

Clinicians' Experience of Alerts in Electronic Health Records

MedInfo Team
Rochester Institute of
Technology
Rochester, USA
mit@rit.edu

ABSTRACT

Pop-up alerts in electronic health records (EHRs) have been seen to be interruptive of a clinician's workflow, sometimes causing annoyance and frustration. To investigate the current state of this situation, our research question is: *What is the experience of clinicians (physicians and nurses) with alerts from electronic health record systems?* We interviewed a physician and a nurse to explore how alerts affect their workflow. It was found that their general impression of alerting is positive, though some issues still need to be resolved. Alerts are now an integral part of medicine; they prevent errors and reduce the cognitive load of clinicians. It was also discovered that alerting, while improved since the initial rollout of EHRs, is not yet fully integrated into the medical workflow. We suggest that this is the next step in alerting improvement – to blend non-critical alerts seamlessly and transparently into a clinician's normal workflow.

INTRODUCTION

Electronic medical record systems not only introduce new ways of documenting medical care, but they also supply clinicians with assistance in providing care. One of the ways clinicians are notified of a potential patient care issue is by automated alerts. These alerts quickly stop what the clinician is doing and notify him or her of an issue that needs immediate attention. These can be triggered by, for example, a potential drug to drug interaction, based on the medication a provider is ordering and what the patient is already taking. Alerts may also give suggestions about, for example, a consult that may be needed, lab tests that are indicated, or a procedure that could be performed. Last year, two of the researchers for this study directly observed physicians in a hospital setting. At that time, the hospital was in the early stages of an electronic health record (EHR) rollout and many clinicians were very dissatisfied with the interruptive nature of the alerts. Some of the alerts were seen as unnecessary or as more annoying than beneficial.

Karunakaran and colleagues [1] observed this as well. They interviewed clinicians in a large teaching hospital to understand barriers to care teams using EHRs for collaborate information seeking, which is an important aspect of medical work. One of the barriers they found was that alerts were too frequent, and sometimes for “very trivial things” [1]. Alerts were interruptive to workflow and to interactions with patients and other clinicians.

Valenta and colleagues [2] studied physicians' perceptions of clinical decision support in the form of alerts at a Veterans Affairs (VA) clinic. The alerts, based on clinical practice guidelines, are built into the VA's VistA clinical information system, and are displayed to physicians at the point of care. The most important problems with alerting were perceived to be inappropriate or irrelevant alerts, too many alerts, reduced time to interact with patients, intrusion on professional autonomy, and perception that work is being monitored. It is notable that the researchers only studied negative perceptions of alerts, whereas we are interested in both positive and negative clinician experiences of alerts.

Our prior observation of physicians motivated us to conduct this research to learn about clinicians' *current* experience of receiving alerts, to see if it has changed. We wanted to study nurses as well as physicians, since nurses also receive many alerts. Our research question is: *What is the experience of clinicians (physicians and nurses) with alerts from electronic health record systems?* We decided that the best way, and in fact the only feasible way, we could answer this question in the limited time available was with an interview study.

METHODS

We chose to interview one physician and one nurse who are experienced users of EHRs. Using professional contacts and personal acquaintances, we identified a physician and a registered nurse who were willing to be interviewed. Though we had only two participants, they represent a diversity of user experience: user type (physician, registered nurse), EHR (Computerized Patient Record System (CPRS), EpicCare) and level of familiarity/comfort using EHRs (competent, “super user”/trainer).

The first interviewee, Participant Doctor (PD), is a primary care provider at a VA outpatient clinic, and has been using their CPRS system for about fifteen years. Our second interviewee, Participant Nurse (PN), is a registered nurse who works in high-risk Obstetrics at a large teaching hospital. She uses eRecord – her hospital's customization of EpicCare, an EHR developed by the software company Epic. During the 2011 rollout of eRecord, PN became a designated eRecord “super user” for her unit, serving as a resource to other nurses. She is now an eRecord trainer, but continues to work per diem as a nurse on the same unit.

The interviews were semi-structured. We developed an interview outline to help us ask the questions and communicate the information that we planned (see Appendix). The interview consisted of three sections: an introduction, the questions, and a conclusion/debriefing. In the question section, there were four “themes” that were explored: 1) what is your experience of alerting with your current EHR, 2) how do alerts affect your workflow, 3) what is your perception of the helpfulness of alerts, and 4) what are your alerting needs and goals. After stating the main question of a theme, we would go on to ask detailed questions pertaining to it. We also asked some spontaneous questions to help explore what the participant was relating. For the interview with PD, two researchers were present, and three were present for PN. In both interviews, one researcher conducted the interview, and another occasionally asked spontaneous questions. Each interview lasted about one hour.

RESULTS

Method of Analysis

The transcript for the first interview was given to one researcher to analyze for common themes in the responses given. A coding system was developed, then given to a second researcher to use in re-coding roughly one-quarter of the transcript. That section of the transcript was then compared line-by-line between the two coders in order to determine the percentage agreement. Out of 31 coded sections, 24 were coded the same by both coders, 7 were coded differently, and 5 were only coded by one of the two coders. Thus, the coding agreement was about 61%. The coding system was then used by the second researcher to code the second interview.

Coding System

Responses from the two interview participants were categorized by four codes: Information Provided, statements describing the means by which the participant received information from alerts; Positive Experiences, statements describing alerts that improved the user’s experience; Negative Experiences, statements describing alerts that detracted from the user’s experience; and Desirable Features, statements describing functionality not yet in place that the participant would like to see from alerts.

Interview 1

Information Provided

Participant Doctor (PD) reported receiving information from alerts in a variety of ways. The core of her workflow seemed to be centered on a notification list labeled in the EHR as “View Alerts.” This comprehensive list of notifications for PD’s patients is immediately displayed when she first logs in.

It can range anything from telling me that I haven’t signed my progress note on a patient, to telling me, yes, he’s been scheduled to see the

podiatrist like I ordered, to giving me his lab results, radiology results – it’s very broad. (PD)

A second type of alert she gets is a list of clinical reminders for a patient that are visible in a separate frame while writing a progress note. A third type is medication order checking, which presents alerts concerning patient drug allergies, drug-drug interactions, and polypharmacy (i.e., the patient is on numerous medications). Depending on context, some of these alerts will display a second time after being dismissed, in order to ensure that the user is aware of the information.

A fourth type of alert, in the form of a window with a blinking red bar of text, will be presented upon opening the charts of patients who are a suicide-risk, are violent, or are employees or volunteers at the clinic.

Positive Experiences

The interviewee reported a number of positive experiences relating to alerting. Alerts containing important information were unprompted (order checking), while others had information readily available (View Alerts). These alerts are clearly visible so there is no possibility that the user will not notice them, and they are always relevant to the user’s workflow. Furthermore, the alerts also contain information that the user can act on. For example, an alert notifying her of a lab value might influence what medication she chooses to prescribe.

If their kidney function is out of normal ... it pops up and tells me what their creatinine is. (PD)

Clinical reminder alerts remain unobtrusive in order to minimize distractions for the user, which might in turn cause them to lose focus on their interactions with the patient during a visit.

Negative Experiences

PD also reported some negative experiences when encountering alerts. These responses specifically involved the View Alerts list.

She reports getting 50 or more of these notifications a day, and there is very little prioritization — the only notifications labeled high urgency are requests for prescription refills.

If a patient calls in and leaves a message ... it will come in as one of these View Alert notifications. And sometimes these are things like – I need to have my toenails trimmed, and sometimes it’s things like – I’m having this terrible chest pain, I think I might be having a heart attack. And it comes in the same [priority]. (PD)

Finally with regards to View Alerts, any notification, once opened, will not be accessible later. PD has to write notes down on paper if she can’t act on them immediately, which defeats the purpose of electronic medical records.

Desired Features

Because View Alerts notifications automatically mark themselves as read upon being opened, PD would instead prefer to control this herself.

I'm surprised that it doesn't have [a way to indicate] OK – I've acted on this, now you can get rid of it. (PD)

Other desired features with View Alerts are: better initial prioritization, the ability to sort by urgency, and colored highlighting for urgency levels.

Interview 2

Information Provided

Participant Nurse (PN) reported that when she is in a patient chart, a specific type of alert called a Best Practice Advisory (BPA) can pop up. These can fire at any point in the workflow. BPAs are recommendations for a course of action to take, typically to perform a specific type of assessment or consultation. Examples given included a fall risk assessment, special dietary needs requiring a nutrition consult, a logged patient request to see a chaplain, or sepsis risk. BPAs have no difference in appearance based on severity; however there are different steps for resolving each one depending on what type of alert it is. In contrast, vitals alerts and lab result alerts use red highlighting to draw attention to abnormal values.

Positive Experiences

The participant gave a large number of responses for Positive Experiences with alerts. PN reported that the EHR she uses has the capability to optimize how, when, and which alerts are displayed.

[W]e've already optimized a lot of these things to try and reduce the pop-up fatigue ... with nursing ideas of, well, do we need this to really pop up every time you log on? (PN)

For instance, the option to select “not on treatment team” was added to certain BPAs so that a covering provider would not have to see the alert anymore, but it will still be passed on to someone on the treatment team. In general, alerts have been customized so that providers only see what they need to see. PN also reported that when alerts do appear, they can be helpful just from a workflow perspective.

[I]f you can't ask if the patient is safe at home in the present company ... you can choose the option of “unable to assess at this time” and then it will automatically snooze for about 4 hours. (PN)

[I]t's a lot easier to just order it straight from the alert instead of trying to find the order, and know that you are placing the right one ... It takes you right to what you need. (PN)

Overall, PN stated that alerts have little impact on patient interaction.

I think that if you know how to handle them appropriately, it doesn't have a very big impact. (PN)

Negative Experiences

Despite the optimizations reported in the previous section, PN related that there are still some problems with alerting. Users who are unsure how to handle certain alerts may cancel or snooze them, which results in those alerts being passed on to the next shift, creating a backlog.

If you are someone who does know what to do with them, you end up taking care of these things that weren't really your responsibility and didn't really happen when the patient was under your care. (PN)

Confusion can arise due to changes to the EHR system. Users only go through training once, and while system changes are communicated to the user base, there is no guarantee that everyone has read or understood those changes. Even for those trained on the latest system,

There are a lot of situations/alerts that you can't really replicate in a training system. (PN)

Desired Features

PN had limited responses fitting the category of Desired Features. One specific alert type – indicating that the patient may be at risk for sepsis – will often misfire on obstetric patients, so she would like to see its firing logic improved.

[T]hat pop-up could come up for anyone especially for obstetrics because the vital signs will be off more likely for pregnant women. (PN)

She also wanted to see the “cancel” button removed from most alerts in order to require users to act on them.

We can give them something that can get them out of it but ... they also know that they need to readdress this instead of continually ignoring it. (PN)

Limitations

There was not very much time for us to locate interview participants, which was only further hampered by the fact that medical professionals are quite busy individuals. Consequently, we were limited to only the two participants.

The coding system that was developed from the first interview was not particularly robust as it was only based on the first interview. Again, there was not much time to develop or refine it, and with an agreement of 61% considered adequate for the purposes of this study, the decision was made to use the system as it was.

Although effort was made by the interviewers to ask questions neutrally in order to avoid influencing the participant's responses, there is always an opportunity for bias to slip in, especially as both interviewers have existing knowledge of the domain.

DISCUSSION

Our research question was: *What is the experience of clinicians (physicians and nurses) with alerts from electronic health record systems?* In our previous observations of physicians, we experienced their frequent frustration with alerts, which they considered to be too numerous and sometimes trivial. Given how pervasive this problem was, and how much it is discussed in the literature [1, 2], we expected it to still exist today, somewhat ameliorated. Instead, the present experience of our two participants with alerts is significantly positive. PN is using the same EHR as the physicians in our previous observations, and she too had negative experiences of alerts in the early days.

... we did have a period of time where you were constantly getting alerts... people were getting alerts that weren't appropriate for them to address. (PN)

However, as discussed in the Results section, much work has been done at PN's organization since then to improve alerting, and her current experience is mostly positive.

Discussing the sepsis alert in particular, she explains that it reduces her cognitive load.

I like that I don't have to go through and look at all of the lab values and the vital signs and try to do all that comparison in my head - that if the patient does meet some of those early criteria for sepsis, I'm going to get that pop-up. You feel like [the alerts have] "got your back." (PN)

PD also has a positive view of alerts, describing View Alerts as indispensable.

I think that, as primary providers, [View Alerts] help us to keep track of what's going on with our patients ... You have to have these things, you have to have them. (PD)

There is still room for improvement, though, and both participants had several suggestions of how they would ideally like to get alerts, as discussed in Results, above.

Considering an alerting system in general, from what we learned from the two participants, we envision that an improved system would blend non-critical alerts seamlessly into a clinician's workflow. For example, PN described a number of alerts that can fire while admitting a patient (order a nutrition consult, order a chaplain visit, check if safe at home). If these could be blended into the admission screen, then dealing with these situations would seamlessly fit into PN's workflow. Critical alerts should still appear as pop-up windows, but less urgent notifications would no longer disrupt workflow.

Our ability to draw knowledge from this study is limited by the fact that we only had time to interview two clinicians, and did not have enough time to analyze these interviews as

thoroughly as we would have liked. Both of the clinicians were skilled EHR users, but it would have been instructive to have also interviewed less skilled users. We also found that including all "electronic health record systems" in the research question was too broad, because we learned that user experience with alerts will vary greatly depending on the specific EHR they use. Also, user experience depends on the specific role of the EHR user, whether physician or nurse or physical therapist, etc. So a research question we would like to study in the future is: *What is the experience of nurses with alerts from the eRecord EHR?*

CONCLUSIONS AND FUTURE WORK

In contrast to clinicians' sometimes negative perceptions of alerts when EHRs were first rolled out, the participants' general impression of the current state of alerting is positive. They perceive alerts as indispensable to their workflow – reducing their cognitive load and performing helpful double checks. One participant attributed the improvement in perception to improvements made in her EHR's alerting functions. There is still room for improvement, however, as the participants identified things they would like to see changed, and alerting is not yet fully integrated into the medical workflow. We suggest that this is the next step in alerting improvement – to blend non-critical alerts seamlessly and transparently into a clinician's normal workflow.

We intend to follow up this study with a similar one, but focused on one type of clinician – nurses – and one EHR, and involving participants who have a broad range of knowledgeability and comfort with the EHR. This would hopefully help us understand what issues less knowledgeable users have with alerts.

ACKNOWLEDGMENTS

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REFERENCES

1. Arvind Karunakaran, Young Hee-Nam, and Madhu Reddy. 2012. Investigating barriers to electronic medical record use during collaborative information seeking activities. In *Proceedings of the 2nd ACM SIGHIT International Health Informatics Symposium (IHI '12)*, 743-748. <http://doi.acm.org/10.1145/2110363.2110451>
2. Annette L. Valenta, Margaret M. Browning, Timothy E. Weddle, Greer W. P. Stevenson, Andrew D. Boyd, and Denise M. Hynes. 2010. Physician perceptions of clinical reminders. In *Proceedings of the 1st ACM International Health Informatics Symposium (IHI '10)*, 710-717. <http://doi.acm.org/10.1145/1882992.1883101>

APPENDIX: INTERVIEW SCRIPT

Introduction

- Because this is for a class, and we are not experienced interviewers, we have a script we will be following. But we would like you to feel free to bring up things we haven't asked about or expand on things as thoughts occur to you.

- We would like to record this session, if it is OK with you. We will later transcribe the interview and will destroy the recording. The interview will be the data that we work with. Is it OK to record?

- TURN ON RECORDING

- This interview is for a class on Research Methods in Human-Computer Interaction.

- We are learning about qualitative research by actually doing it (a "miniature" version) – this is not an actual research project, it is a class assignment.

- We very much appreciate you agreeing to be interviewed, which will help us to learn.

- We will be recording and analyzing the interview, but will keep your identity confidential.

- Of course, we don't want to discuss any patient confidential information.

- You can decline to answer any question.

- Our "research question" is: What is the experience of clinicians (physicians and nurses) with alerts from electronic health record systems?

- What we mean by an alert is a warning or notification that you receive from an electronic system via, for example, a pop-up box/window on a computer screen, an email, a text, or a page. An example of an alert message might be that the patient is allergic to the medication you are ordering.

Questions

1. Theme – what is your experience of alerting with your current EMR?

- a. What Electronic Medical Record system do you use?
- b. What types of activities are you doing in the system when you get alerts?
- c. Do you get alerts when you are not in the system (e.g., via page or text or email?)
- d. Can you describe what the alerts are like? Are there different types depending on the activity you are doing or the severity of the alert? What form are they in? (Can you draw them?)

2. Theme – how do alerts affect your workflow?

- a. What is the impact of alerts on your interactions with patients?
 - b. What is the impact of alerts on your workflow other than when you are interacting with patients?
3. Theme – what is your perception of the helpfulness of alerts?
- a. What works well about alerts – or how has your experience of alerts been positive? Examples?
 - b. What does not work well about alerts – or how has your experience of alerts been negative? Examples?
 - c. Do you have any frustrations or concerns with alerts? **What would you change if you could?**
4. Theme – what are your alerting needs, goals?
- a. How would you prefer/wish to be alerted of critical information? Of non-critical information? If you could have the perfect system to give you alerts, what would it be like?

Debriefing:

-Is there anything else you'd like to add?

-The thoughts you have shared with us today will help us in learning about Human-Computer Interaction and how to do research on it. Also, since some of us are in the Medical Informatics field, what you have shared with us will also help inform the future work we will do to try to improve healthcare information systems for users.

-Thank you!

-TURN OFF RECORDING