Identifying Usability Issues between Expert and Novice Primary Care Physicians when using an Electronic Health Record (EHR)

Martina A. Clarke, MS1, Jeffery L. Belden, MD2, Min Soon Kim, PhD1,3
1Informatics Institute, University of Missouri
2Department of Family and Community Medicine, University of Missouri
3Department of Health Management and Informatics, University of Missouri

Abstract

Lack of usability consideration when designing EHRs may lead to high cognitive load, medical errors, and decreased quality of patient care. The work we describe attempted to address early learning barriers of beginning residents. To determine usability gaps between expert and novice primary care physicians, 17 physicians completed nineteen tasks, using think aloud strategy, based on an artificial patient visit note. Thirty-five usability issues, grouped under five themes, emerged during subtask analysis.

Introduction

Primary care provides medical care for a significant amount of common illnesses and account for a great number of patient visits. With the healthcare reform underway, an increase in patients will induce a shortage of primary care providers, which may reduce time physicians spend with patients. In clinical practice, the function of health information technology (HIT) is growing and more physicians are adopting EHRs extensively because of the financial incentives promised by CMS. Lack of usability consideration when designing EHRs may lead to high cognitive load, medical errors, and decreased quality of patient care. For physicians to use EHR effectively and efficiently, the system should allow physicians’ to complete clinical tasks without significant errors caused by confusion and difficulty of cumbersome systems. Novice and expert physicians were compared to discover whether physicians’ experience level with the EHR affects the number of usability issues they encounter. The objective of this study is to identify exclusive and mutual usability issues between expert and novice primary care physicians to eventually improve the EHR training program for new users of the EHR. Our hypothesis is that expert physicians will experience less usability issues than novice physicians when using the EHR.

Method

To determine usability gaps in use of EHR systems between expert and novice physicians, standard lab-based usability tests were conducted incorporating think aloud strategy and video analysis using Morae®. The usability session lasted approximately 20 minutes and was conducted at the University of Missouri Health System (UMHS) by eleven family medicine and four internal medicine resident physicians, and one attending physician. Currently there is no evidence-based way to measure a user’s EHR experience so novice physicians and expert physicians were differentiated based on clinical training level and experience because there is no evidence based way to measure EHR experience. Thus, first year residents were classified as novice users and second year residents and above and attending physicians as expert physicians. Convenience sampling method was used when selecting participants. The scenario presented to the residents in this study was a “scheduled follow up visit after a hospitalization for pneumonia.” Nineteen tasks commonly performed by both expert and novice primary physicians, were developed for the participants to complete. The tasks that were used in this study were also a part of the EHR training residents received at the beginning of their residency to make this evaluation practical and would not include complex tasks not covered in training. Residents were compensated for their participation.

Sub tasks were included in the usability analysis to deduce how participants interact with the system on a more granular level to recognize subtle usability issues, such as, errors, workflow, and navigation pattern variability that would have otherwise been unnoticed. Thematic analysis was employed to categorize common usability issues with each other. Based on themes from a study by Walji et al. 2, five themes were used: inconsistencies, user interface issues, structured data issues, ambiguous terminologies, and workarounds. Inconsistencies are defined in this study as a lack of uniformity among different elements, such as naming conventions, and location of buttons, in the EHR. User interface issues are difficulties that arise when the physician interacts with the EHR's screen menus and icons. Structured data issues are complications caused by data that resides in a fixed field, such as drop down menus, within the EHR. Ambiguous terminologies are obscure labeling of items in the EHR that makes the system difficult to understand. Workarounds are working processes that diverge from intended work methods to bypass issues instead of fixing them 3.

Results
There were thirty-one common usability issues observed among both novice and expert physicians, two unique usability issues identified among novice physicians and two unique usability issues identified among expert physicians. Six usability issues were related to inconsistencies, nine usability issues were concerning user interface issues, six usability issues were related to structured data issues, seven ambiguous terminology usability issues were identified, and six usability issues in regards to workarounds.

Table 1 Select examples of usability issues identified followed by implications to clinical practice and suggestion for improvement.

<table>
<thead>
<tr>
<th>Usability Issue</th>
<th>Example</th>
<th>Clinical practice/workflow Implications</th>
<th>Suggestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illogical ordering of lists</td>
<td>Task 17: Add a medication to your favorites list - Medication list cannot be sorted alphabetically when imported into a patients visit note.</td>
<td>Non-alphabetized lists frustrate physicians when they cannot figure out how to sort the medication list</td>
<td>Interface change: Import medication list to patient visit note in the order that physicians had them sorted in the CPOE.</td>
</tr>
<tr>
<td>Misuse of textboxes.</td>
<td>Task 7: Document new medication allergy - Some ‘read only’ fields appeared as editable text boxes. For example, when adding a medication allergy, a text box is highlighted which makes users assume that they should type in the textbox when they cannot.</td>
<td>Highlighting a field that cannot be edited fields brings attention to the field suggesting to the users that they should enter information into the field, which confuses the user and wastes time.</td>
<td>Interface change: Do not add yellow highlight to fields that cannot be edited.</td>
</tr>
<tr>
<td>Unclear import function</td>
<td>Task 13: Include diagnosis - Physicians do not know they should highlight all the diagnoses before clicking ‘Include’ to get the entire list of diagnoses into the visit note.</td>
<td>Takes more time when physicians have to repeat the process of adding wanted items because physicians’ first attempt was unsuccessful.</td>
<td>Interface change: Simplify the interface by being consistent with labeling action items.</td>
</tr>
<tr>
<td>Multiple fields with the same functionality</td>
<td>Tasks 14 &amp; 15 - There is no clear difference between the drop down labeled ‘Requested Start Date’, the drop down labeled ‘Requested Time Frame’, and the radio button labeled ‘Future Order’</td>
<td>Future labs may not be ordered properly so labs may not be completed at the right time. Patients may have to get the test redone, which brings additional cost to the patient.</td>
<td>Interface change: Remove fields that may be duplicates from the interface.</td>
</tr>
<tr>
<td>Extra steps to complete multiple orders</td>
<td>Task 15: Place order for Basic metabolic panel (BMP) - Novice physicians didn’t know how to create two orders concurrently. One novice physician mentioned knowing that there was a way to order them both but did not know how.</td>
<td>Take more steps to complete multiple orders</td>
<td>Training: Train resident on how to place multiple orders.</td>
</tr>
</tbody>
</table>

### Conclusion

Overall, this study was able to identify varying degree of usability gaps between expert and novice physicians that may be impeding the use of EHRs. The study revealed that higher experience levels with EHR is not equivalent to being an expert, proficient in using EHR. This study involves the physicians in one health care institution where only one EHR system is used. As such, the study’s findings may have limited generalizability to other ambulatory clinic settings due to the selection of different types of EHR applications and physician practice settings. However, the EHR platform to be employed in the study is one of the top commercial products with significant market share. Future studies should include a larger sample of physicians and broaden the scope to specialty physicians. Improvement in the EHR’s usability issues may lead to less frustration, which enhances user satisfaction, performance, and improves proficiency. These results may assist EHR vendors in improving the user interface for physicians to use effectively. This study may also assist in the design of EHR education and training programs by highlighting the areas of difficulty residents are currently facing.

### References