

Open-EMR Usability Evaluation Report

Clinical Reporting and Patient Portal

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Introduction

Open-EMR is a freely available Electronic Medical Records software application that can run on any operating systems platform. It is open source and ONC EHR certified with fully integrated features that allow for scheduling, billing and other features used in recording medical records.

Open-EMR features fully integrated EHR, practice management, scheduling, billing and prescribing. On top of all this, it also supports a Patient Portal that can be used by patients to view reports, labs, allergies, appointments and other medications. It also could support any third part API that would securely support Patient Portals. Open-EMR requires a usability study due to its importance in healthcare delivery. A usability study allows several ways of assessing efficiency within a practice with the subsequent goal of effective ways for patient care and safety. In most clinic settings, time is of the essence, thus a usability study for Open-EMR will measure how intuitive it is, its ability to perform user tasks efficiently with minimal effort, resources and excellent reporting. A high level of commitment is made by those who select the Open-EMR system for their clinic operations, a verdict that is not easily changeable or reversible, therefore a reliable usability rating of the product chosen before implementation is highly regarded and must be tested by users to ensure it can adequately support the practice of medicine in a clinic setting.

The purpose of this usability study is to put the Open-EMR to test by both clinicians and patients and evaluate its ability to meet specific requests from these users. The evaluation process will involve recruited professionals doing a usability test based on heuristic evaluation methods. The results of the usability evaluation study will be based on a specified baseline designed to understand the challenges faced by users in evaluation Open-EMR. The testers will be actual users in their respective fields of healthcare. We chose the heuristic method due to its quick and easy evaluation interface.

The usability evaluation will allow us to tests features within Open-EMR that Clinicians and Patients would mostly request from the system. For Clinicians, the usability evaluation will involve the process of retrieving and viewing health reports across the board from the EMR for all enrolled patients. The report will be in different formats presented to allow Clinicians a quick outlook view on their current patient's health status. The Clinicians should be able to use this

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formats to evaluate any ongoing health issues with their patients and determine if they would be eligible to be enrolled in various ongoing studies based on certain research criteria. The main objective is to test the ease of use from the clinician's perspective in navigating Open-EMR to view patient records.

The patient portal evaluation will assess the usability of Open-EMR features that allow patients to view their health history that includes Problem list, Medication List, Medication Allergy List and Appointments. . We will also focus on the level of difficult or ease of use from the patient's perspective in being able to navigate the Open-EMR features.

User Groups

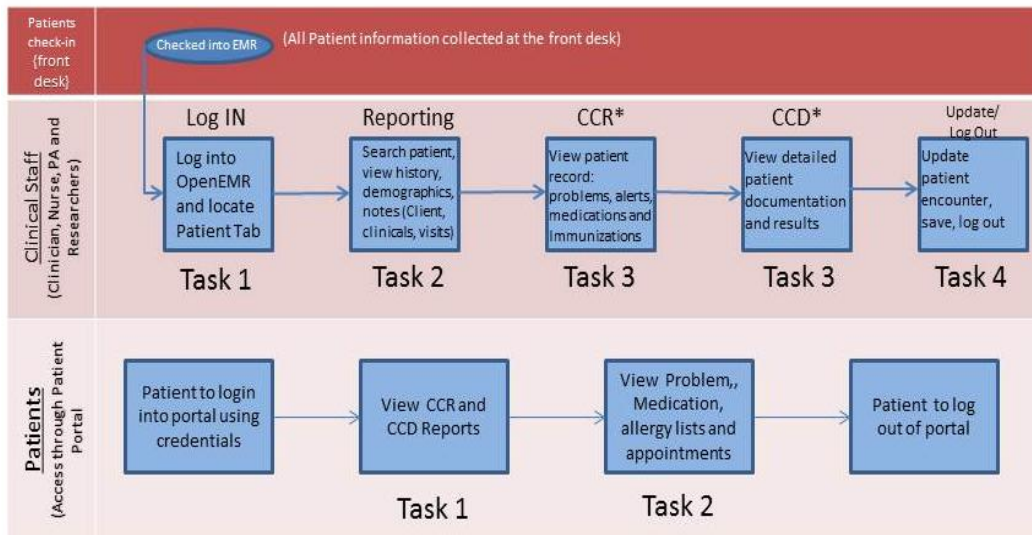
We have two different user groups for the usability evaluation selected to cover a broad base of expertise and the Open-EMR features. In the first group, we have healthcare providers; clinicians, nurses and research associates. We used two doctors and one nurse who have both experience in using another EMR system at the hospital and thus had a better understanding of what to expect. We also used research associates, who included a physician assistant (PA) and research assistant and a data assistant. They were measured against a baseline metrics set by the evaluators. Since our objective is the ease of use for Open-EMR, the user groups were not given a manual on how to use the system, but we showed them once the general format of where things are within the EMR and measure how fast they were able to pull the reports the second time around from the moment the logged in to when they logged out.

Our second user group will test Patient portal capabilities and features. The Patient portal will not require any specific qualifications or skills to use, except user being a patient who has a record in Open-EMR that has patient portal option turned on and who can browse a website. A pre-user knowledge base level will be recorded in terms of technology expertise to differentiate between novices and experienced technological savvy users. We will also use the same patient records dataset for Patient portal features usability test. Features in patient portal should make information gathered in previous clinical encounters be available for an individual to check, which helps them to track their health. Assessing usability of these Patient portal features is of importance as these features will help EMR's to meet meaningful use requirement.

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CLINICAL USER AND PATIENT PORTAL WORK FLOW



*CCR – Continuity of Care Record

*CCD – Continuity of Care Document

Ravi, Owino - Work Flow

Methodology

Assumptions: We collected and setup around 100 patient records in our Open-EMR instance. Out of these we populated 22 records with all vital signs data, medication and problem lists. The rest of the records have demographics and not fully populated record. Though it may not represent real world scenario in terms of number of records and amount of data, we assume it should not impact the study, as the features tested for usability are more concerned about querying, navigation and viewing data aspects rather than loading the system with realistic size of data/records.

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Note: Due to various factors, most of the reports generated did not contain all the general information typically found in a hospital environment. (we set up 100 patients, but only 22 had some of the vital aspects of a real live patient) Using a demo version of Open-EMR created more learning curves for us.

We used various methods to collect usability data. The first was a scenario-based inspection. We used Camtasia, a software application that allows the evaluator to record on-screen activities being performed by the user and then timed them from the start to the finish. All completion of tasks were timed for each user and recorded. After creating credential information for the selected personals, we took the laptop with the Camtasia software loaded to each user and conducted the scenario-based inspection of Open-EMR. After finishing the scenario-based inspection, we conducted a heuristic inspection of the application against industry accepted standards.

After the users had finished testing the Open-EMR system, we emailed them a questionnaire. We developed the questionnaire using a free online service called, Survey Monkey. The questionnaire asked the users to answer questions based on their experience of using Open-EMR.

Scenario-based Inspection

Based on baseline inspection of Open-EMR, we developed the same usage scenarios for the clinicians. The patients were given a scenario to navigate and view their health history.

Clinical Reporting Scenario 1: *Review specific patient history*

Users: Clinicians and Researchers (2 doctors, 1 nurse, 1 PA, 1 Research Assistant and 1 Data Assistant.) The same laptop was used for all the tests performed.

Goal: The Clinician should be able to log in, find one of the assigned patients and retrieve a patient history report that shows demographics, medications, diagnosis, risk factors, and any exams/tests or lab results.

Task 1: Log into Open-EMR with user name and password.

Task 2: Search and locate specific patient

Task 3: Navigate to Reports section and view patient history

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Clinical Reporting Scenario 2: *Generate a Patient List of all patients in the EMR*

Users: Clinicians and Researchers.

Goal: View all patient demographic data to analyze geographic location, last visit and vitals

Task 1: Navigate to Reports section

Task 2: Select list option and pick dates to view (From: xxx To: xxxx)

Task 3: Export list to csv file or print

Task 4: Analyze list to see if it contains all needed information

Link to Survey: <http://www.surveymonkey.com/s/92RT5MM>

Patient Portal Scenario 3: Patients should be able to login into portal once their records are updated to allow them to access portal. Users will be provided with login id, password and URL to access patient portal.

For Patient portal features usability study we will consider these tasks, these tasks will provide patient access to the following information:

Task 1: View Reports (Continuity of Care Record/Continuity of Care Document)

Task 2: View Problem List, Medication List, Medication Allergy List and Appointments

Baseline Data

We will baseline data from initial subset sample of users and collect metrics on such as time taken to perform tasks, errors in navigation for that specific task. Results comparison between different users, Ease of flow, Accuracy in retrieving the data, Errors experiences during the usability test. We will compare the baseline data to the overall metrics we collected for the all the users that we used for the study.

Baseline data for patient portal usability

There are currently two patient portals available with Open-EMR, native and third party portals. In this study we considered only native portal bundled with Open-EMR. Third Party portal support requires registration of instance and connectivity and with vendor providing that portal software, so we did not consider that for this study. Native patient portal in Open-EMR is

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supporting only few features, so we came out with two tasks that will cover the features available and enabled it in patient records to have access with the instance.

We will give our user groups credentials and task list that we want to perform them. We are not providing any further instruction for the performing the tasks, as we would like to study navigation and intuitiveness of the portal for patients to check on their healthcare data. At the end of tasks list, we will ask users to complete survey that will provide qualitative metrics in usability study. Survey questions will be posted in web and data will be collected from e-mails generated.

Here is our initial survey link on questions considered for Patient Portal

<http://www.surveymonkey.com/s/TTVTHW7>

Questionnaire for clinical reporting testers

The questionnaire was developed to focus on user interaction with the system and what they were able to find useful feature or non-useful features. Users were also rated to measure the difficulty experienced in doing certain tasks assigned.

Success/Ease in completion of tasks

How easy was it to log into the Open-EMR with your username and password?

How easy was it for you to use the individual patient history reporting feature?

How easy was it to view reports on patient data (demographics, history, vitals e.t.c)?

How easy was it to navigate through Open-EMR and find (patient, reporting, clinical, save and exit tabs)?

Level of satisfaction with system

Overall, are you satisfied, dissatisfied or neither with the overall design of the interface?

What do you like least about the Open-EMR user platform?

Usefulness of data retrieved

How useful was the data you were able to retrieve from the Open-EMR system?

How useful was the documentation provided?

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How user friendly is the Open-EMR system?

Do you have any other comments?

Results and summary of findings

For our results and findings, we will focus on issues that affect the completion of tasks, and thus impact users and quality of data retrieved, but does not affect the general design of Open-EMR. We set up our baseline to measure from the recording interactions the below results for baseline. From the recording captured in Camtasia, we recorded the following baseline information based on time it takes users to log in and be able to retrieve requested data from the system. For the baseline, it took a total of 5 minutes to log-in, and retrieve useful information with minimal errors and all results achieved at the highest scale level. Errors experienced were low to medium and did not affect the baseline user's results.

Summary Baseline for Scenario 1 and 2

Sample size: 7 first-time Open-EMR users

	Time	Results	Error	Completeness
		Yes/no		
Task 1 - Log in	0.5 min	Yes	0	100%
Task 2 - Navigate	2 mins	Yes	1 - medium	80%
Task 3 - locate and export	2 mins	Yes	2 - medium	90%
Task 4 - View and exit	0.5 mins	Yes	0	100%

The tasks were designed to test the system's ability to provide valuable data in a research setting. The baseline was set earlier to determine the basic time needed to complete tasks and if the user was able to get any errors while completing the task and viewing patient data from the system.

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Time it took to retrieve data (0-25 mins) and # of **errors** reported (0-10) – fig.1

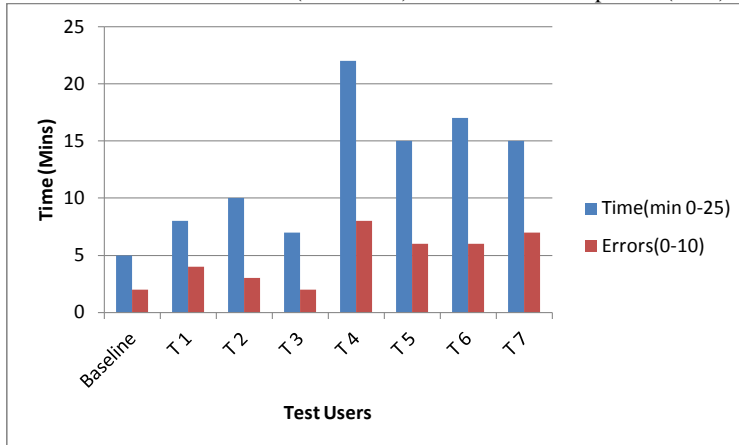


Figure 1

From these results, we can see that the amount of errors experienced by the test users affected the amount of time it took them to navigate the Open-EMR and retrieved needed data. For users with technology backgrounds (T1 & T3), their results were very close to the baseline. For users with clinical backgrounds (T2 & T5), their results compared to the baseline were average. (Figure 1) For researcher, with no technology and clinical background, their performance was different to the baseline. It took them longer to log in and retrieved data from the system with more errors than the other testers and with less successful results. (See figure 2)

Report results (0-10), 10 being highest rate of success – fig.2

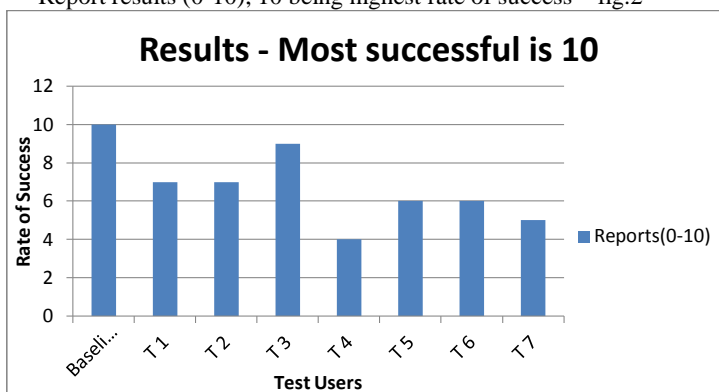


Figure 2.

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Summary findings from survey

- 1. On Success/Ease in completion of tasks:** All users sampled were able to log in with moderate ease. Baseline users were able to log in with extreme ease, while more advanced users were able to log in very easily. (fig. 3) Most of the testers who were at the university experienced very little errors while logging in, while those off-campus required to have the VPN to be able to log in. (from the recordings). Most testers were able to find all the tabs easily to complete their assigned tasks. The patient tab was the easiest to find, and the results were very similar to the baseline. On a scale of 0-10, most users were under 5 for ease in navigation of the Open-EMR system and were able to find the data needed to complete assigned tasks (Fig. 4)

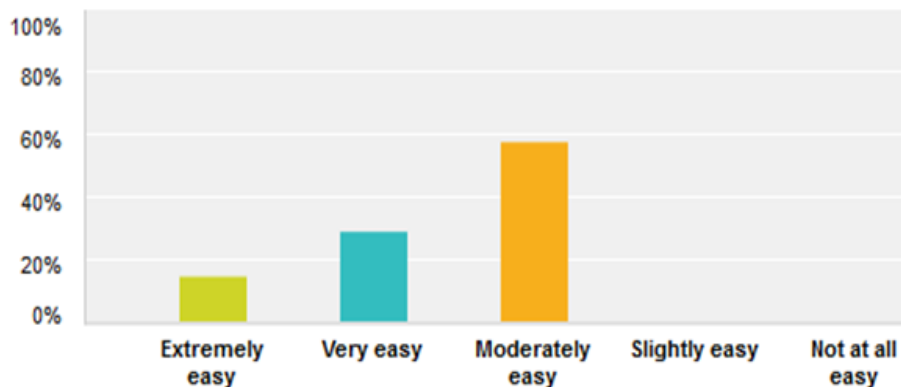


Fig.3: How easy was it to log into the Open-EMR System?

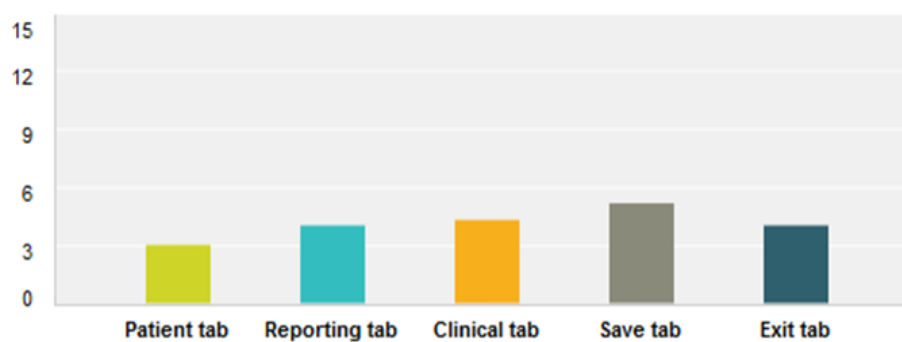


Fig. 4: How easy was it to navigate through the Open-EMR and find tabs

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- 2. Level of satisfaction with the system:** The level of satisfaction with the system varied based on the level of ease for users. The clinical tab was the least easy to use, and thus most users were slightly satisfied with the system. Users who had experience with WebCIS at the clinic were less satisfied with the Open-EMR system due to it being a newer system and one that they were not so familiar with. There was also less satisfaction due to the level of data that they were able to retrieve from the system. In the recordings captured by Camtasia, most users seemed to be confused with the different sections of the system that they could get reports, but were unaware of what the differences were in those reports. The level of satisfaction was overall average and below the baseline, but could be more interesting to find out how that would change with a larger sample size.

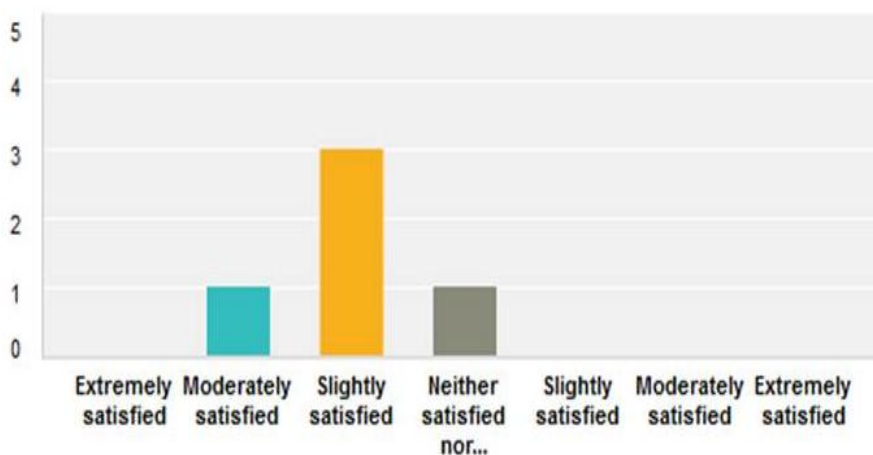


Fig. 5: Overall, are you satisfied, dissatisfied or neither with the design of Open-EMR interface?

- 3. Usefulness of data retrieved:** Due to the expectations set by various backgrounds, it was hard to measure the usefulness of the data retrieved. Clinicians found the data to contain good vital information and demographics, while the researchers and data assistants were looking for more statistical output of the data and found it to be less useful. The baseline was able to find all the needed demographics and history data to accomplish the tasks assigned, and thus found it extremely useful, but more than 80% of the testers found the data retrieved to be somewhat useful. Thus, it was difficult to measure the usefulness of

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the data retrieved, based on the different roles played by the testers. With a large sample size, this aspect could be explored more to convey different aspect of usefulness (Fig. 6)

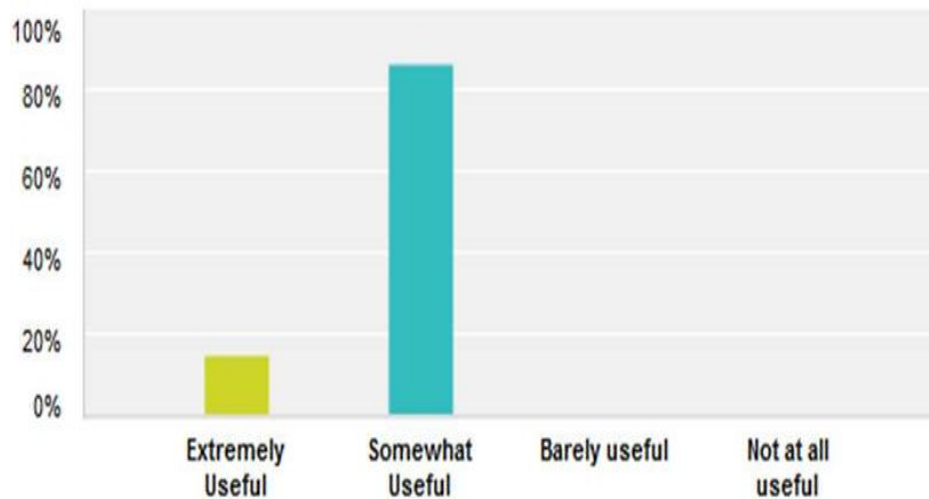


Fig. 6: How useful was the data you were able to retrieve from Open-EMR?

Despite users being able to view reports easily (Fig. 7), the clinicians found the reports to be moderately useful and were a deviation from the baseline users who were focused more on being able to populate the reports with data that the type of data displayed. Clinicians were thinking more of data they could analyze and find useful for research purposes.

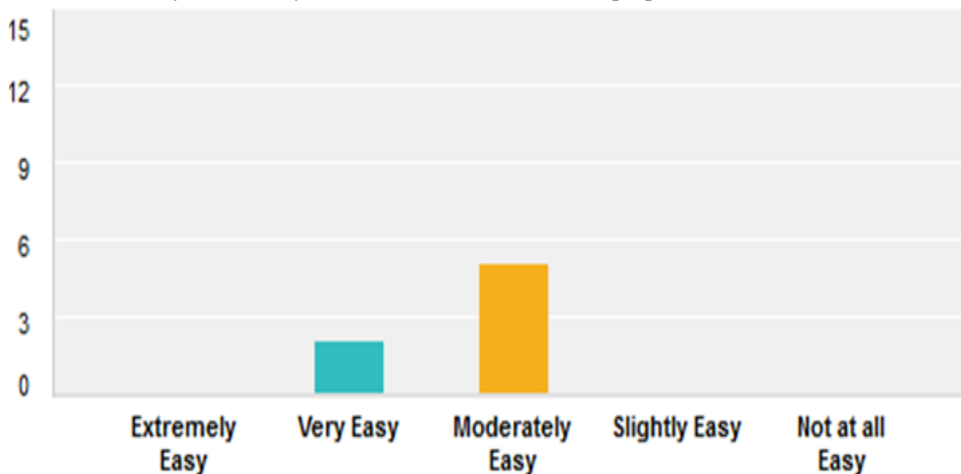


Fig. 7: How easy was it to view Reports on patient data? (Demographics, history)

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4. **Other findings:** Overall, the comments were more focused on issues that caused errors for the users. The baseline users didn't comment, but other users found the system slower or could be their internet connection was slower. The savvy users found the system to be very cryptic and the UI experience didn't adjust to best present the information requested. Other comments were more in line with a normal user interaction with a new system that they are unfamiliar with.

Responses (5)

Text Analysis

My Categories

PRO FEATURE

Use text analysis to search and categorize responses; see frequently-used words and phrases. To use Text Analysis, upgrade to a GOLD or PLATINUM plan.

Upgrade

Learn more »

Categorize as...

Filter by Category

Search responses

Showing 5 responses

clustered

5/6/2013 12:44 PM

[View respondent's answers](#)

There are two areas to view reports. It would take getting use to learn all the features presented. All reporting should be in one area completely separate from the clinical interaction aspect of the EMR

5/6/2013 12:25 PM

[View respondent's answers](#)

needed more speed

5/5/2013 3:24 PM

[View respondent's answers](#)

It involves too many steps to view other useful clinical data. With a huge workload and a lot, it could take too much time to get useful data from the system.

4/24/2013 10:30 PM

[View respondent's answers](#)

I felt navigation was generally pretty cryptic and that the UI experience didn't adjust to best present information based on the type of information.

4/24/2013 3:59 PM

[View respondent's answers](#)

Fig. 8: *Do you have any other comments?*

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Conclusions on strengths and weakness for Clinical use

Overall, Usability testing provided an opportunity to explore the Open-EMR system, but at a very surface level. Through the recorded videos of users interacting with the system, we found out that Open-EMR needs to be more intuitive, with additional functions that allow for better reporting. It is an excellent system for entering data, but require more work for that data to be retrieved, thus it would be a good choice for a primary clinic to use, but would require more development and additional functionality added for it to be used in a clinical research environment. Since its open source, it would be cost effective to implement an Open-EMR system for small to medium sized medical practices. It has a built in scheduling system that would be a plus for effective scheduling. From the observations, we could also state that the current system does have strengths in its format of demographical data, vitals and history in the way the report is displayed to the user.

The system is however intimidating to first time users with a clustered platform that takes time to getting used to. Users struggled to find a reason for the bottom bar being there, and would eventually find the bottom to turn it off. It seems to be of no use to have the bottom section divided from the top, especially for clinical use. The report areas were also in different areas. Users could view reports from the top section after logging in, but the reports were not comprehensive. For a comprehensive report, users had to use the reporting tab on the left pane of the screen. It would be useful to have one area for reporting with all the tabs reflected under reporting. This amounted to a data mining weakness.

Since the users had variable backgrounds of clinical use, the usability testing helped to measure how well the EHR would meet needs of different targeted audience. Meaningful use would be different for each subset targeted audience. With training tools and improved functionality, the Open-EMR could be a force to be reckoned with in the healthcare industry, especially for small to medium sized health facility with limited funding or resources. For clinical use, Open-EMR would have to enhance its clinical reporting features and provide tools that would allow clinicians and researchers to easily mine useful data from the system.

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Patient Portal Usability Study Report

The Patient Portal study assessed the usability of Open-EMR features that allow patients to view their health history that includes problem list, Medication List, Medication Allergy List and Appointments. Features in Patient Portal should make information gathered in previous clinical encounters be available for an individual to check, which helps them to track their health. So assessing usability of these Patient Portal features is of importance as these features will help EMR's to meet meaningful use requirement.

We populated few patient records in the Open-EMR instance used for this study, so that users can access those records to check and assess Patient Portal capabilities and features. The user for Patient Portal will not require any specific qualifications or skills to use, except for being a representative of a clinic patient and knows how to access a web portal. We took a cross section of sample of users, user knowledge base varied from novices to experienced technological savvy users and the age group for users was between 30-50 years. We considered a subset of users and collected data of that subset users to baseline our study. We attempted to have enough representativeness in the sample as we considered novice users and power users who used other vendor patient portals recently.

Open-EMR installation by default does not turn on portal functionality. We enabled Patient Portal in administrative screen to turn this portal feature on and enable urls to access the site functionality. Also access of portal is controlled per patient record, so patients are asked whether they would like to have access to patient portal and only after their consent this attribute is updated in patient record to provide access to that user. Patients should be able to login into portal once their records are updated to allow them to access portal. Users were provided with login id, password and URL to access Patient Portal.

Task List

For Patient Portal features usability study we considered the following tasks, these tasks will provide patient access to the following information:

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- Reports(Continuity of Care Record/Continuity of Care Document)
- Problem List
- Medication List
- Medication Allergy List
- Appointments

These features are important in EMR, as these are the criteria considered to certify an EMR for meaningful use.

Data Collection tools and procedures

Initially we intended to measure time taken for completing task lists in Patient Portal usability study, but after engaging couple of users and while interviewing them to access patient portal, we came to realization that end users for patient portal are not bound by any time constraints to complete the task list given. The constraints and setting for task list for end users and healthcare providers is different. For ex. healthcare providers in clinical setting are bound by window to complete tasks before next appointment, so it would make sense to quantify completion time. But in Patient Portal study, users are more casual in their approach to look for healthcare information and hence we did not consider quantitative timeline metric, but at the same time we kept an eye if users unusually struggle for long time to figure out the tasks at hand.

We considered the following metrics to baseline:

- 1) Success/ease in completion of tasks
- 2) Usefulness of information presented and
- 3) Desirable features and additional functionality in Patient Portal.

Our survey questions are framed to measure these metrics. We sent an e-mail with instructions to users in our study covering how to access the web site, credentials information, task list to view different lists, and survey links. We asked to complete survey after completion of tasks by taking note of their experience in tasks performed. Our survey tool used (Survey Monkey) collected data and provided us consolidated view of the results. We collected data for initial baseline set of users and used it to discuss the deviation observation in for overall collected data.

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Questionnaire design: Here is the set of survey questions used to capture usability metrics after performing task lists:

Success/Ease in completion of tasks and usefulness of information presented:

How easy was it to log into Patient Portal with your credentials?

Please rate how easy was it for you to navigate to different reports/lists?

Are you able to retrieve Reports and able to see Continuity Care record and document?

How useful is Problem List, Medication List and Medication Allergy List in the format presented in portal?

Desired features:

How strongly do you feel that Patient Portal need to have features such as customized trackers/tools for your specific healthcare needs? Ex: Tools to track your blood glucose levels over a period of time.

If Patient Portal presents Healthcare information/articles relevant to your problem list, how likely will you use that information in maintaining your health?

If Patient Portal provides a tool(such as e-mail/chat/video conf.) to communicate with your healthcare provider, how likely will you use that feature to communicate with your provider on your healthcare needs?

How comfortable are you to complete healthcare questionnaire in Patient Portal that is usually provided as paper documents during your appointment at doctor office?

Study findings

- 1) On Success and ease of completion of Task lists: We did not see much deviation from baseline data. Base line data users selected that Open-EMR accessibility is very easy and they did not face issues in logging in or viewing the reports requested. Interface was intuitive and simple and the number of options presented are few to navigate and browse. All of the users we sampled were able to complete the task list and they did not face any errors in accessing the reports. Figure below shows data for all the users sampled. And the graph shows most of the users find it very easy and shows very little variation across the sample.

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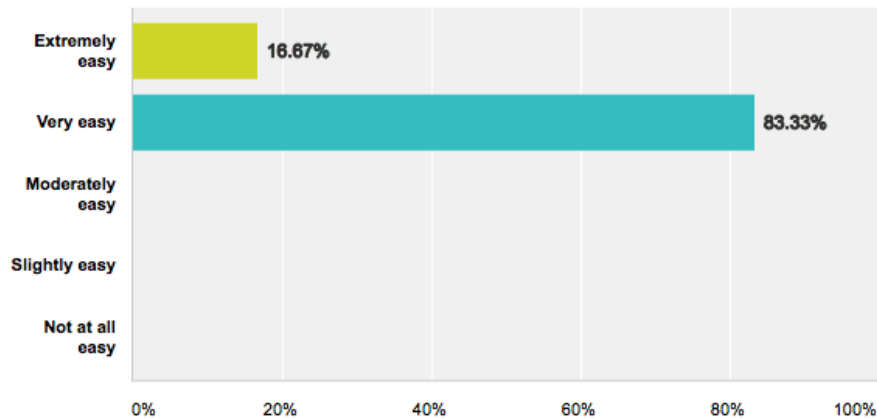
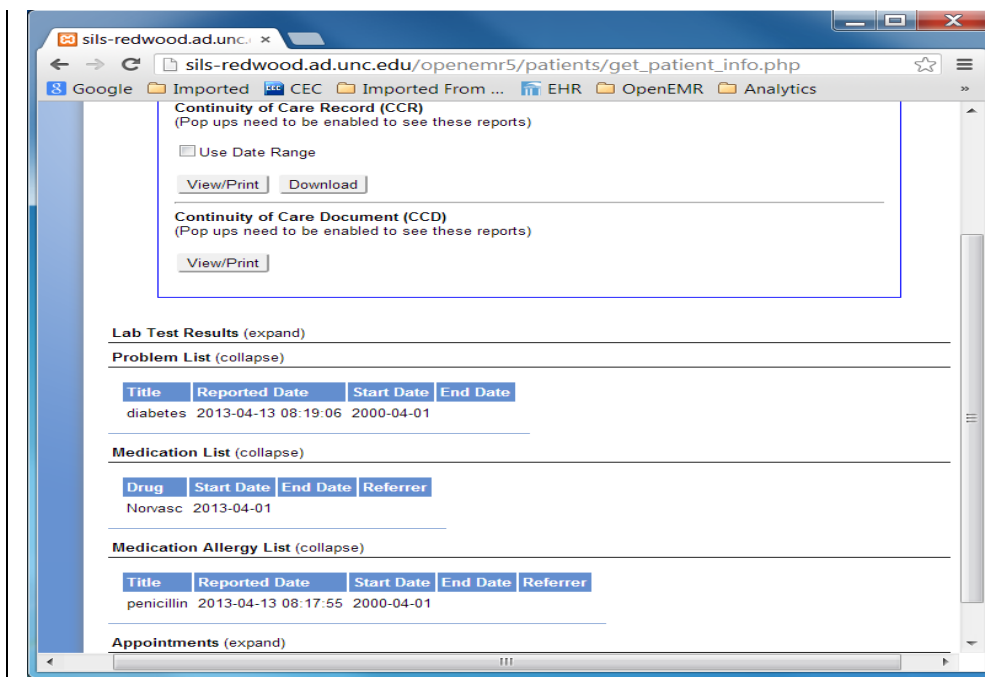


Figure 1: Survey metrics showing easiness and distribution in completion of tasks

Screenshot of Patient Portal below:



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- 2) Usefulness of information presented: We have seen lot of deviation from the initial base line data in measuring usefulness and format of information presented. We observed expectations from novice users and users who already have seen vendor based patient portal varied a lot. Also in the interviews with users exposed to vendor based EMR(eClinicalWorks) solutions, those users commented there is less correlation between medication list , problem list in Open-EMR and compared it what was presented, mapped and coherently presented in their personal patient portal that they were already using provided by their primary physician.

Figure 2: below reflects wider variation (number of colors) and distribution percentage in expectations from novice users and power users.

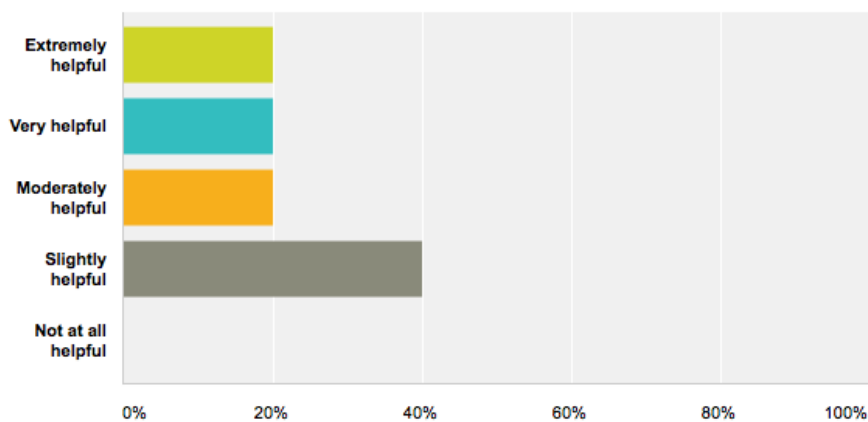


Figure 2: Chart showing Usefulness of information metric and distribution across users

3) Desirable Features and additional functionality for Open-EMR Patient Portal:

Expectations for desirable features did not deviate much from baseline data, and the features we considered in survey questions aroused similar expectations from novice users and savvy users. In the interviews with users, it was pointed out that Open-EMR native portal does not let users to modify or upload any healthcare data that a user want to track in health record. Native Patient Portal was presenting only subset of information from patient record and information flow is only in one direction.

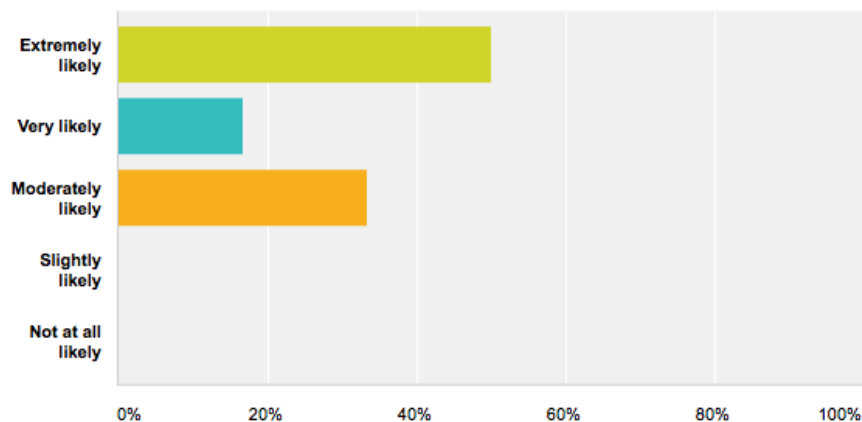


Figure 3: Usefulness and need of additional features in Patient Portal

Conclusions and Recommendations on Patient Portal:

In conclusion Open-EMR and its current native portal functionality appear primitive. Existing interface is simple and intuitive for users to navigate and view their medical records. But we found out in interviews that lot more additional functionality is desired than what it is supporting now. Healthcare providers that opt for Open-EMR solution for tracking records may not find viable to offer native portal option for their patients in its current form, as it lacks lot of desirable features. Also the existing interface does not provide any option/tools for users to upload and proactively track their healthcare data. Though Open-EMR provides API to developers to

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develop custom Patient Portals that can implement these additional desirable features, it will be not be viable option for healthcare providers to invest time, effort and IT staff to implement it.

In Open-EMR product, healthcare provider centric functionality and features might be comparable to vendor based EMR solutions, but its native patient portal functionality is not yet mature enough to release for wider user base. As healthcare industry is becoming more customer (patient) centric, it is imperative for open source tools like Open-EMR address changing customer needs and expectations and develop, enhance customer facing functionality features and provide tools that help users in maintaining better health in future releases.