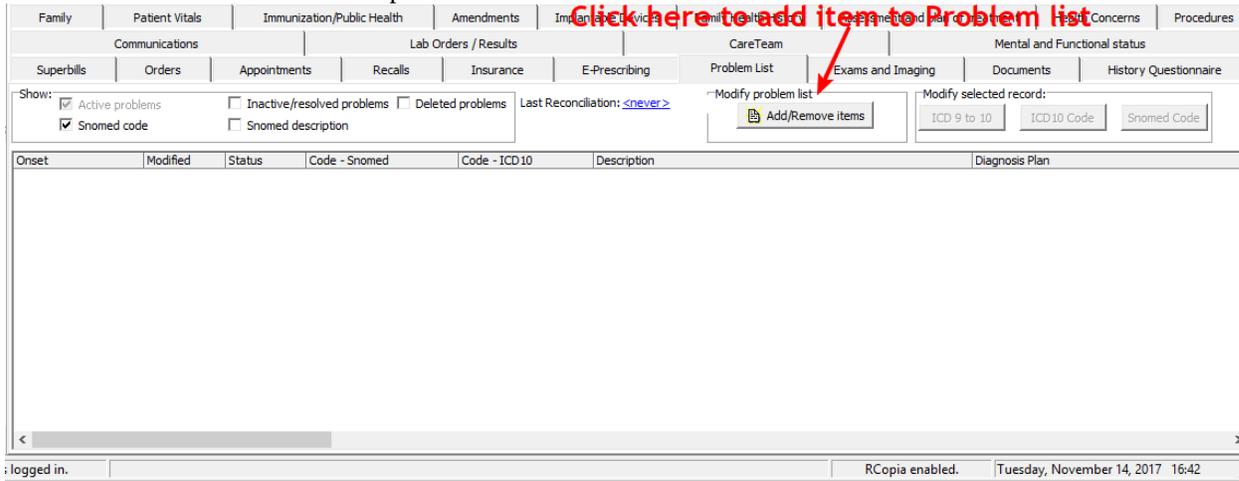
   o Add two problems to the list

Figure 4

     o Save and close patient;

- Change a problem on the problem list
  - Open patient
  - Navigate to problem list tab
  - Select first row in problem list
  - Change status to inactive
  - Save and close patient

- Display the active problem list
  - Open patient
  - Navigate to problem list tab
  - You see only active problems now
- Display the historical problem list
  - Click on checkbox "Inactive/resolved problems" you will see also resolved problems now – this is historical problem list;

Task 3: Implantable Device List   (59 Seconds)

170.315(a)(14) – Implantable device list

- Record UDI
  - Open patient
  - Navigate to Implantable devices tab
  - Press button New
  - Fill UDI identifier or paste it
    - **GS1 Issuing Agency -** (01)10884521062856(11)141231(17)150707(10)A213B1(21)1234
    - **Health Industry Business Communications Council (HIBCC)** +B066000325011NS1/$$420020216LOT123456789012345/SXYZ456789012345678/16D20130202C1
    - **International Council for Commonality in Blood Banking Automation (ICCBBA)** =/W4146EB0010T0475=,000025=A99971312345600=>014032=}013032&,1000000000000XYZ123
  - Press load data button to populate fields (this is internet call which make request for UDI information)
  - Press OK to add new implant to the list
  - Apply changes to make record permanent
- Change UDI Status
  - Change UDI status to Inactive

GMDN PT Name	Serial Number	Expiration Date	Is Active
Cardiac resynchronization therapy implantable defibrillator	BLC200461H	1/28/2016	Inactive
Cardiopulmonary bypass system filter, arterial blood line	XYZ4567890123 45678	2/2/2020	Active / Inactive

- o   Apply changes
- Access UDI, device description, identifiers, and attributes
  - o   Select UDI record on the right you will see all his identifiers and attributes

Task 4: Clinical Information Reconciliation and Incorporation (136 Seconds)

170.315(b)(2) – Clinical Information Reconciliation and Incorporation
- Incorporate a CCDA and conduct reconciliation of the medications, medication allergies, and problems in the CCDA with the information currently in the patient's record
  - o   Go to Portal/Portal Data Sync
  - o   Press [Refresh] button
  - o   Choose patient with your ID number
  - o   On right grid select encounter Figure 11

Figure 5

- o   Press [Get Data] button
- o   After several seconds windows for Allergy reconciliation will popup
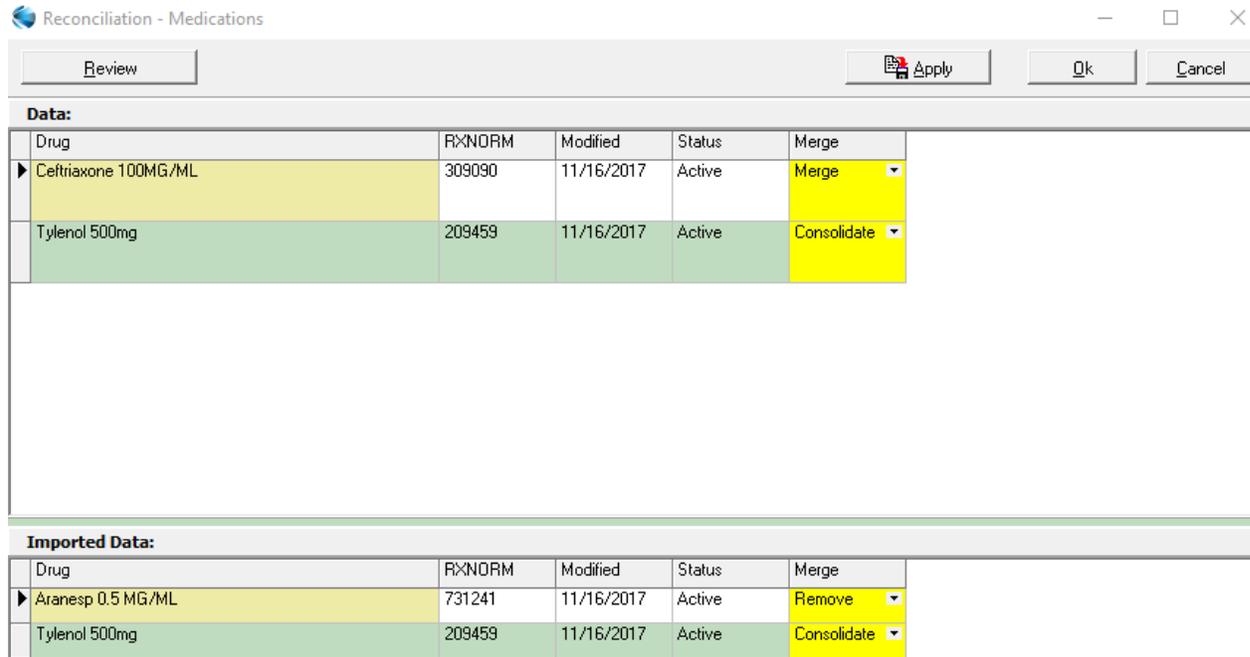
Figure 6

  o On imported data grid change Remove to Merge this will add item to the patient allergy list, consolidated items go as one
  o Press [Review] button to check how reconciliated list will look
  o Press [OK] to save changes
  o Repeat steps for Medications and Problems
- Generate a new CCDA with reconciled data
  o Open patient which you just reconciled
  o Create new exam, add reason for visit/exam type
  o Close and save exam
  o Go to Portal/Portal Data Sync
  o Navigate to Send Data to Portal tab
  o In edit box LastName put "R"
  o Choose your patient
  o Click on Exam you just created in grid
  o If everything is find button [Send Data to Portal] will be active
  o Press Button [Send Data to Portal]
  o Go to Portal/Open Portal/Portal
  o Find your patient

  o Click on [ccd] button
  o With click to attached file link you can download C-CDA file or html for this encounter

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Task 5: Clinical decision support (330 Seconds)

170.315(a)(9) – Clinical decision support

Go to tools/clinical decision support:
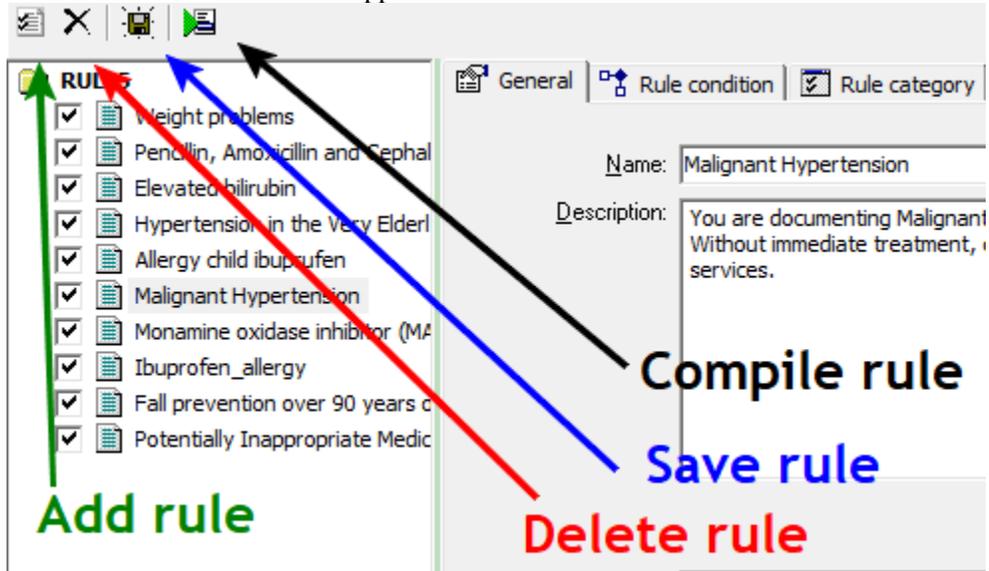
Figure 7

There is 4 buttons on toolbar what they do is explained on Figure 5
- Add a CDS intervention and/or reference resource for each of the required elements

This part is common for all rule types:
- o Press button add rule
- o General tab data:
  - ▪ Name: [Rule name]
  - ▪ Description: [Rule description]
  - ▪ Bibliographic: [Rule bibliographic citation]
  - ▪ Funded by: [Who provided rule]
  - ▪ Author: [Rule author]
  - ▪ Release: [Rule release date]
  - ▪ Revision: [Rule revision date / version]
  - ▪ Link: [Link to educational resource about rule]
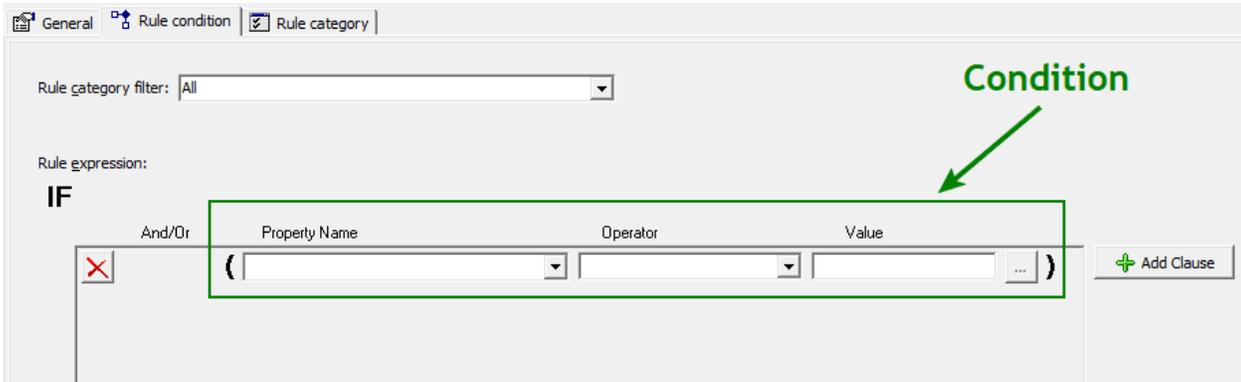
Figure 8 - Rule condition tab

- o Rule condition tab(Figure 6):
  - Rule category filter – this Combo control will filter Property which can be added to clause by rule categories there is 6 rule categories
    - Problem list rules
    - Medication list rules
    - Medication Allergy list rules
    - Demographic rules
    - Laboratory Test rules
    - Vital signs rules
  - Conditions
    - Property name – here we select which patient attribute will use to trigger the rule
- o Problem list rules
  - Select rule category filter to be Problem List
  - Property Name can be one of these:
    - Patient.ProblemList – this will search all problems in patient problem list
    - Patient.ProblemList [Active] - this will check only [Active] patient problems
    - Patient.ProblemList [Inactive] – this will check only [Inactive] problems
    - Patient.ProblemList [Resolved] – this will check only problems which are marked as [Resolved]
    - Patient.ProblemList [Deleted] – this will check only problems which are marked as [Deleted]
  - Operator in this case have only 2 options ("contains" and "not contains").
  - Click on button […] to add problem
  - Problem list rules can add clauses with SNOMED or ICD-10 Code (Figure 7)

Figure 9

- o Medication list rules
  - Select rule category filter to be Medication List
  - Property Name can be one of these:

- Patient.MedicationList– this will search all medications in medication list regardless their status
- Patient.MedicationList [Active] – will check only medications which status is [Active]
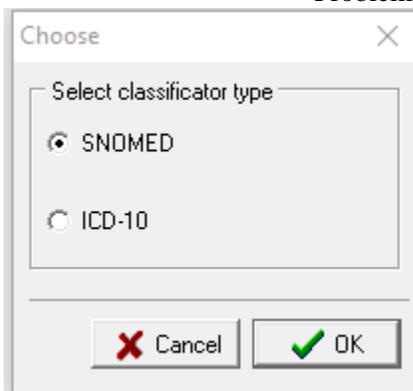- Patient. MedicationList [Inactive] – will check only medications which status is [Inactive]
  - Operator have 2 options
    - "contains" – this will trigger rule only if medication exists in the list.
    - "not contains" – this will trigger rule only if medication does not exists in the list.
  - Click on button […] to add medication
  - A form will open to search medication by RXNORM code or by Name

- o   Medication Allergy rules
  - Select rule category filter to be [Medication Allergies]
  - Property Name can be one of these:
    - Patient.MedicationAllergies – this will search all medications in medication list regardless their status
    - Patient.MedicationAllergies [Active] – will check only medications allergies with status [Active]
    - Patient. MedicationAllergies [Inactive] – will check only medications allergies with status [Inactive]
    - Patient. MedicationAllergies [Deleted] – will check only medications allergies with status [Deleted]
  - Operator have 2 options
    - "contains" – this will trigger rule only if medication exists in the list.
    - "not contains" – this will trigger rule only if medication does not exists in the list.
  - Click on button […] to add medication allergy
  - A form will open to search medication by RXNORM code or by Name
- o   Demographic rules
  - Select rule category filter to be [Demographic]
  - Property name
    - Patient.DateOfBirth
    - Patient.Age
    - Patient.Sex
    - Patient.SexualOrientation
    - Patient.GenderIdentity
    - Patient.PreferedLanguage
    - Patient.SmokingStatus
    - Patient.Races
    - Patient.Ethnicities
  - Operators can vary for different properties this is full list:
    - = { is equal to } ;
    - <> { is not equal to } ;
    - <= { is less than or equal to } ;
    - >= { is greater than or equal to } ;
    - > { is greater than } ;
    - < { is less than } ;
    - Contains ;
    - Not contains ;
- o   Laboratory Test rules
  - Select rule category filter to be [Laboratory Test]
  - Property name

- Patient.LaboratoryTestsPatient.Sex
  - Operators:
    - Contains ;
    - Not contains ;
  - Click on button […] to add condition value (Figure 8)

Figure 10 - Laboratory test condition defining

- You can select laboratory test By Code or Name when you press […] or click in edit box Loinc code
- If check box "Use condition on Test Value" is unchecked rule will just search in patient laboratory tests result do we have such test / or not (depending on operator)
- If check box "Use condition on Test Value" is checked you can add value when this rule will trigger
  - Vital Signs
    - Select rule category filter to be [Vital Signs]
    - Property name
      - Patient.VitalSigns.BMICheckDate
      - Patient.VitalSigns.BMICheckAge
      - Patient.VitalSigns.Weight
      - Patient.VitalSigns.Height
      - Patient.VitalSigns.BMI
      - Patient.VitalSigns.BPCheckDate
      - Patient.VitalSigns.BPCheckAge
      - Patient.VitalSigns.BPSystolic
      - Patient.VitalSigns.BPDiasystolic
      - Patient.VitalSigns.PulseRateCheckDate
      - Patient.VitalSigns.PulseRateCheckAge
      - Patient.VitalSigns.PulseRate
      - Patient.VitalSigns.RespiratoryRateCheckDate
      - Patient.VitalSigns.RespiratoryRateCheckAge
      - Patient.VitalSigns.RespiratoryRate
      - Patient.VitalSigns.BodyTemperatureCheckDate
      - Patient.VitalSigns.BodyTemperatureCheckAge
      - Patient.VitalSigns.BodyTemperature
      - Patient.VitalSigns.OximetryCheckDate
      - Patient.VitalSigns.OximetryCheckAge

- Patient.VitalSigns.Oximetry
- Patient.VitalSigns.OxygenConcentrationCheckDate
- Patient.VitalSigns.OxygenConcentrationCheckAge
- Patient.VitalSigns.OxygenConcentration
  - Operators can vary for different properties this is full list:
    - = { is equal to } ;
    - <> { is not equal to } ;
    - <= { is less than or equal to } ;
    - >= { is greater than or equal to } ;
    - > { is greater than } ;
    - < { is less than } ;
  - Values differ depending on property
  - By pressing [Add clause] button you can add a rules which are combination between two categories
- Trigger the CDS interventions/resources added using the applicable data elements from each of the required elements
  - Go to patient search on menu bar type TEST choose patient with name (CDS(X)) where X is your id in our test
  - Now populate data to trigger events
    - Demographic rule – enter such DOB so age of patient to be over 85 years (example: 11/11/1917)
    - Problem list rule –
      - Navigate to Problem list tab
      - Press Add/Remove items
      - Search for I10 code
      - Add Essential hypertension to list
      - Save & exit
      - Click on Code-Snomed cell
      - Press [Snomed Code] button
      - Search by code 59621000
      - Select one diagnosis
      - Warning message will appear
    - Medication and Allergy rules for People which work with RCOPIA
      - Navigate to e-prescribing tab
      - Press Login to RCOPIA
      - Add common allergy ibuprofen
      - Select reaction and onset date
      - Press ADD button
      - Click on manage medications
      - Search for Selegiline
      - Choose 5 mg capsule
      - Fill sig data; start date; duration
      - Press continue
      - Close RCOPIA
      - Events should popup after downloading rcopia data
    - Medication and Allergy rules for People which does not work with RCOPIA – we will preload patients during the test with allergies and medications they just need to open patients and events will
    - Vital signs rule
      - Navigate to Patient Vitals
      - Enter Date and Weight over 200 lb
      - Click on next row
      - An warning message will popup
    - Combined rule

- Navigate to e-prescribing tab
- Press Login to RCOPIA
- Search for Benadryl
- Choose 25 mg capsule
- Fill sig data; start date; duration
- Press continue
- Close RCOPIA
- Event will popup after downloading rcopia data

- Laboratory test rule
  - Create new exam
  - Select exam type, chief complaint
  - Navigate to Medical Decision Making tab
  - Here choose Lab Orders'/ Results
  - Press New button
  - Select LOINC code (1975-2) for Lab Order and Test as it shown on Figure 9
  - Enter Test Result value > 1.9 (example 2.5)
  - Press OK
  - Warning will popup

Figure 11

- View the intervention/resource information using the Infobutton standard for data elements in the problem list, medication list, and demographics
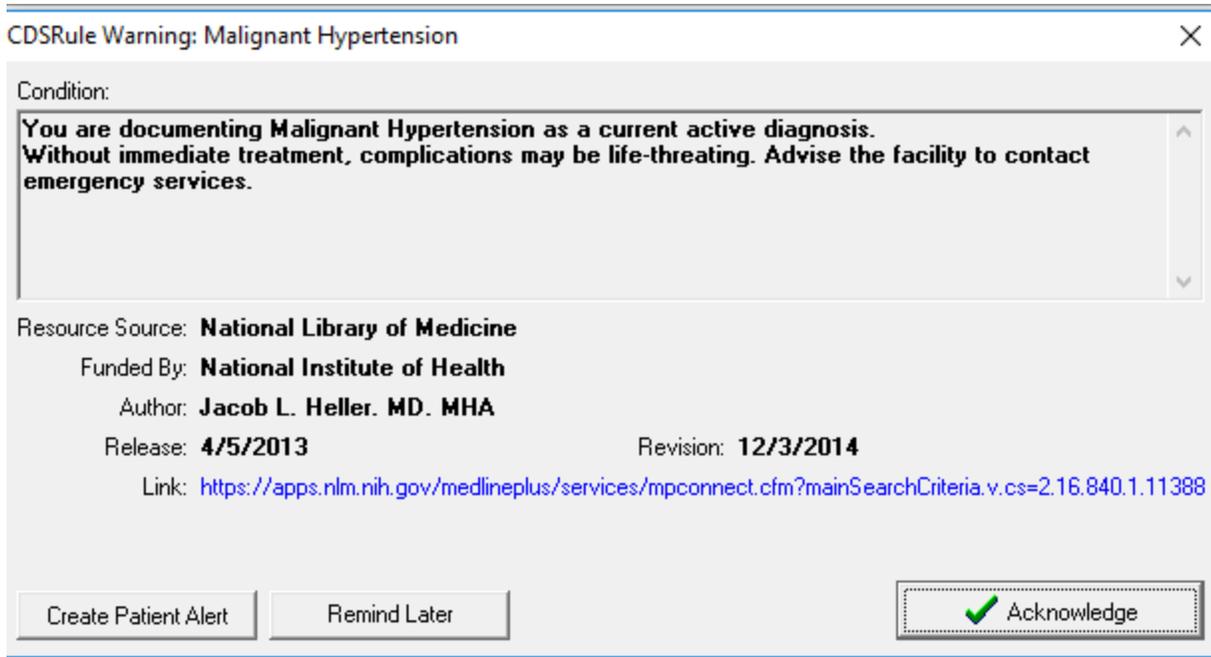 - When you get event windows you have a link with Infobutton data

Figure 12

- Trigger the CDS interventions/resources based on data elements in the problem list, medication list, and medication allergy list by incorporating patient information from a transition of care/referral summary
- Access the following attributes for one of the triggered CDS interventions/resources: bibliographic citation, developer, funding source, release/revision date – Attributes are visible on CDSRule warning window

Task 6: Clinical decision support, Configuration of Rules (648 Seconds)

- 170.315(a)(9) Clinical decision support, Configuration of Rules

Problem list rule data

General tab
- Name   Malignant Hypertension
- Description   You are documenting Malignant Hypertension as a current active diagnosis.Without immediate treatment, complications may be life-threating. Advise the facility to contact emergency services.
- Bibliographic   National Library of Medicine
- Funded by   National Institute of Health
- Author   Jacob L. Heller. MD. MHA
- Release   4/5/2013
- Revision   12/3/2014
- Link   https   //medlineplus.gov/ency/article/000491.htm

Rule condition tab
- Rule category filter   Problem List
- Property name   Patient.ProblemList [Active]
- Operator   contains
- Value   59621000 Essential hypertension
- Rule action   Create a warning message

Rule category tab
- Press button Get by Rule Condition

Medication list rule data
General tab
- Name   Monamine oxidase inhibitor (MAOI) use in the elderly
- Description   This medication is an MAOI and should be used with caution in the elderly population with regard to orthostatic hypotension and fall risk.
- Bibliographic   Journal Drugs Aging
- Funded by   Membership
- Author   Volz HP. Gleiter CH
- Release November 1998
- Revision   November 1998
- Link   https   //medlineplus.gov/druginfo/meds/a697046.html

Rule condition tab
- Rule category filter   Medication List
- Property name   Patient.MedicationList [Active]
- Operator   contains
- Value   859186
- Rule action   Create a warning message

Rule category tab
- Press button Get by Rule Condition

Medication allergy list rule data
General tab
- Name   Ibuprofen allergy
- Description
- Bibliographic   About Health
- Funded by   Membership
- Author   Daniel More. MD
- Release 2014
- Revision   12/16/2014
- Link   https   //medlineplus.gov/druginfo/meds/a682159.html

Rule condition tab
- Rule category filter   Medication Allergy List
- Property name   Patient.MedicationAllergies
- Operator   contains
- Value   198405
- Rule action   Create a warning message

Rule category tab
- Press button Get by Rule Condition

Demographic rule data
General tab
- Name   Fall prevention over 90 years of age
- Description   Research reveals the prevalence in incidents of falls amongst over-90-years-old are exceedingly high and reinforce the important need of prevention.
- Bibliographic   BMC Geriatrics
- Funded by   Department of Public Health and Primary Care
- Author   Jane Fleming
- Release 17 March 2008
- Revision   None

- Link https
  //apps.nlm.nih.gov/medlineplus/services/mpconnect.cfm?mainSearchCriteria.v.cs=2.16.840.1.113883.6.103&mainSearchCriteria.v.c=781.99&mainSearchCriteria.v.dn=&informationRecipient.languageCode.c=en&age.v.v=85&age.v.u=a

Rule condition tab
- Rule category filter   Demographic
- Property name   Patient.Age
- Operator   > {is greater than}
- Value   80
- Rule action   Create a warning message

Rule category tab
- Press button Get by Rule Condition

Laboratory test rule data
General tab
- Name   Elevated bilirubin
- Description   Elevated bilirubin may indicate liver disease and/or gallstones.
- Bibliographic   National Library of Medicine
- Funded by   National Institute of Health
- Author   David C. Dugdale. III. MD
- Release 12/3/2014
- Revision   2/13/2015
- Link   https
  //apps.nlm.nih.gov/medlineplus/services/mpconnect.cfm?mainSearchCriteria.v.cs=2.16.840.1.113883.6.1&mainSearchCriteria.v.c=1975-2&mainSearchCriteria.v.dn=&informationRecipient.languageCode.c=en

Rule condition tab
- Rule category filter   Laboratory tests
- Property name   Patient.LaboratoryTests
- Operator   contains
- Values
  - LOINC code – 1975-2
  - Use condition on test value – checked
  - Test value   > {is greater than}
  - Value   1.9
- Rule action   Create a warning message

LOINC Num	Name
1975-2	Bilirubin.total [Mass/volume] in Serum or Plasma
1975-2	Bilirubin.total [Mass/volume] in Serum or Plasma

Select LOINC item

Search: 1975-2   Search
By Code   By Name

Specify condition to find laboratory test

LOINC code: [1975-2] Bilirubin.total [Mass/volume] in Serum or Pla ...

☑ Use condition on Test Value

Test value: > { is greater than } ▼ | 1.9

☐ Use condition on Test Date

Test was made less than | 0 | ⇕ days ago

[X Cancel] [✔ OK]

Rule category tab
- Press button Get by Rule Condition

Vital signs rule data

General tab
- Name   Weight problems
- Description   Big weight can cause increase chance of cardiatic arrest
- Bibliographic   Test Data
- Funded by   Test Data
- Author   Someone Noone
- Release 8/24/2017
- Revision   8/24/2017
- Link   https   //medlineplus.gov/ency/article/003101.htm

Rule condition tab
- Rule category filter   Vital signs
- Property name   Patient.Vitals.Weight
- Operator   > { is greater than}
- Value   200
- Rule action   Create a warning message

Rule category tab
- Press button Get by Rule Condition

Combined rule data

General tab
- Name   Potentially Inappropriate Medication Use in Older Adults
- Description   Benadryl is not recommended in patients 85 years of age or older. According to the Beers criteria and the Screening Tool of Older Persons' Prescriptions (STOPP) criteria
- Bibliographic   National Center for Biotechnology Information
- Funded by   Membership
- Author   Zachary A. Marcum. PharmD. MS
- Release Jun 22. 2012
- Revision   Jun 22. 2012
- Link   https
          //apps.nlm.nih.gov/medlineplus/services/mpconnect.cfm?mainSearchCriteria.v.cs=2.16.840.1.113883.6.88&m

ainSearchCriteria.v.c=1049909&mainSearchCriteria.v.dn=&informationRecipient.languageCode.c=en&age.v.v=85&age.v.u=a

Rule condition tab

- Rule category filter   All

This rule have 2 rule clauses

- By Medication in Medication List
  - Property name   Patient.MedicationList
  - Operator   contains
  - Value   1049910
- By Demographics (Age)
  - Property name   Patient.Age
  - Operator   > {is greater than}
  - Value   80
- Rule Action   Create a warning message

Rule category tab

- Press button Get by Rule Condition

SYSTEM USABILITY SCALE QUESTIONNAIRE

Rate 1-5: Strongly Agree to Strongly Disagree

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

Additional Comments:

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