Subjective Assessment of Usefulness and Appropriate Presentation Mode of Alerts and Reminders in the Outpatient Setting

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Abstract

There is very little known about the limits of alerting in the setting of the outpatient Electronic Medical Record (EMR). We are interested in how users value and prefer such alerts. One hundred Kaiser Permanente primary care clinicians were sent a four-page questionnaire. It contained questions related to the usability and usefulness of different approaches to presenting reminder and alert information. The survey also contained questions about the desirability of six categories of alerts. Forty-three of 100 questionnaires were returned. Users generally preferred an active, more intrusive interaction model for "alerts" and a passive, less intrusive model for order messages and other types of reminders and notifications. Drug related alerts were more highly rated than health maintenance or disease state reminders. Users indicated that more alerts would make the system "more useful" but "less easy to use".

Introduction

One of the acknowledged benefits of outpatient electronic medical records (EMRs) is their ability to provide clinicians with useful information to help decision-making and decrease errors. In their call for the development of a Center for Patient Safety within the Agency for Healthcare Research and Quality, the Institute of Medicine editors include computer-assisted decision making among the technologies that could improve patient safety[1]. Improved quality, cost effectiveness and a decrease in undesirable practice variation are other anticipated outcomes. That electronic alerts and reminders are useful has been well demonstrated in numerous studies[2-4]. Given their potential benefits, there is great incentive for system implementers to rapidly increase the number and coverage of alerts and reminders. There is, however, evidence that the effect of alerts may degrade over time[5] and that users may ignore or override alerts[6]. There are a number of related usability issues including whether alerting systems should err on the side of sensitivity and error detection or specificity and fewer false positives[7]. In fact, there is very little known about the limits of alerting in the outpatient setting. Under what circumstances does "benefit" turn to "bother"? What types of alerts and which presentation modes do users prefer? What constitutes a well-formed and appropriately applied alert?

Because our goals are to develop systems that provide both usefulness and usability, we are interested if, in our setting, such alerts improve clinical quality, and if our users consider them easy to use. We queried clinicians about their subjective assessment of usefulness and appropriate presentation mode of alerts and reminders.

Background

Clinicians at Kaiser Permanente Northwest have used a comprehensive EMR since 1994 and have experienced an increasingly rich information resource[8,9]. The EMR supports presentation of passive, active, solicited, and unsolicited alerts and reminders. We define passive as those alerts that are displayed and available in the background on various screens, and active as those that pop-up and require immediate attention. By solicited we mean alerts that are presented at the user's request, and unsolicited as those that are not requested. Recently we introduced relatively intrusive, active, unsolicited alerts and we are planning to introduce additional ones.

Alert Notification Modes

There are a variety of alert notification modalities within our EMR that could be studied. The ones we chose to illustrate the spectrum were the entirely passive and unintrusive Health Maintenance Reminder (HMR) and the active and somewhat intrusive BestPractice™ alert (BPA).

Health Maintenance Reminders (HMR)

The presence of an HMR is indicated by the words "Health Mnt", in red letters, on the

clinician's schedule screen when the electronic chart of an eligible patient is selected. Eligibility for an HMR would typically include a patient who is due or overdue for a designated preventive care item such as a Pap smear or flu shot. For the clinician to determine the specific content of the reminder, she would click a button to receive a detailed message. Then, if she chose to act on the reminder, she would open another window and either place an order or enter an exclusion reason ("over-ride").

BestPractice Alerts

In contrast, BestPractice™ alerts are triggered when certain predetermined components or screens of an eligible patient's electronic medical record are viewed. A pop-up window is presented. This might occur a maximum of one time per visit session per clinician for each eligible patient. This alert causes at least a short interruption to workflow, as it requires a response before the previous activity can be resumed. It contains a brief message, such as the following, regarding the nature of the alert: "This patient is on the Diabetes Registry and/or the ASA high risk list and should be on ASA unless contraindicated. Please document ASA use or contraindication using the Allergy detail button." It then offers a method of satisfying the alert or postponing it, presenting the question "Do you want to view the SmartSet™?" If the user chooses "No", the alert is effectively postponed until the next encounter. If the user chooses "Yes", she is brought to a screen on which the specified order(s), associated data and documentation are pre-populated (a so-called SmartSet™). To complete the order requires only an additional click. To enter exclusion criteria, correct apparent false positive alerts or add additional details requires additional steps, however.

Prior Clinician Experience with Alerts

Prior to and during the study period all clinicians were exposed to passive "health maintenance reminders", in the normal course of their work. The clinicians were also all exposed to active "alternative medication alerts", consisting of a pop-up window with prescribing guideline information triggered by certain medication orders. In addition, during a one-month period ending just prior to distribution of the survey half of the clinicians were randomly assigned to receive an active (BestPractice™) electronic alert when viewing the EMRs of patients eligible for an aspirin therapy recommendation. This is the first alert of this type that we have implemented. At the time of this study we had not implemented drug-allergy, drug-drug, or drug-disease alerts.

Clinician Acceptance of Alerts

Previous work suggests characteristics that may contribute to user acceptance of alerts (Table I). In a simple experiment, users assigned higher value in direct proportion to the number of alerts, up to a limit, and to alerts defined as higher priority. However, they required greater accuracy from the higher priority alerts[10]. Subject domain, relevance to the particular patient or circumstance, and context of the user's current task and focus of attention[11] may also contribute to a user's assessment. Presentation mode or nature of the interruption[11] including its content, degree of intrusiveness and its various perceptual characteristics such as size, color, shape, auditory cueing and similar design elements may all contribute to this judgment[12]. Finally, the alert's usefulness including the ease with which it can be evaluated for relevance and acted upon may enter into this appraisal.

Table I.
Characteristics contributing to user acceptance of clinical alerts

Number
Priority
Accuracy
Subject Domain
Relevance
Presentation Mode
Usefulness

Methods

One hundred, randomly selected Kaiser Permanente Northwest (KPNW) primary care clinicians, all experienced users of the EpicCare™ electronic medical record (Epic Systems, Madison, Wisconsin), were sent a four-page questionnaire by interoffice mail. A reminder was sent after 1 week, by electronic mail, to all 100 clinicians

Clinicians were eligible for selection if their practice departments were Family Practice or Internal Medicine. Their degrees included Medical Doctor, Osteopathic Doctor, Physician Assistant, and Nurse Practitioner. Eligibility further required that they were full time (at least .88 Full Time Equivalent) during the one-month study period. Clinicians occupying administrative positions, members of designated Clinical Strategy Committees, and members of the Clinical Information System (CIS) Advocates (a group of volunteer CIS

"champions") were excluded. Study participants were randomly selected from this group of clinicians.

Questionnaire Content

The questionnaire contained questions about respondent characteristics. It also contained two multi-part questions related to the usability and usefulness of approaches for presenting reminder and alert information.

The survey contained a multi-part question about the desirability of six potential categories of alerts. These categories were Drug-Allergy, Drug-Drug, and Drug-Disease interactions, Overdue and Due Health Maintenance reminders, and other Disease State Management reminders. In addition, there was a multi-part question related to the preferred interaction model, in terms of degree of intrusiveness ranging from "always passive" to "always active", for four categories of alerts and reminders. Active was defined as "such as a pop up message requiring your attention at the time of presentation". Passive was defined as "available in the background for review when and if you wish". The categories were: 1) Alerts ("e.g.: drug-allergy or drug-drug interaction information when a drug is ordered"), 2) Order Messages ("e.g.: alternative drug or procedure recommendations in response to the placement of an order"), 3) Reminders ("e.g.: health maintenance or disease state guideline recommendations") and 4) In-Basket Notifications ("e.g.: a just posted lab result or a telephone message relating to a patient you saw yesterday."). Finally, the respondents were asked to respond to the open-ended question: "Do you think more alerts and reminders in EpicCare will make it more or less ***useful*** and more or less ***easy to use***? Please explain."

Results

Clinicians returned forty-three of 100 questionnaires. Respondents did not differ significantly from the clinicians in the entire sample on those characteristics measured (Table II).

Thirty-one (74%) of respondents thought **Drug-Allergy** interaction alerts would be "always useful" whereas 6 (14%) thought they would "usually" and 5 (13%) "occasionally" be useful. For **Drug-Drug** interactions, the acceptance was similar with 30 (71%) of respondents indicating they would "always", 9 (21%) "usually" and 3 (7%) "occasionally" be useful. Enthusiasm was even stronger for **Drug-Disease** interactions. Here 30 (71%), 10(24%) and 2(5%) reported they would "always", "usually" and "occasionally" be useful, respectively. The response for the other

Table II.

Characteristics of samples

	Responders	Sample
Total	43	100
Age*	42.8/7.8	NA
Gender	--	--
Male	70 (30)	64 (64)
Female	30 (13)	36 (36)
Degree	--	--
MD/DO	79 (34)	72 (72)
AH	21 (9)	28 (28)
Specialty	--	--
IM	47 (20)	52 (52)
FP	53 (23)	48 (48)
Yrs of Practice*	13.4/8.3	NA
Yrs of EMR Use*	4.1/2.8	NA

NA=not available. Figures expressed as: *Mean/S.D. or Percent(number)

categories of alerts and reminders was more mixed. However, in each case 69-75% of respondents indicated they would "always", or "usually" be useful. (Table III.). The three drug related categories have similar distributions, as do the three health maintenance or disease state categories. (Figure I).

Table III.

Usefulness of alert and reminder categories by percent and (number)

Type of Alert/Reminder	Never	Occ.	Usually	Always
Drug-Allergy	-	13(5)	14(6)	74(31)
Drug-Drug	-	7(3)	21(9)	71(30)
Drug-Disease/Condition	-	5(2)	24(10)	71(30)
Overdue Health Maint.	2(1)	24(10)	38(16)	36(15)
Due Health Maint.	5(2)	26(11)	33(14)	36(15)
Disease State Manag.	5(2)	20(8)	41(17)	34(14)

Maint.=maintenance. Manag.=management. Occ.= occasionally. Figures expressed as: Percent(number).

User responses to questions about their preferred interaction model showed variability (Table IV). Some users preferred "always passive" and some "always active" for each category of alert or reminder. However, users generally preferred an active, more intrusive interaction model for "alerts" and a passive, less intrusive model for order messages and other types of reminders and notifications.

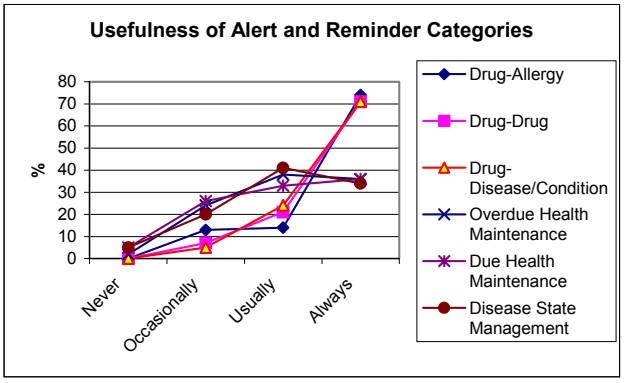

Figure I.

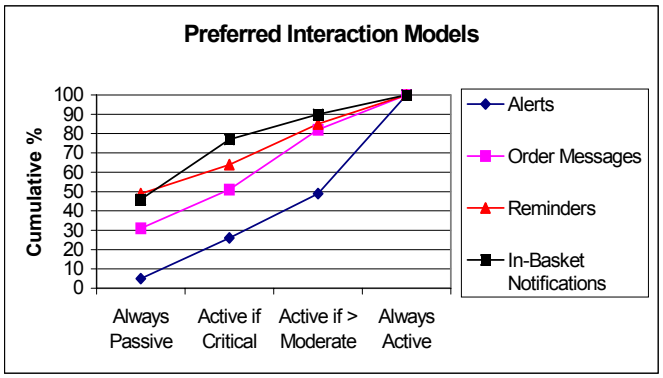

Figure II.

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Table IV.

Clinician preference for notification intrusiveness by notification type by percent and (number)

Type	Always Passive	Active if Critical	Active if ≥ Moderate	Always Active
Alerts	5 (2)	21 (8)	23 (9)	51 (20)
Order Messages	31 (12)	20 (8)	31 (12)	18 (7)
Reminders	49 (19)	15 (6)	21 (8)	15 (6)
In-Basket Notifications	46 (18)	31 (12)	13 (5)	10 (4)

Figures = Percent (Number).

If one sums the responses to each of these categories, it is apparent that for all categories except for alerts, at least 50% of the responses are accounted for by ”always passive” or “active if critical”. Adding in, “active if at least moderate”, accounts for at least 80% of responses in these categories. In the case of alerts, however, all three of these categories together still represents only 49% of responses. Respondents view alerts differently than the other categories (Figure II). The figure suggests that clinicians prefer progressively more intrusive notification as one progresses from in-basket notification to reminders, order messages and then alerts.

User Comments

In response to the question about whether more alerts and reminders will make the system ‘more or less useful’ and ‘more or less easy to use’, users wrote thirty comments. The expressed opinions covered the gamut. However, the predominant view was “more useful” but “less easy to use”, with 14 responses indicating each of these views. By contrast, “less useful” and “more easy to use” were indicated by only 1 and 2 responses respectively. Fourteen responses essentially indicated, “it depends”.

Characteristic comments included: “More useful. Less easy to use!!!”; “probably make it more useful/easy to use though going through all the messages/alerts will take more time”; “Alerts are useful but where they are placed is important.”; “I am likely to ignore the alert if it is not critical and can wait or is not pertinent to immediate problem.”; “Might be useful as long as they don't slow me down”; “Too many "active" alerts/reminders will get in the way, disrupt workflow”; “Many of the ASA alerts come up in patients of mine with documented ASA already being taken, so the alert is a nuisance”; “It all depends. If carefully selected and easily accessed and/or bypassed could be very useful. Otherwise, could be too time consuming, disrupt workflow and invite ignoring them without attention to them”.

Discussion

Some alert domains or categories may be better accepted than others. In this study, drug related alerts were more highly rated than were health maintenance or disease state reminders. Clinicians distinguished between different interaction models and indicated a preference for more active interaction for alerts and more passive interaction for order messages, reminders and notifications.

It is not clear from our data, however, whether the apparent affinity for actively presented drug information truly represents a special concern or requirement for drug data. Because we represented alerts in the questionnaire as “e.g.: drug-allergy or drug-drug interaction information when a drug is ordered”, the data could be confounded, given the high usefulness rating of drug related alerts previously noted. Perhaps the “active” endorsement is for

drug information, not for alerts per se. Had we included other possible alert types in the definition, such as for "abnormal or panic laboratory results", "out of range or critical vital sign values" or "contraindicated procedure orders", we might have been better able to make this distinction. Moreover, it is again important to note that our implementation of EpicCare did not yet include drug related alerts and so our users performed this rating without having experienced them. An alternative hypothesis is that the higher endorsement for alerts related to prescribing, as opposed to those related to being reminded to do something, is linked to the health professionals' greater sense of culpability for acts of comission than for acts of omission, originating with the admonition "primum, non nocere", "first, do no harm".

User comments support the assertion that characteristics of alerts such as number, accuracy, ease of satisfying, and degree to which they support or disrupt workflow will affect acceptability of specific alerts. Not surprisingly, many of these busy clinicians expressed concern about alerts costing time.

The present study examined a one-month period, commencing with the introduction of a single intrusive alert. This study does not evaluate the effect of multiple simultaneous or sequential alerts. Users did express concern about alert numbers.

This study was performed in a single health care organization, with experienced users of a single EMR and represents a view of their perception at a given moment in time. Confirmatory studies with other organizations and EMRs will be useful. It will also be useful to revisit some of these issues with these users at a later date.

Conclusion

Users generally preferred an active, more intrusive interaction model for "alerts" and a passive, less intrusive model for order messages and other types of less urgent reminders and notifications. Drug related alerts were more highly rated than health maintenance or disease state reminders. Users indicated that more alerts would make the system "more useful" but "less easy to use".

Further understanding of user requirements, preferences and tolerances related to computer-assisted alerts and reminders should advance the design of systems that better achieve improvement in safety, quality and cost.

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