Selecting an EMR for Your Practice: Evaluating Usability

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HIMSS EHR Usability Task Force

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Purpose of this Document

This document has been prepared as an aid to practices engaged in selection of an EMR system and the Regional Extension Centers (RECs) who may be assisting them. While formal, professionally conducted, usability evaluations can provide in-depth product comparisons, this may not be a practical consideration for small to medium size practices. This guide outlines some basic steps to include in a vendor selection process that will help practices evaluate EMR usability based on current usability recommendations and best practices. While the target audience of this guide is smaller practices, the steps outlined in this document can also be used by large practices and healthcare institutions.

What is Usability?

*Usability is the **effectiveness**, **efficiency**, and **satisfaction** with which specific users can achieve a specific set of tasks in a particular environment*[1]*.* All of these components of usability can be evaluated and measured (either formally or informally). Ease of learning is also a component of usability, although not easy to measure in a quick, informal study.

Efficiency is generally the speed with which users can complete their tasks. Which tasks and clinic processes must be most efficient for success? Can you establish targets for acceptable completion times of these tasks? For example, is it reasonable in your practice for clinicians to take ten minutes to document a complex new patient visit or 30 minutes turnaround time for a telephone refill request?

Effectiveness is the accuracy and completeness with which users can complete tasks. This includes how easy it is for users to make errors. User errors can lead to inaccurate or incomplete patient records, can alter clinical decision-making and can compromise patient safety.

Sample questions related to effectiveness:

- Is data entry too complex or confusing to perform completely and as intended?
- Do you see possibilities for incorrect data entry?
- Will you be able to retrieve the data you enter in a usable form for patient outreach, evaluation of outcomes and required reporting?
- Is information poorly presented and subject to misinterpretation?
- Are there other barriers you see when you try the product?

User satisfaction is usually the first concept people think of in relation to “usability.” Satisfaction in the context of usability refers to the subjective satisfaction a user may have with a process or outcome. Satisfaction is highly subjective, but routine questionnaires can provide good insight into what problems or issues users have with the system and why. Efficiency, effectiveness, and satisfaction cannot be taken in isolation—all three components must be evaluated and balanced based on your practice's goals and priorities.

Usability has very little to do with visual appeal of the user interface. In fact, applications that use lots of colors or visual elements probably would have a lower usability "score" than well thought out designs that are simpler in appearance. Thoughtful use of visual elements can be a supporting factor that helps enhance product usability.

Usability and functionality are often hard to tease apart. While it is not always necessary to fully distinguish the two, it is important to understand the difference (see the example in Table 1 below).

Problem List Functionality	**Problem List Usability**
• The EMR permits you to add, update, correct, and remove entries on a patient-centered problem list. • The problem list may be filtered and sorted in meaningful ways.	• The choice list for problem selection uses terminology that is familiar, unambiguous and useful to the clinician for this context of use. • The mechanism for selecting a new problem is simple and straightforward, requiring very few steps. • It is easy to visually integrate a problem with associated clinical data or events (e.g. lab results, medications, procedures, or clinic visits). • The EMR eliminates the need for redundant data entry by allowing easy cross-population of entries in problem lists and progress note assessments. • The EMR protects against duplicate entries on the problem list (both literal and conceptual) to maintain its clarity and usefulness.

Table 1: Problem List Functionality versus Problem List Usability

EMR Usability Principles

As shown in Figure 1, the following principles of software usability can be applied directly to the evaluation of EMR systems. While usability principles apply to all software, this set has been assessed and put forth as being those of key concern for electronic medical records.[2]

The Elements of a "Usable" EMR

Figure 1: EMR Usability Principles

Examples of how an EMR application supports the usability principles include:

1. **Si**mplicity
    a) No information or visual elements are included that are not necessary to the task.
    b) Important information stands out, and function options are easy to understand.
    c) The application has clear, clean, uncluttered screen design.
    d) Functionality is limited to that which is essential to core tasks and decision making.
2. **Na**turalness
    a) The screen metaphors are familiar to everyday life, or commonly expected computer experiences for the clinician.
    b) Workflows match the needs of the practice.
    c) The application appears intuitive and easy to learn; training will not be an overwhelming process.
3. **Co**nsistency
    a) All the different parts of the application have the same look and feel, consistent placement of screen elements, etc. Terminology and data entry fields are used consistently. Understanding how one screen works helps you understand how other screens work.
4. **Fo**rgiveness and **F**eedback

a) It is hard to lose data or destroy time-consuming effort with a wrong click or wrong choice of buttons.
b) If you make a mistake, the application helps you avoid it or the application provides a method to recover from errors gracefully (the system is "forgiving").
c) The system provides informative feedback to the user about actions they are about to take or have taken.
d) Information is provided to the user when the system is processing, indicating what is occurring and how long it might take.

5. **E**ffective **U**se of **L**anguage
    a) The application uses the same words that your clinicians use (while providing mapping to standardized codes and terms used for data retrieval).
    b) List or entry-form choices are clear and unambiguous.
    c) Sentences read like natural English (or the selected language).
6. **E**fficient **I**nteractions
    a) The application minimizes the number of steps it takes to complete tasks; appropriate defaults are always provided.
    b) The application provides navigation options such as shortcuts for use by frequent and/or experienced users.
    c) Navigation methods minimize user movements such as scrolling and switching between typing and mouse clicking.
7. **E**ffective **I**nformation **P**resentation
    a) Information on screens includes sufficient white-space and large enough fonts to be read easily with high comprehension. No information should be in all upper case.
    b) Colors are used to convey meaning (e.g. *red* to indicate medical urgency), not just for visual appeal.
8. **P**reservation of **C**ontext
    a) The application keeps screen changes and visual interruptions to a minimum during completion of a particular task.
9. **M**inimize **C**ognitive **L**oad (in other words, "help me think about the patient, not about the system")
    a) Information needed for a particular task or decision making is grouped together on a single screen rather than requiring the user to mentally integrate information from multiple screens in the system.
    b) Alerts presented to the user are concise and informative with clear actions, and are appropriate in number.
    c) The application performs calculations automatically for the clinician so that they do not have to manually perform the calculations.

Practice Guide to Evaluating EMR Usability

These key steps in your selection process will assist you in selecting the most "usable" EMR:

1. Engage your users from the start.
2. Consider practice goals.
3. Include usability questions in your Request for Proposal (RFP); solicit responses from multiple vendors.
4. Review available survey data.
5. Perform usability tests with your final two or three EMR product contenders.
6. Observe other similar practices using the products (may be done sooner).
7. Discuss your findings with the vendor(s) before making a final decision.

Together, these steps will identify issues you need to discuss with the vendor before making your final decision, greatly increasing user buy-in and smooth implementation of the selected EMR.

The following sections discuss each of these areas in more depth.

1. Engage Your Users from the Start

Engage your users from the beginning of the process. The first steps are defining the EMR requirements for your practice and identifying potential products that might meet your needs. Do not select a system simply based on the recommendations of colleagues. Provide incentives to physicians to engage in the process and include nurses, medical assistants, medical records staff and all others who will use the system. Ensure that your product review and selection team is composed of true end users who will actually be using the system and not just personnel who make IT purchasing decisions. Assemble a representative team who will:

- Review and contribute to development of requirements
- Identify practice goals and/or key areas for workflow improvements
- Collectively develop an understanding of “usability” (including efficiency, effectiveness and satisfaction)
- Attend multiple vendor demonstrations
- Craft clinical scenarios to be used to assess usability of the selected products
- Create and conduct usability tests
- Collect lessons learned from peers in other practices who have adopted EMRs
- Participate in site visits to observe other practices with the systems under consideration
- Communicate with their peers in the practice regarding project progress
- Gather feedback from their peers on key issues
- Solicit guidance from your REC and professional organizations.
- Contact RECs for guidance.
- Contact your State and/or National Academy for guidance.

2. Consider Practice Goals

Consider what goals are most important to your practice when adopting an EMR and how these goals relate to usability. For example, are you especially concerned about:

- Improving the **efficiency** of telephone prescription refill requests?
- Physician **satisfaction** with an electronic clinical documentation process?
- Ability to **effectively** use patient encounter data for clinical outcomes analysis and patient outreach?
- How much training will be required for physicians and others to become adept with the system? (**ease of learning**)

Document your key concerns and share them with the whole team. These primary goals should become the drivers for how you evaluate usability.
Think about simple baseline measures related to your goals. For example, efficiency is typically measured by how long it takes to perform sample tasks during a usability test. Satisfaction and concerns can be assessed with questions included in a post usability test questionnaire. Ease of learning can be assessed by having users attempt the same scenario/task with a number of "test tasks" and objectively measure learning based on the number of attempts and measures such as time to completion and success rate.

Consider looking at your current practice goals regardless of whether you have a paper-only process or use some combination paper and digital means of managing your practice. Use these as a baseline measure for comparison with the various EMR products you may be reviewing. When looking at factors such as how long it takes to complete specific tasks, be sure to look at the bigger picture and the benefits that are the result of the EMR versions of these tasks (such as the ability to review results or enter orders from home, data entry, and use of clinical decision support components).

Depending on the specific nature of effectiveness concerns, targeted questions may be appended to the usability test scenarios (answered after the scenario has been completed) or included in the overall questionnaire to be filled out after the full test has been completed. Usability testing is discussed in a subsequent section of this document, with sample scenarios and usability questions provided in the appendices.

3. Include Usability Questions in Your RFP

Drafting a Request for Proposal (RFP) for EMR vendor candidates is something you may do yourself or with the assistance of a consultant or your REC. In addition to the usual questions regarding functionality, security, technology, and interoperability, it can be enlightening to include some questions about usability.

In general, these questions should try to elicit information about the type and formality of usability activities the vendor has undertaken themselves as part of the development and evolution of their product. Asking about the qualifications of their staff and for access to sample usability test results can be very instructive. The purpose of the RFP usability questions is to help you develop a general feel for where each vendor stands. A company that can show it has embraced usability practices in design and development will stand out and will be better positioned to meet your needs over time, as well as compete in the evolving EMR marketplace.

Sample questions along with the types of responses you should be hoping for (as well as some red flags to watch out for) are provided as Appendix A.
Note that even if the vendors you are considering have well-established formal usability practices, you should still perform your own informal test, as discussed in a subsequent section. Performing your own test is the only way you will know if the product will meet the needs of *your* practice and *your* users.

4. Review Available Survey Data

Various forms of survey data regarding specific EMR systems are available free of charge from organizations such as KLAS (www.klasresearch.com) and the American Academy of Family Physicians (AAFP)(www.aafp.org). The Certification Commission for Health Information Technology (CCHIT) currently performs simple usability assessments of EMRs during their certification process with results available on their website (www.cchit.org). Check also with professional organizations for your specialty to see what they may have to offer.
Keep in mind that the data currently available to the public is all gathered through informal, non-scientific means. Most information available is simple user satisfaction data collected from healthcare managers rather than directly from clinical users. Organizations are only just beginning to provide information regarding perceived efficiency and effectiveness of EMRs. Use this data to help formulate your questions, but do not allow it to override your own assessment based on your practice goals. In the future, there may be a nationally regulated process in place that will provide formal usability evaluations of EMRs and other clinical systems, with ratings published publicly.

5. Perform Usability Testing

Perform a usability test of the final two or three products on your list. This can be done using fairly simple methods. These will not be scientific studies, but an adequately structured means

of collecting valuable insights from a cross-section of your users specifically related to product usability.

a) Create a representative set of clinical scenarios that include all essential tasks: visit documentation, order entry, maintenance of problem and medication lists, practice workflow involving multiple users, inter-practice communication and so forth. Consider a mix of frequent tasks along with highly important and complex tasks. Define for each scenario what it means for the participant to successfully complete the task.

Unless you are expecting to use dictation only for progress notes, it is also important to include template creation and customization in your test scenarios. The vendor will probably tell you that they provide a library of templates, and they will provide a service to help you customize them as necessary. However, templates created by someone other than yourself or your practice often will not meet your specific needs; also, using the template tools will help you assess their ease of use. You need to test template creation to determine if:

- You or an assigned internal staff member can create new templates or modify those provided with reasonable ease AND
- You can easily modify the content pulled in by a template "on the fly" when using it to document a specific patient case.

Include with each scenario a set of task-specific questions for the test participant to answer after they have completed the test scenario. Focus these questions on efficiency, effectiveness and satisfaction as well as usability concerns you might have related to the specific task. See Appendix B for some sample scenarios that might be useful in a primary care practice.

b) Request that your vendor support this activity; currently this is not a common request that they receive but it will become increasingly so. Provide them with a list of the scenarios you would like to test but not the scenario details; it will defeat the purpose of the test if they set up templates to perfectly match your test cases. You will also need to provide them with a list of the test patients (e.g. "45-year-old Hispanic female with history of diabetes and hypertension") and background data (e.g. prior test results) that will be needed to support your scenarios. Request that the vendor representative have a means of resetting the test data in between participants so that they each have the same experience with the system during testing.

c) Schedule a set of representative users from your practice to participate in a one-on-one test of the EMR. It is essential that the test be *hands-on* (not a demonstration) by *your clinic users* (not vendor representatives).

d) Prepare a post-test questionnaire to be filled out by the users who participate in the testing after they have completed all the scenarios. These will be general questions that capture their overall experience with the software. Include a simple rating scale for each question so that the data can be easily aggregated across all the participants. Appendix C includes a sample post-test questionnaire.

e) Prior to the usability testing, invite all expected participants to a system demonstration by the vendor; allow as many questions as needed.

f) Conduct the usability test. The basic elements of a simple usability test are as follows:

- Have the vendor set up a workstation with access to their test or demonstration system they have prepared for your scenarios.
- Assign a member of your usability team to be the test facilitator. The role of the facilitator is to:
    - Provide each participant with the test scenarios and basic instructions.
    - Record the time it takes for the participant to complete each scenario using consistent starting and stopping points.
    - Record key comments made by the user during the test without interrupting or asking them questions.
    - Record whether the participant was able to successfully complete each scenario.
    - Track common errors made by participants (if obvious to the facilitator).
    - Provide each participant with the post-test questionnaire at the end of the test.
- Schedule your participants to come one at a time to participate in the usability test.
- If possible, test multi-user workflow scenarios (e.g. telephone prescription refill) with separate users performing each role. This will give you the best sense of how the system operates in a collaborative environment. If not possible, have every participant perform all roles in the scenario for their test session.
- Instruct the participants to attempt to perform the scenarios without assistance, "thinking out loud" as they go. The vendor representative should provide technical assistance only (for example, if the system crashes, resetting the data for each participant).
- The participant should answer scenario specific questions as each scenario is completed, and fill out the general questionnaire at the very end.
- You may also want to verbally debrief each participant when they are done for overall comments and impressions.

Your organization might want to consider engaging a usability specialist to assist in planning and conducting the usability test. Check with your REC or the Usability Professionals Association for resources that are available in your area.

6. Observe Other Similar Practices

Make plans to observe at least two similar practices using the product(s) you are considering. This can be done any time after you have narrowed your EMRs of interest down to the final few (before or after usability testing). If you do not have relationships with any such practices, your REC or professional association may be able to help you locate them and/or provide contacts. If the vendor provides you with practices to visit, keep in mind that these will be a biased selection (although there is still information that can be learned).

Arrange to take a team of at least one physician, one nurse and one medical assistant and/or medical office staff when visiting a practice; these may be staff you expect to serve as your most expert users. Ask for your team to be able to observe their counterparts working with the system for at least a couple of hours. Each team member should go prepared with a checklist of questions or issues that have arisen so far in your usability evaluation process that relate to their own work.

Arrange for a meeting or luncheon afterward with a few of their users so that questions can be asked from your checklists or that came up during observation. Find out what challenges their users have had learning and customizing the system. How long did it take them to be fully "up to speed?" What was easy or difficult to learn? What workarounds have they had to develop and why? What tasks do they find frustrating due to system inefficiencies or complicated design? What kinds of errors do they find are too easy to make? What problems do they have in multi-user workflows?

7. Discuss Your Findings with the Vendor(s)

After the usability test and practice observation you will need time to aggregate your results and discuss them as a team. Identify the issues that came up repeatedly, scored poorly in the questionnaires, or generated special concerns. Prioritize your list based on how serious of an issue you believe each item to be for your practice.

Meet with your vendor one more time and give them an opportunity to address your concerns. In some cases, there may be a much easier way to accomplish tasks than your users discovered – give them a chance to show you. In other cases, they may be able to tell you about enhancements that will be included in an upcoming release that may resolve particular problems.

Ask them how the issues you identified align with difficulties other customers report. How will they incorporate this information into their product improvement process? Also ask them for clarification if needed on any of their responses to the RFP usability questions. If they do not have robust usability practices and a usability team in place yet, they may be in the process of ramping up this capability.

Whatever product you choose, offer to participate in future usability studies and user-centered design activities the vendor conducts – it will give you direct input to product improvements and improve the likelihood of their success as well as your own.

Resources

Following is a list of where one can find more information about basic usability concepts and methods, as well as publications specifically related to EMR usability. Some of these resources are directed at web usability, but most of the material applies equally to application design.

Books

- *Rocket Surgery Made Easy: The Do-It-Yourself Guide to Finding and Fixing Usability Problems*. Steve Krug, 2010
- *Don't Make Me Think: A Common Sense Approach to Web Usability, 2nd ed.* Steve Krug, 2006
- *Usability Engineering*. Jacob Nielsen, 1993.

Websites

- HIMSS EHR usability page – publications and presentations on EHR usability by HIMSS members http://www.himss.org/ASP/topics_FocusDynamic.asp?faid=358
- Usability.gov – a government website containing good information on usability http://www.usability.gov/

Organizations

- Usability Professionals Association (UPA) http://www.upassoc.org/
- Human Factors and Ergonomics Society (HFES) http://www.hfes.org/web/Default.aspx

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Appendix A. Sample EMR Usability RFP Questions

At the present time, vendor practices vary with respect to building usability methods known as "user-centered design" (UCD) into the design and development of their products.[3] Both answers and non-answers will be instructive; differences seen across vendors will likely be evident. A company that has embraced usability in design and development will stand out and will be better positioned to meet your needs over time, as well as compete in the evolving EMR marketplace.

RFP Questions Related to Vendor Usability Practices and Staff

1. Please describe the most significant formal usability test that has been conducted on this EMR product. Please include the following information:
    a. The number and types (roles) of users that participated
    b. The mix of computer skill level in the pool tested (novice to expert)
    c. How participants were recruited (e.g. from one organization or many?)
    d. The scenarios tested
    e. Efficiency measures that were captured for each scenario and the overall results for each
    f. Effectiveness measures that were captured for each scenario and the overall results
    g. Satisfaction data that was captured either per scenario or as overall results
    h. Other qualitative results captured during the process
    i. How your organization utilized the data to incorporate changes into your product

    Evaluating their response:
    While this type of testing is becoming software industry standard practice, many EMR vendors have not yet done this. If they have, they may have only captured one or two measures of interest. This type of testing would normally be done when the product is near completion in order to assess whether they have met their usability goals for the development of the product.

    If the vendor has done this at all and can provide you with some data, they are currently in a leading position with respect to usability practices. The broader the mix of user participants in terms of both role and computer expertise, the better. Seeing the scenarios tested will tell you how relevant the results may be to your practice.

2. Please describe what other user-centered design and usability evaluation practices you include in your development process, including informal usability testing. Again, include number and types of users involved, manner in which they were engaged, type of data

collected and how your organization used the information to improve the product design.

Evaluating their response:
There are numerous methods that can be used at different points in the development process and there is no one right answer to this question. However, here are some good indicators of usability practices as well as some questionable responses:

Good:

- *Iterative, informal (qualitative) usability testing with a broad selection of users starting early in the design phase*
- *Expert review (by human factors or usability specialists)*
- *Contextual inquiry (a specific method of learning about users and their tasks by observation in the workplace)*
- *Task analysis (a formal analysis of tasks performed by each type of user and how they relate to each other in the workflow)*
- *Focus groups (facilitated by human factors or usability specialists)*

Questionable:
All of the following approaches are helpful contributors to product design but do not constitute usability/UCD methods and do not give you any indication of the vendor's true incorporation of usability practices and principles. If these are the ***only*** *responses given, that is not a good sign that they have embraced usability in their design process.*

- *User group input*
- *Vendor staff with clinical background provides the user understanding and clinical perspective*
- *"Our product was designed by a physician/clinician"*
- *Feedback from current users*
- *Help desk log review*

3. Please describe the size and professional skill set of your user-experience or usability team. How many have advanced degrees in Human Factors, Cognitive Psychology or Human-Computer Interaction?

Evaluating their response:
Every team should have some expertise in the above academic areas. Depending on the size of the company, you hope they have at least one Master's or PhD level individual. Small companies may not be able to demonstrate advanced degrees, but medium to large companies definitely should. Some companies that lack internal resources may outsource user-centered design and usability to consultants, which is a perfectly good alternative.

Other RFP Questions Related to Usability of the Product

4. Describe the amount of training expected for different user roles and how long it typically takes for an individual to become proficient in the application. Please provide specific data based on experience with existing clients*. (Note: The amount of training required is one good gauge for ease of learning).*

5. Describe what elements of the user interface are:
    a. Configurable by the provider institutions (e.g., font size, colors, views, shortcuts, favorites, reports, etc.)
    b. Customizable by the provider (e.g., workflow, screen creation/layout, form fields, templates, reports, etc.)
    c. Customizable by you/the vendor in response to a provider request (e.g., workflow, screen creation/layout, form fields, templates, reports, etc.)

    Note: Keep in mind that customization is a double-edged sword. Too much or the wrong kind of customization by the customer can undermine the existing usability of a well designed product. The need for substantial customization may be the result of a poorly designed system.

6. To what extent does the application provide shortcuts for power users and administrators?

7. To what extent does the application support users with disabilities by following accessibility guidelines, for example, Section 508 compliance?

8. Please provide the top five complaints you receive about the user interface of your product. What have you done to address these complaints?

9. What are the most common errors made by users? How do you track those errors? How do you assess them for patient-safety implications?

Appendix B. Sample Usability Task Scenarios

The following scenarios demonstrate how you can structure scenarios for your usability test. You should create your own scenario based on the key practice goals you have defined, the most frequent types of tasks performed, as well as the most critical.

Scenario 1: New Patient with Multiple Complaints

New patient presents with 3 days of dysuria, hematuria, urgency and frequency. No fevers, chills, or back pain. Physician orders Bactrim DS 1 tab bid x 3 days, phenazopyridine 200 mg tid after meals. Two days later, patient phones in that she has an itchy rash between the toes of her left foot. Physician recommends OTC terbinafine cream to apply bid x 10 days.

Tasks:

1. Establish new patient record
2. Enter current medications, allergies, and patient medical history
3. Enter complaints and assessments for first visit and establish the problem list
4. Order a urinalysis
5. Order prescription medication: choose ciproflaxin (or an alternative of your choice), complete order entry of other medications, change ciproflaxin to bactrim
6. Generate encounter form for billing purposes
7. Enter additional complaint for the itchy rash
8. Note recommendation for OTC medication on record

Evaluate Task 1: Establish new patient record

1. How many steps does it take to establish a new patient record? Is the process straightforward? Would training have been necessary to figure it out?
2. Does the sequence of the screens used to collect the information make sense to you? Does it accommodate who would be actually entering in the information (e.g., front desk, medical assistant, etc.)?

Evaluate Task 2: Enter current medications, allergies, and patient medical history

1. Upon the patient's first visit, does the system provide a screen(s) to collect all critical information typically obtained during an initial visit such as medications, allergies, and patient medical history?
2. If there are multiple screens, do the screens flow in a logical sequence? Did you have to jump around across different screens to enter standard questions?

Evaluate Task 3: Enter complaints and assessments for first visit and establish the problem list

1. When entering patient's complaints, is supportive information provided to indicate potential conditions/diagnosis?
2. Were examination, progress note, and other assessment screens set up in a way to allow you to efficiently document your assessments while matching your documentation habits? Are assistive features such as "smart text" templates or auto-

completion features provided to aid you in documenting efficiently? Were these features effective or did they get in your way?
3. Does the system support your workflow when the patient adds an additional complaint via phone shortly after the first visit?
4. Does the information entered in your assessments flow into the problem list? Did you need to reenter the information in the problem list? If the system automatically carries forward the assessment information to the problem list, should it have done that or would you have wanted to indicate the types of items that should show up on the problem list?

Evaluate Task 4: Order a urinalysis

1. How are outside lab orders handled? Could you stay within the system or did you need to go to an entirely different system to order the labs? Did the experience feel consistent with the way your EMR works (e.g., are key items such as categories of diagnostic tests labeled and presented similarly)?
2. When ordering the labs, are you able to get an estimated time for when the results would be available?

Evaluate Task 5: Order prescription medication

1. What steps did you have to take to put in the new prescription order? Is it quick and easy to create a new order?
2. Was it easy for you to find and select the medications you were looking for? Were you presented with irrelevant options based on your diagnosis?
3. When you had to select a medication, were the formulary categories presented in a way that made sense to you? Does the system let you type in the name of the medication?
4. Are you able to determine whether the selected medications were covered by your patient's insurance? Could you ascertain that from your prescription order screen?
5. As you enter each medication, are your choices including the dosage information efficiently summarized for your review?
6. When you had to change the choice of antibiotic, what steps did you have to take to make the change? Did the sequence of steps make sense to you?
7. How is the prescription given to the patient/pharmacy? If transmitted electronically, is there a copy (that cannot be filled against) easily provided to the patient? Is there a record of the script in your EMR?

Evaluate Task 6: Generate encounter form for billing purposes

1. What steps are necessary to enter in diagnosis and level of visit?
2. How is the encounter information sent to the billing/AR system?

Evaluate Task 7: Enter additional complaint

1. Upon reviewing the patient's record after several days, were you able to quickly get a sense of the patient's problems?
2. Where would you go to enter the additional "itchy rash" complaint? Did this make sense to you?

Evaluate Task 8: Note recommendation for OTC medication

1. Where would you enter the recommendation for the OTC cream? Would you want to have this documented on the patient's medication list?
2. Were you able to associate the OTC cream recommendation with your diagnosis for the complaint?
3. Are there any follow-ups necessary for this patient? Is it clear from the record whether there are any pending actions?

Scenario 2: Chronic Patient Recheck on Weight and Diabetes

Chronic patient with HTN, Obesity, Type 2 Diabetes and elevated LDL comes in for a recheck of his weight and diabetes. Doctor wants fasting BS (in office), Lipid panel & HbA1c (sent out), VS including weight, diabetic foot exam, and intervening history before seeing patient. At end of visit, doctor increases glipizide from 5 mg bid to 10 mg bid.

Task:

1. Review patient record
2. Enter instructions to staff for preparations prior to seeing patient
3. Staff receive physician instructions and perform instructions: Obtain fasting BS, vital signs including weight, perform diabetic foot exam, get intervening history and send out lab orders for lipid panel and HbA1c
4. Review staff updates to patient record
5. Evaluate lab results: lipid panel, HbA1c
6. Change existing prescription based on diagnosis: increase glipzide from 5 mg bid to 10 mg bid
7. Review care management plan and develop treatment plan.

Evaluate Task 1: Review patient record

1. Are you able to get a rapid snapshot of the patient's current health status?
2. Is the patient's historical record presented in a way that makes sense for you to a) quickly review the patient history? and b) look for specific occurrences of a condition?
3. Were you able to quickly get a sense of the patient's existing treatment plan?
4. Is the patient's demographic information such as gender and age displayed prominently and in a location that makes it easy for you to reference? Does this information stay on a consistent location throughout the various screens or in a location that makes sense to you?
5. Are tests and procedures that are due to be performed on the patient clearly indicated? Are you able to efficiently identify these tests and procedures and determine why they need to be performed?

Evaluate Task 2: Enter instructions to staff for preparations prior to seeing patient

1. What steps did you need to take to enter instructions to staff?
2. If you have fixed procedures on the types of activities performed for all your hypertensive patient consults, were you able to efficiently specify those activities?

Evaluate Task 3: Staff receive physician instructions and perform instructions

1. What steps did you (staff) need to take to retrieve physician instructions?
2. When performing the various instructions, how easy was it for you to update the patient's record with the relevant information, i.e. fasting BS, vital signs, result of exam?
3. Were you able to quickly figure out the period for intervening history you needed obtain? What steps did you need to take to add to the patient's history?
4. How are outside lab orders handled? Could you stay within the system or did you need to go to an entirely different system to order the labs? Did the experience feel consistent with the way your EMR works, e.g. are key items such as categories of diagnostic tests labeled and presented similarly?
5. When ordering the labs, are you able to get an estimated time for when the results would be available?

Evaluate Task 4: Review staff updates to patient record

1. Were you, the physician, able to see the status of the activities you had provided instructions to perform? How was this information presented? Was there sufficient information presented or too much irrelevant information?
2. When reviewing the updates to the patient's history, is it clear to you who the source of the information was? Were you able to tell where this information originated from?

Evaluate Task 5: Evaluate lab results: lipid panel, HbA1c

1. How were you informed that the outside lab results came in?
2. How were the lab results presented? Were abnormal results clearly differentiated from normal results?
3. How does the system handle the construction of flow sheets? Did you have to create a flow sheet manually? Were you able to easily include the most recent results on the flow sheet?
4. Were there any visual displays that helped you evaluate the results in the context of this specific patient (e.g., comparisons of patient's results vs. average for demographic category or graphs/sparklines of patient’s glucose or HbA1c over time--before and after treatment plan)?
5. Did you have to perform any manual calculations to figure out the lab results (e.g., did you have to calculate LDL or did the system calculate it and present it to you)?
6. How do you send a lab result letter/notification to the patient?

Evaluate Task 6: Change existing prescription based on diagnosis: increase glipzide from 5 mg bid to 10 mg bid

1. Upon evaluating the lab result and the other information required for the patient's visit, were you able to get to your next action quickly?
2. Based on your diagnosis to change the patient's prescription, what steps did you need to take to make the changes? Were you able to indicate your reasoning for adjusting the prescription?

Evaluate Task 7: Review care management plan and develop treatment plan

1. In formulating or revisiting a care management plan for the patient, does the system offer decision support for factors such as target LDL, aspirin therapy indication, reminders for periodic testing and immunizations?
2. Does the system display the appropriate risk factors for the patient based on their demographics and conditions? Were you able to determine how many coronary artery disease risk factors the patient has currently and the predictive risk for a coronary-disease-related event in the future?
3. Based on the various risks scores, does the system provide information to help guide your decisions about the treatment plan?
4. Were you able to provide the patient with intuitive and patient-friendly lab report results?
5. If you had patient education materials and handouts, were you able to provide them to the patient at the end of the visit? How did you obtain this material? What methods were available for providing the materials to the patient (e.g., print out from the system, e-mail to the patient)?

Scenario 3: Existing Patient Phones in Request for Medication Refill

An existing patient phones in a request for a medication refill.

Scenario variations:

- Patient ran out of refills for a drug taken regularly (e.g., allergy medication)
- Patient ran out of refills for a drug taken for a specific treatment event (e.g., antibiotics)
- Drug is a controlled substance
- Patient's insurance no longer covers the drug, switch to a different drug
- Patient has known allergy to NSAIDs
- Pharmacy contacts your office about the refill
- Patient needs refill to be sent to a new pharmacy
- Patient requests refill through a patient portal

Task:

1. Access and review patient's record
2. Determine if prescription should/can be refilled
    a. Alternate task: Prescription requires phone conversation with patient
3. Enter prescription refill order
    a. Alternate task: Switch to a different medication for patient with known drug allergies

Evaluate Task 1: Access and review patient's record

1. Does the system allow specialized workflows for different types of prescription refills? (examples listed above in scenario variations)
2. Upon accessing the patient’s record, what steps did you need to take to verify that the patient does indeed have an existing script for the desired refill?

3. How does the system handle the display of the patient's current medications? Are they displayed on a single screen or several screens? Is it clear which medications are current vs. past medications? Are you able to easily verify the last fill dates for past medications?
4. How does the system handle the display of other key information, such as allergies? Is all the important information you might want to quickly reference readily available on the display or quickly accessible with little disruption?
5. Were you able to ascertain from the record that the specific medication is indeed due for a refill? Could you find the specific medication quickly?
6. When reviewing the record, were you able to quickly refamiliarize yourself with the patient's medication history, problem list and the care/treatment plan associated with that medication? How many steps did it take to find the problem list associated with the medication?

Evaluate Task 2: Determine if prescription should/can be refilled

1. When determining whether the prescription can/should be refilled, were you presented with all the supporting information that you needed? Were you able to reference information such as your treatment plan notes, and lab tracking studies for the medication?
2. When reviewing the list of medications, were you able to get a sense of other prescriptions that are due/have an upcoming refill?
3. How does the system track medications that require refills? How are dates and refill intervals calculated and displayed? Is the information displayed efficiently for your prescription refill workflow?

(A) Alternate Task: Prescription requires phone conversation with patient

1. If you need to have a quick conversation with the patient to verify the effect of the medication on their condition, and then subsequently decide to change the dosage of the drug, what steps did you need to take to change the dosage?
2. Were you able to capture observations based on the patient's reports on the medication effects?
3. When entering the dosage change, were you able to enter relevant notes to update your treatment plan?

Evaluate Task 3: Enter prescription refill order

1. If you decide that the prescription should be refilled, did you have quick access to select the appropriate action (e.g., renew, discontinue directly from the medication list)?
2. If the refill requires a patient visit, are you able to indicate that patient visit is necessary and provide an interim (temporary) refill (e.g., for a reasonable dosage cycle until the patient can come in for a visit)? What steps did you need to take to enter a temporary refill?
3. If the patient's insurance will no longer cover the drug, are you notified prior to completing the refill? At what stage does the system inform you? Is this marked clearly?

4. If the medication refill is to be filled at a different pharmacy, how does the system accommodate this? Do you have to reenter the prescription from scratch? What steps do you need to take to change the pharmacy at this stage?
5. How are prescriptions presented for signature? If you tend to have refill approvals queued up for your signature, are you able to approve these all at once or do you have to go through each one?

(B) Alternate Task: Switch to different medication for patient with known drug allergies

1. If you need to switch to a different medication (e.g., due to insurance coverage), how does the system handle this change? What steps did you need to take to enter the change? Did you have to discontinue the medication and reenter information from scratch for the new drug? Is the replacement medication associated with the appropriate set of treatment plans/notes?
2. If the patient has a known drug allergy, is it clear from reviewing the patient's record that you're dealing with a patient who has a drug allergy?
3. When selecting the new medication, does the system allow you to select from a medication list that includes NSAIDs that the patient has indicated allergic reactions to? Does the system provide a warning if you select a drug that the patient is allergic to? If a warning is provided, was it clear from the warning that the patient is allergic to the NSAID you are about to prescribe and a potential allergic reaction may result?

Appendix C. Sample Post-Test Questionnaires

Post usability test questionnaires are administered to a test participant immediately after completing the test scenarios and before any debriefing. The first questionnaire included in this Appendix is the System Usability Scale (SUS).[4] This is a general questionnaire that has been used in many usability studies; if used as intended, it has been shown to be a reliable evaluation tool. A brief overview of the SUS can be found in Wikipedia.[5]. For instructions on how to score responses on the SUS as well as a sample scored questionnaire, see Brooke.[4]

The second sample questionnaire illustrates how you might include questions more directly related to the usability principles discussed as key for EMR design. Include questions aligned with your practice goals. For instance, if efficiency of clinical documentation is one of your key concerns, then include questions about the efficiency and ease of use of the documentation tools. This set of questions (or any that you include on your own) would not constitute a scientifically reliable tool, just a simple means of collecting subjective responses from your participants in a structured way. There would also be no official means of scoring responses to these questions other than face-value impressions.

1. System Usability Scale (SUS)

	Strongly Agree				Strongly Disagree
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

2. Additional Sample Usability Post-Test Questions

	Strongly Agree				**Strongly Disagree**
1. The application had clear, clean, uncluttered screen design.	1	2	3	4	5
2. The application kept screen changes to a minimum during completion of a task.	1	2	3	4	5
3. The application minimized the number of steps it took to complete tasks.	1	2	3	4	5
4. Information presented on screens was easy to comprehend quickly.	1	2	3	4	5
5. Information needed for a specific task was grouped together on a single screen.	1	2	3	4	5
6. Choice lists were clear and unambiguous.	1	2	3	4	5
7. Clinical documentation tools were efficient to use.	1	2	3	4	5
8. Alerts were only presented at appropriate times.	1	2	3	4	5
9. Data could be entered once then used in multiple places.	1	2	3	4	5
10. I felt confident I could make a mistake without losing my work.	1	2	3	4	5