

Clinicians' Assessments of Outpatient Electronic Medical Record Alert and
Reminder Usability and Usefulness Requirements: a Qualitative Study

By

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A DISSERTATION

Presented to the Department of Medical Informatics and Outcomes Research
And the Oregon Health & Science University School of Medicine
In partial fulfillment of
the requirements for the degree of
Masters of Science
May 2002

School of Medicine
Oregon Health and Science University

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Acknowledgements

I especially want to thank my wonderful wife, Kathy and my children Shoshanna and Jacob, for “loaning” me to this pursuit and tolerating my too frequent preoccupation with it. “Greater love hath no man.”

I thank the clinicians who took an evening to join a conversation about alerts and reminders, Kati Traunweiser for capably serving in the role of Assistant Moderator of the three focus groups and Dee Shaw who recruited the participants. I thank all the individuals who observed one or more focus group and shared their comments with me: Homer Chin, Adrienne Feldstein, Malinda Fleege, Dawn Hayami, Holly Jimison, Dan Laferriere, Val Lawrence, Peggy McClure, Nan Robertson, Lisa Shook, Dean Sittig, David Smith, Nancy Stevens and Nancy Vuckovic. I want to acknowledge the members of my thesis committee, especially Chairman, Paul Gorman, M.D. In addition, Dean Sittig, Ph.D., attended all three groups, independently coded the first group, assisted me in comparing our results, and provided considerable support and counsel through out the project. Finally, I want to thank Epic Systems, Corporation, and it’s President, Judy Faulkner, for believing in and funding this research.

This project was partially funded by a grant from Epic Systems, Inc. Additional support was provided by the Kaiser Permanente Clinical Systems group.

Abstract

Electronic medical record alerts and reminders are increasingly relied upon as a means of decreasing medical errors and increasing the quality and cost-effectiveness of care. They may serve as useful memory aids and draw attention to a variety of situations in which safety, quality, or optimal utilization of scarce resources might otherwise be compromised. However, clinicians indicate that alerts and reminders can either help or hinder. Discerning the elements that determine which they will do, and the requirements of a helpful alert or reminder was the focus of this study.

Three focus groups consisting of a total of 16 participants were convened. These included 10 male and 6 female primary care clinicians. There were 3 pediatric, 8 family medicine, and 5 internal medicine specialists, 13 physicians, 2 physician assistants, and 1 nurse practitioner. The mean duration of time with Kaiser Permanente was 9.5 years, with a range of from 1 to 24.5 years. All participants had access to the electronic medical record in their exam rooms.

Focus groups were recorded and transcripts were iteratively coded and analyzed for themes that would help illuminate characteristics of a helpful alert or reminder. Five themes emerged: Efficiency, Usefulness, Information Content, User Interface, and Workflow. In addition there were New Ideas and Surprises. Following a question-by-question summary of responses, each theme is described in detail and supported with illustrative excerpts. This is followed by a summation of requirements and further discussion.

Introduction

This study characterizes determinants of usable and useful outpatient electronic medical record alerts and reminders. The project involved planning, conducting and analyzing a series of focus groups of current users of an electronic medical record at Kaiser Permanente Northwest, in Portland, Oregon.

Background and Significance

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 safety¹. Improved quality, cost effectiveness and a decrease in undesirable practice variation are other anticipated outcomes. Such information may be integrated into electronic medical records utilizing a variety of methods and include alerts, reminders, and other knowledge resources such as on-line textbooks, journals, clinical guidelines and similar references.

However, many barriers to physicians following clinical practice guidelines have been identified². These barriers include: lack of awareness of the guideline's existence, lack of familiarity with the guideline's recommendations, lack of agreement with the guideline, lack of self-efficacy (the belief that the clinician can actually initiate and sustain a behavior), lack of outcome expectancy (the belief that a given behavior will result in a particular outcome), inertia of previous practice, and external barriers including patient and environmental factors². It is probable that some of these barriers, at

least awareness and familiarity and possibly lack of self-efficacy, outcome expectancy and inertia, could be mitigated with timely and appropriate alerts and reminders, particularly if they were designed to be actionable, supportive of clinical practice and compatible with desired workflow.

That electronic alerts and reminders can be effective has been well demonstrated in numerous studies³⁻⁵. System implementers typically have a mandate from their sponsors to derive benefit from EMRs and, given the potential utility of alerts and reminders, there is great incentive for system implementers to rapidly increase their number and coverage. There is, however, evidence that the effect of alerts may degrade over time⁶ and that users may ignore or override alerts⁷. Although this is partially attributable to the barriers noted above, there are also a number of related usability issues and questions. What types of alerts and which presentation modes do users prefer? What constitutes a well-formed and appropriately applied alert? How are they perceived by EMR users, and what characteristics make them more or less usable^{8,9}? Should alerting systems err on the side of sensitivity and error detection or specificity and fewer false positives¹⁰? Under what circumstances does “benefit” turn to “bother”? In fact, there is very little known about the limits of alerting in the outpatient setting.

Clinicians at Kaiser Permanente Northwest (KPNW) have used a comprehensive EMR since 1994 and have experienced an increasingly rich information resource¹¹⁻²¹. This EMR supports the presentation of a variety of alerts and reminders. KPNW clinicians also have ready access to on-line resources including a rich and evolving complement of textbooks, journals, and clinical practice guidelines via intranet and the Internet. It was soon after first enabling electronic alerts and reminders at KPNW that the

members of the EMR Implementation Team began to hear the first concerns about them. Figure 1 shows the actual text of an electronic message received by a leader of our implementation in 1999. Those of us on the project team were excited that after several years of focusing our energy almost exclusively on rolling out the EpicCare™ electronic medical record, we were finally at a point where we could turn our attention to decision support, an area that we firmly believed offered the promise of great benefit to our users and to the overall organization. At that point, however, I don't think any of us had given

·12/20/99
·TO: Chin, Homer (CHINHO)
·Subject: Epic red lights· I am having problems with Epic red lights that flash at me all day.
· The health maintenance reminders are slowing me down. I am frustrated at the smoking one especially; it never seems to go off no matter how hard I try to make it go away. The aspirin one is also a big bother; many patients have relative contraindications and I do not have the time to quickly find out how to exempt them. We have been given way too much information in too little time.
· I am not sure if you are hearing this from other physicians or not. I would appreciate any feedback you might happen to have.
· Thanks, "seeing red"

Figure 1. Clinician Frustration With Alerts

much thought to the actual impact of alerts and reminders on users. We really hadn't considered that the impact might be negative as well as positive. However, feedback such as that illustrated here caused me to begin to reflect on this matter. I decided that these clinicians and this setting presented an important opportunity to gain further understanding of this topic.

Definitions

In this document the words **usability** and **usefulness** are used. The Merriam-Webster online dictionary defines “usable” as an adjective meaning “capable of being used, convenient and practical for use.” Usability is a noun having the quality of being usable. This dictionary defines “usefulness” as a noun meaning “the quality of having utility and especially practical worth or applicability.” Nielsen²², however, defines usefulness as having two dimensions, utility and usability, so this acknowledged usability expert would argue that usability is really a component of usefulness. He defines utility as “whether the functionality of the system in principle can do what is needed” and usability as “how well users can use the functionality.” Usability, he maintains, is itself a multidimensional concept that incorporates learnability, efficiency, memorability, error rate and error handling, and user satisfaction. In this paper, I use “**usability**” in Nielsen’s multidimensional sense, that is, “how easy are the alerts to use?” I use “**usefulness**” in the sense that Nielsen uses “utility”, that is, “do the alerts work?” Later, when I discuss the themes that emerged from the focus group data, some of these terms surface again. Of the five themes, two are dimensions of usability: efficiency and user interface. Three are dimensions of usefulness: information content, workflow, and what users, in a more colloquial application of the word, might themselves term usefulness.

In this paper the terms “**alert**” and “**reminder**” are used nearly interchangeably. They both prompt the user to consider information in making a decision or performing an action. Their connotations may be somewhat different, with the term “alert” suggesting more urgency and perhaps exigency. The term “reminder” implies more of a memory aid and perhaps connotes less threat. Although I have generally tried to respect these nuances

in usage, as we will see alerts and reminders exist along a continuum and their effect and implication depends on a variety of properties including the way in which they are presented and their information content.

In further characterizing alerts and reminders, I use “**intrusive**” versus “**non-intrusive**” to refer to a spectrum of prominence in the human-computer interface. I use “**modal**” to refer to one particular result of employing a computer interface with “modes.” In human computer interface parlance, the mode dictates how the interface responds to input. “For a given gesture, the interface is in a particular mode if the interpretation of that gesture is constant²³.” The consequence of this that is germane to the present discussion is that a pop-up window or dialog box that is modal forces the user to stop whatever he is doing and turn his attention to it. “**Non-modal**” interface elements do not require a response before the user performs other actions. Finally, I use “**solicited**” to mean alerts that are presented at the user’s request, and “**unsolicited**” to refer to those that are not requested.⁹

BestPracticeTM alerts are modal, “pop-up” alerts and SmartSetsTM are pre-populated order and charting sets developed and utilized by Epic Systems in their electronic medical record system, EpicCareTM.

Previous Work

Previous work suggests characteristics that may contribute to user acceptance of alerts. 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 alerts⁸. Subject domain, relevance to the particular patient or circumstance, and context of the user's current task and focus of attention²⁴ may all contribute to a user's assessment. Presentation mode or nature of the interruption²⁴ including its content, degree of intrusiveness and its various perceptual characteristics such as size, color, shape, auditory cueing and similar design elements may also contribute to this judgement²⁵. Finally, the alert's usefulness including the ease with which it can be evaluated for relevance and acted upon may be a factor. A recent randomized control trial of computerized prevention reminders as part of an inpatient physician order entry system demonstrated effectiveness, in contrast to an earlier study in the same institution²⁶. The authors attributed the dissimilar outcome to "relatively small changes in the presentation of these reminders." In the first case, they were non-intrusive, required physicians to "make a deliberate choice to view", and suggested but did not facilitate orders. In the successful case, the reminders were more intrusively displayed, highlighted with color, complete with pre-populated orders that could be effected with a single keystroke, set to default to "ordered" and repeated up to four times for each eligible patient for each hospital stay. Furthermore, the "escape" key was disabled, making fulfilling the reminder definitely the "path of least resistance".

In a questionnaire study performed at Kaiser Permanente Northwest, users generally indicated a preference for a more intrusive interaction model for "alerts" and a less intrusive model for order messages and other types of less urgent reminders and notifications. Drug related alerts appeared to be 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"⁹. The study raised a number of issues such as

whether an apparent affinity for actively presented drug information represents a special concern or requirement for drug data as opposed to for active alerting per se.

Alternatively, it was suggested that the higher endorsement for alerts related to prescribing, as opposed to those related to being reminded to do something, might be linked to the health professionals' greater sense of culpability for acts of commission than for acts of omission. The questionnaire examined a one-month period, commencing with the introduction of a single intrusive alert. It did not evaluate the effect of multiple simultaneous or sequential alerts. In that study there was also an open-ended question that solicited user comments on the usefulness and usability of alerts. User comments supported the assertion that characteristics of alerts such as number, accuracy, ease of satisfying, and degree to which they support or disrupt workflow affect the acceptability of specific alerts. Not surprisingly, many of these busy clinicians expressed concern about alerts costing time. Although providing valuable insight, it was not clear that the comments identified all the pertinent user acceptance criteria.

There have been some studies examining clinical questions that occur to physicians during patient encounters and the degree to which they chose to pursue their answers, although these studies were not of clinicians using electronic medical records. One study suggests that primary care clinicians pursue about 30% of their questions²⁷. The authors found that only two factors were significant predictors of pursuit of the answers: the physician's belief that a definitive answer existed, and the urgency of the patient's problem. Neither the difficulty of finding the answers, nor other factors, was found to be a significant predictor. Nevertheless, one wonders whether timely alerts, reminders or knowledge-based messages would increase the likelihood that important clinical

knowledge gaps would be filled. An observational study of 103 family doctors found they asked an average of 0.32 questions per patient, the most common of which were related to drug prescribing (19%)²⁸ Except for the drug questions, most topics were not pursued (64% not pursued, overall). When they did pursue an answer, they took an average of less than 2 minutes doing so. A study of internal medicine residents revealed similar findings²⁹. The residents identified an average of 0.66 questions per patient and pursued 29% of them. The most common reason stated for failure to pursue the answers was lack of time (60%), followed by forgetting the question (29%). Once again the special attention accorded to drug related content emerges and makes this domain especially attractive to consider for alerting. There appears to be real potential to address clinical knowledge or attention gaps in an efficient manner with appropriate alerts and reminders.

Purpose of Evaluation and Research Questions

The objective of this evaluation was to generate insights and acquire a better understanding of the requirements of a useful and usable ambulatory information environment with special attention to alerts and reminders. Despite the cited evidence, the “jury is out” on the ultimate value of such a milieu. Accordingly, the evaluation could be performed with independence, objectivity, and without advocacy.

The specific research questions at the outset were:

- What are the determinants of whether an electronic alert or reminder will be a help or a hindrance?
- What are the requirements of a helpful alert or reminder?

The intent was to draw conclusions based on the collected data and, as is the nature of qualitative research, the goal was “illumination rather than judgment³⁰.” Some of the hypotheses I considered before performing the study were:

- The users will distinguish between types of alerts and will be more accepting of some than of others
- They will be more accepting of alerts and reminders that they recognize as helping them prevent important errors (acts of commission) than of those assisting them in performing important tasks that they would not otherwise be likely to remember to perform (acts of omission).
- They will not categorically prefer a given interaction mode over another, but will understand that different modes lend themselves better to particular situations
- Their receptivity to alerts in general and to specific alerts in particular will depend on whether they perceive that alert has saved or cost them time, and secondarily, whether it has added significantly to the quality of the care or service that they are able to deliver
- Their receptivity to alerts will depend on how they perceive their own role and responsibility in the health care system and vis a vis the patient’s care. (e.g.: this might vary between primary care clinicians and non-primary care specialists, and between physicians and their paneled patients as opposed to non-continuity patients.)

Evaluation Method and Metrics

This evaluation continues the exploration of these issues using qualitative methods to perform data collection, validation, analysis and interpretation. Qualitative methods are particularly appropriate here because of the early stage of knowledge in this domain and the lack of clear definition of exactly what the important questions or pertinent variables are. I planned and carried out three focus groups of representative users of the clinical information system at Kaiser Permanente Northwest for the purpose of identifying key attitudes and acceptability criteria for electronic alerts and reminders. The setting and subjects of the study were clinicians at KPNW and the outcome was a qualitative description of issues and concerns related to usability and acceptability of outpatient alerts and reminders among the targeted group of clinicians.

To increase its external validity and generalizability it would be of interest to extend the study to at least one additional environment where an electronic medical record with alerts and reminders is in use. This was beyond the current project scope, however.

Focus Groups

The study utilized focus groups³²⁻³⁶ of clinicians. Focus groups allowed exploration and discovery of the range of usefulness and usability concerns that this group of experts believes are pertinent and important. From analysis of the focus group data, I attempted to discern the common themes, underlying meanings, and principles. These, in turn, may be utilized to generate hypotheses that may be tested in further phases of study.

Intent of Focus Groups

The intent of the focus groups was to carry on a focused group conversation to explore clinicians' attitudes toward outpatient alerts and reminders. The goal was to achieve a more comprehensive and more scientific understanding of the range and variability of attitudes as well as factors that might influence or determine them. In focus group research, while it is important that the study be focused on a researchable topic, the intent is to not overly constrain the conversations, thereby potentially missing unanticipated relevant themes, beliefs or attitudes³².

Number, Size and Location of Groups

In focus group research it is important to have an adequate number of groups, for several reasons³³. First, to achieve a comprehensive understanding, it is important that a wide range of perspectives is included. Moreover, there needs to be an adequate opportunity for participants to express them. Ideally, one would perform focus groups until succeeding groups no longer raised new issues, utilizing an important qualitative research concept known as "theoretical saturation", introduced by Glaser and Strauss³¹. Second, the success and outcome of any particular group is dependent on many factors, and therefore the likelihood of overall project success may be increased with more groups. The discussion that unfolds in any given group will be determined by the particular set of opinions, experiences and personalities of the participants, as well as by the design of the questions and the skill of the moderator³³. Third, provided there are sufficient numbers of groups, it may be helpful to compare and contrast several different categories of groups, each of which is internally relatively homogeneous (for example, groups of Primary Care Clinicians compared to groups of non-Primary Care Specialists).

This may be particularly helpful in analysis, when it might then be easier to distinguish issues that were unique to a particular mix of individuals or circumstances of a given group, and which were more fundamental or widely shared characteristics of the group category³³.

On the other hand, more groups require more planning, recruiting, logistical support and expense, time to conduct the groups and time to prepare for and conduct the analysis. All of these aspects of focus groups require substantial time if done well. A single focus group can yield 10-15 pages of field notes and 30-60 pages of single-spaced transcript³². According to Morgan, the typical number of groups in a particular category is 3-5³². He states that fewer groups may be acceptable when the responses are not diverse, whereas more may be required when opinions are highly variable. He points out, however, that it is difficult to prospectively predict this variability. Depending on techniques and tools it may take an experienced focus group researcher 30-48 hours for transcript preparation and another 30-48 hours for analysis and first draft preparation for a series of 3 focus groups³². Considering the scope and resources of this project and the above issues, we decided to conduct 3 focus groups.

The size of each group also has an important impact on group dynamics and the ability to adequately hear from each participant in the allotted time. According to Morgan, the typical group size is 6-10³². This number allows a reasonable range of opinions while affording each participant the opportunity to be heard. Scheduling a slightly larger number may allow some room for “no shows” without jeopardizing the group. The degree of investment or interest of the participants in the topic also determines the optimal size. If the participants are highly invested or expert in the topic a smaller

number will allow them adequate opportunity for expression and will achieve sufficient group discussion and flow. On the other hand, a group which has low involvement or interest in the topic, or in which the topic is not controversial or complex, may depend on more participants to achieve adequate discussion and range of opinion. My best estimate was that the topic of these focus groups would be intermediate in terms of its interest and the participants' involvement. We decided to target 6-8 clinicians per group.

The location of the groups should be at a well-situated, comfortable site, with adequate accommodations. While convenience to the participants is important, it was felt there might be some advantage to coax them away from their usual work environment, with its accompanying distractions. The location selected was an off-site facility designed for such purposes, the Gilmore Research facility at 729 NE Oregon Street in Portland. It provided a one-way mirror, receptionist, audio recording capability and other amenities.

Participants

The subjects of interest were experienced clinician users of a comprehensive outpatient electronic medical record system. The subjects available were Kaiser Permanente clinicians. Both physicians and allied health clinicians (Physician Assistants and Nurse Practitioners) were included. Although there are several interesting dimensions across which they could be categorized, given the small number of groups in this study we elected to focus on Primary Care Clinicians with access to the EMR in their exam rooms. Primary Care is here defined as including internal medicine, family medicine and pediatrics.

A purposeful sample from among these groups was selected, with the intent of balance by specialty, physician and non-physician, and gender, yielding a mixed cross section of the target population. Only subjects that were willing and able to attend the focus group session were recruited. Seventy-three people met the eligibility criteria. Of these, 49 were contacted by phone and 24 were scheduled (8 per group). The 25 who were contacted but declined to participate did so primarily because of schedule conflicts.

Recruiting

Recruiting focus group participants can be difficult and time consuming, and can be a significant component of the cost of performing focus groups. In this case, a list of potential subjects was obtained from employment records of Northwest Permanente. The investigative institutions (Kaiser Permanente and the Oregon Health & Science University) were familiar to the subjects and the investigator was familiar to many. It was anticipated that the subject matter would be of at least some interest to the subjects. All these factors were expected to increase the success and decrease the expense of recruitment. Nevertheless, a professional focus group agency estimated the recruitment cost for this study at between two and four thousand dollars (Gilmore Associates, personal communication). An incentive payment is typically offered to participants of focus groups. The professional focus group agency recommended a \$125-150 incentive for professional subjects such as physicians. In the Northwest Permanente culture it is likely that an incentive of a \$25 gift certificate would be moderately successful, and that a \$100 incentive, if allowed by the budget, would be highly successful. An experienced scheduler from Kaiser Permanente was used. Participants were awarded a \$25 gift certificate at the conclusion of the groups.

Questions

A series of questions was prepared with attention to interest and relevance, clarity, order and potential for both discussion and analysis. There were 14 questions including “warm ups”. The questions were submitted to about 10 individuals with clinical decision support systems knowledge and experience for their review and comment. Of interest was both the importance of the questions and their clarity. Following revision and careful scripting, they were tested on two physicians similar to the target group.

The complete and final questions from the interview guide are included in Appendix 1. The guide was closely adhered to during the focus groups.

Moderating

The Principal Investigator moderated the groups. While not an experienced focus group moderator, I did have training and experience with individual and group interviewing and facilitating. I further prepared myself for this role via reading³⁵, discussions and practice. The decision to moderate the groups allowed me to gain experience in this role, significantly decreased the cost of the study compared to hiring a professional moderator, and afforded a moderator with intimate knowledge of the subject area. My reputation with these subjects may have given me some credibility and an entrée into their confidence. On the other hand, this choice introduced some risk that participants would filter their responses, consciously or subconsciously, due to their past experiences with or attitudes toward someone viewed as an “expert” and “insider” in relation to the electronic record, as well as a peer in relation to clinical medicine. Furthermore, to the extent participants had perceptions or expectations about me, positive or negative, it is acknowledged that this could influence the outcome of the groups. To

mitigate these risks, I made a concerted effort to carefully adhere to scripted questions and probes, facilitating the conversations but not engaging in explaining, justifying, defending, or designing the alerts.

In addition there was an assistant moderator. A one-way mirror was available at the facility, and there were several additional observers behind the mirror at each group. The assistant moderator and observers were asked to take detailed and systematic field notes, based on the interview guide. These observations also became part of the data set and were available for use in later analysis.

Recording data

The groups were audio recorded. Post group debriefs, by the moderator, assistant moderator and other observers were also recorded. Written transcripts of the groups were prepared.

Analysis

In qualitative studies analysis begins during data collection³⁶. In this case, it began during the actual groups. It requires careful listening and attention to verbal and physical clues from the participants. Elements that may not be captured by a transcript, such as intonation and body language were noted. As mentioned above, field notes and post focus group debrief notes, also became part of the data set. Limited participant verification of preliminary findings occurred by the moderator summarizing key points during the course of the groups. Post-focus group verification, by participants, of the written report has not been utilized to date. Systematic analysis is undertaken so that it is thorough, reproducible, logical, and defensible.

The tape recordings were transcribed and entered into computer software designed for qualitative research (Atlas.ti^R, SCOLARI, Sage Publications, Inc.). Computer assisted analysis supports consistency and a systematic approach, although it may increase analysis time and does require complete transcripts³⁶. While Atlas.ti^R provides tools to facilitate accessing and organizing the information in a dataset, it does not automatically develop codes, themes or conclusions and merely supports the human researcher in this endeavor.

Following entry, the transcripts were coded according to iteratively determined categories. Codes were assigned to words, or phrases in the transcripts according to concept categories discovered in the data, after the “open coding” technique described by Strauss and Corbin³⁹. Later, some related categories were combined and other categories were further subdivided. Concurrent with this work, a question-by-question analysis of the three transcripts was performed. The focus group observer’s notes and the post- group debrief audiotapes were reviewed, and insights were gleaned and incorporated from these. In addition to the coding of the nearly 150 pages of transcripts from the three groups by the Principal Investigator, independent coding of the first focus group was performed by a second investigator, Dean Sittig, Ph.D. The codes and themes developed by the two investigators in this way were compared, mapped to one another, and consolidated. The themes were further analyzed to determine their major properties, and these were linked to the raw data (quotations) and their descriptions. Qualitative interpretation includes common themes (spoken and unspoken), recurring attitudes or opinions, and especially noteworthy remarks. The intent is to discern the underlying

meanings and principles³⁶⁻³⁸. The method provided a formal process of analysis and, via code comparison, a formal challenge to the interpretation.

Subject Consent and Protection and Investigative Review Board (IRB) Requirements

Every attempt was made to protect the rights, safety, privacy, and dignity of Kaiser Permanente clinicians during this study. Subjects received information outlining the type of, rationale for, planned use of, and protection measures for their responses. The potential risks of this study were minimal. Participants were informed that they were free not to participate, without any consequences to their employment.

Information obtained in the study was kept strictly confidential. Participants were informed that all publications and reports derived from this study would be based on aggregate data or anonymous comments and would not identify individuals. No individual information will be released to anyone without prior written consent. IRB requirements from Kaiser Permanente and OHSU were complied with, and approval to proceed was obtained.

Results

Final composition of the groups is discussed in Question 1, below, and shown in Table I.

Questions

This part of the report comprises a question-by-question description of the range of responses from participants, with illustrative quotations. First a brief synopsis of the question is repeated, then a representation of the major responses is provided. (The full text of the questions may be seen in Appendix 1.) Coded numbers, gender, specialty and degrees identify participants. The numbering convention used single digits for participants in Group 1, numbers in the 20's for Group 2 participants, and numbers in the 30's for Group 3 participants.

In presenting quotations from the focus groups, the following convention is used. Excerpts from a single focus group are presented in unbroken sequence as speakers change except when indicated by the designation <break>, which indicates that there is a discontinuity in the excerpt. Since discontinuity between groups can be detected by the change in deciles of the users code numbers (for example from #5 to #27), this discontinuity is not otherwise signified.

Question 1. “State your name, specialty, where you practice, how long you’ve been with Kaiser Permanente, and whether you have access to and use Exam Room Computers”.

This was a “warm up” question, designed to engage all the participants, allow them to introduce themselves and get used to speaking in the group, and gather some very limited

demographic information. There were 16 participants, including 10 males, and 6 females. Although 8 participants were recruited for each group, due to “no shows” the final numbers were distributed by groups as follows (Table I.): Group1 had 5 participants, Group 2 had seven participants, and Group 3 had 4 participants. There were 3 pediatric, 8 family practice, and 5 internal medicine specialists. Thirteen of the participants were physicians, 2 were physician assistants, and 1 was a nurse practitioner. The mean duration of time with Kaiser Permanente was 9.5 years, with a range of 1 to 24.5 years. All participants had some access to computers in their exam rooms at least part of the time. This question was not further analyzed.

Table I. Characteristics of participants, by group.

	Group 1	Group 2	Group 3	Total
Pediatrics	2	1	0	3
Family Medicine	2	2	4	8
Internal Medicine	1	4	0	5
Male	4	4	2	10
Female	1	3	2	6
Physician	4	6	3	13
Physician Assistant	1	0	1	2
Nurse Practitioner	0	1	0	1

Question 2: “Let’s talk about words, ideas or reactions that come to mind when we say “electronic alerts and reminders””.

This question was intended to reveal the types of spontaneous reactions that were evoked by these terms. To some degree, this was also a “warm up”. It was also designed to give a gauge of the pre-existing individual and group orientation toward alerts and reminders and to see to what extent there was an emotional reaction, either positive or negative,

This question did not seem to evoke strong emotional response to the notion of alerts and reminders. Responses were objective (listing, facts, etc.) more often than subjective (emotional, feelings, etc.), even when users were prompted for “feelings”.

Some examples of the kinds of emotional responses that were given follow:

#3 Male Family Practice PA: “Well, it sort of puts you in an awkward situation, because the thing #8 brought up was the smoking cessation. As soon as you get to the order sheet, do you want to go to the smoking cessation track? You know? Well, you know, you’re about ready to order the lab or whatever else, and you’ve got to deal with this thing. I feel guilty if I click it no, because it’s almost as though I haven’t dealt with it, but I always do deal with it. I mean, give them track advice and I identify that they smoke and give them the advice. But it’s just that it’s something that kind of jolts you, because it just jumps onto the screen and then it feels like it’s something you have to do when you don’t want to be dealing with it right at that moment.”

#23 Female Family physician: “They can be really irritating. I mean, I think for the reasons that #21 said. You know, continually getting the same reminders. It gets, ‘I know!’” [Group laughter.]

#21 Female Family practice NP: “But I like having the messages, now that I have the exam room computer. Before I used to get reminded in my office and I had to try to REMEMBER as I went over there. But now, as I’m clicking and ordering things, I’ll say to the person, “Okay. We need to be doing that Pap,” or I’ll look and I’ll say, ‘Have you thought about quitting smoking?’”

#37 Male Family physician: “Annoying. What’s annoying, Michael, is if you talk to somebody about smoking, I don’t want to be reminded about it. I do it automatically. Same with cervical screening and stuff. It gets in the way a little bit. Now the little red thing up there, that really helps; the tag that’s in the upper right-hand corner of the screen, because that’s a key to look.”

Question 3: “How many different types of alerts and reminders can you think of.”

The purpose of this question was primarily to “level set” and ensure that participants were aware of and considering a wide range of alerts and reminders in the further discussions.

Secondly, it was designed to determine the range and type of entities that the users considered to fit into the description, “alerts and reminders.” There was a fairly broad awareness of the range and variety of entities that can be considered “alerts and reminders.” Table II. shows the range of alert types that were *spontaneously* offered, by group.

Table II. Alert types spontaneously offered, by group

	Group 1	Group 2	Group 3
"Pop-up"	X	X	X
Alternative drug	X	X	X
Alternative orders	X		
Chart completion	X		
Charts pending	X		
Computer system errors			X
Custom		X	
Drug-allergy			X
Drug-disease/condition			X
Drug-drug interaction	X	X	X
Duplicate orders	X		
Health maintenance	X	X	X
Immunizations		X	
Messages	X		
Open orders exist	X		
Password			X
Patient calls	X	X	X
Value checks		X	

Question 4: “Can anyone think back to a recent example where an alert or reminder was helpful?”

Many instances where alerts and reminders have been helpful were readily volunteered. Drug related alerts and reminders were among the most popular. Drug allergy alerting (not currently available in the Kaiser Permanente Northwest implementation of EpicCare™) “is obvious” said one individual. Several people mentioned using the alternative drug messages as a source of solicited drug information.

#28 Male Internist: “It helps me, especially if I’m trying to think of something. I know that if I put in this particular drug it’ll give me something I was trying to think of. I’ve used it that way before.”

They also like the fact that this type of reminder provides them choices. Some find that sharing this information with patients in the exam room can be helpful. Many users endorsed pharmacy reminders (“alternative drug messages”).

#5 Male Internist: “I find the pharmacy reminders almost always helpful, particularly when it comes to cost issues, because I don’t know which medicines cost more than the others or, you know, which contract Kaiser has the best deal on.”

There was general agreement that relative cost information is helpful.

#1 Male Pediatrician: “I think when it comes up it’s helped me in things that I don’t prescribe very often”.

In addition users remarked that sometimes health maintenance reminders, such as a pop-up hemoglobin A1c alert in a diabetic, can draw attention to something which might otherwise have been overlooked in a visit, especially in urgency care or when seeing a patient that is not on your panel or with whom you are not familiar.

#3 Male Family Practice PA: “Actually the hemoglobin A1c. I do all same day appointments. I don’t carry a panel. I saw somebody for something innocuous and was not aware of their diabetes and realized they had not had an A1c done in a long time, nor had they had their micro-albumins screen either. Once I reviewed their labs, because of the hemoglobin A1c alert, and they just had a horrible ratio on their micro-albumin screen and their A1c was way out of whack. Kind of just turned out to reveal the fact that they hadn’t been taking their medication, so then it led to this whole other intervention of stuff. I mean, they came in and to go through an ankle, or something like that, so it really sort of changed the course, the whole dynamic of the encounter. That was just a couple of weeks ago.”

Several users remarked that the messages and calls alerts are helpful. Individuals liked the fact that the “patient call” alert shows in red if it is deemed an “urgent” call.

Some users also see the less intrusive Health Maintenance reminders as useful. For example, being reminded by the red message can be helpful in remembering to address smoking issues.

#27 Male Internist: “I usually notice the red alert and if I have time, try to address those.”

One male internist who doesn’t do a lot of Pap smears offered that he appreciated a Pap smear alert at the end of visit in the exam room as it helped him better address this need, even though the patient might be fully dressed and there for an entirely different

reason. (A female family physician that does numerous gynecologic exams, on the other hand, offered that this reminder for her was very annoying.)

There was some endorsement for “data completion” reminders. These are reminders that prevent you from closing an encounter without a diagnosis or service level code, transmitting some incomplete orders and referrals, or leaving blank a required field.

#33 Female Family practice PA: “The other thing is- what is that- data completion. I think that’s very useful.”

#35 Female Family physician: “Yeah, anything like that, yeah”.

#33 Female Family practice PA: “I mean, any kind of level of service, you’ve got to have that.”

Question 5: “Can we generalize about specific clinical areas or circumstances in which alerts and reminders might be especially helpful or important?”

To generalize, alerts and reminders are helpful with “things you would forget”, “like pharmacy stuff”, “like moving target things like the immunization schedule”, “things that are complicated”, “things that the patient isn’t specifically coming in for” (like immunizations), “some of the medications that we prescribe less often”, the latter with drug monitoring and lab recommendations. “Any condition...I can think of diabetes right off the bat...that requires kind of regular monitoring”, “routine maintenance”, “or illness related maintenance”, as opposed to simply “health maintenance” (i.e.: prevention). That is, “disease state reminders”.

#25 Male Internist: “ I mean, somebody who doesn’t come in very often or you’re just seeing for somebody else and you don’t know them. If it’s somebody with a chronic disease...being able to just sort of trigger these things that you catch while the person is there in the office...that sort of maintenance stuff that would otherwise go by the wayside. That’s real valuable for me.”

#26 Female Pediatrician: “But in general, I think they’re helpful for gathering information.”

Question 6: “Can you think of a recent example where an alerts or reminder was a hindrance to your work?”

There were also many examples of alerts and reminders being a hindrance or at least a nuisance. Sources of concern included when or how the alert presented and whether fulfilling the alert was easy or not. For example, the message which says you are unable to close the note because you are missing a required encounter diagnosis or “Level of Service” code, but does not move the cursor to the screen or field which would allow easy resolution of the warning is considered annoying. Many concerns were workflow related. An alert that presents or prompts for specific information at an inopportune time in the encounter is a frequent annoyance.

#27 Male Internist: “Well, you know, I hadn’t put the diagnosis in before, so I find that annoying. It doesn’t need to ask me that. I’ll put the diagnosis in afterwards.”

Accuracy of the alerts is also important. Sometimes the alert might not be appropriate for the particular patient, such as because of age, gender, or inaccurate assignment to a high-risk group. Sometimes the alert seems to present irrelevant or extraneous information given the particular circumstances at hand. Another manifestation of this is a sort of “cry wolf” scenario, and has been termed “alert inflation”. For example when a message is sent as urgent (red) when it should be routine (blue) for patient calls. Also seen as inaccurate are warnings about “duplicate orders” even though the same order is entered once for “now” and a second time as a “future.”

#1 Male Pediatrician: “I mean you specifically made it standing or future. I mean it made an acknowledgement you’re not ordering it for now. It shouldn’t ask you if you’re sure.”

#8 Female Family physician: “That’s kind of annoying, cause it’s like, yeah, I know.”

#5 Male Internist: “I did it on purpose.”

#8 Female Family physician: “Right. Quit bugging me.”

An important category of annoyances is the “already known hindrance”, for example, when the clinician has already made a thoughtful decision to use a second line antibiotic because the patient is allergic to the first line choices but nevertheless gets a warning message. People feel the system should be “smart enough” to know, if it’s documented on the allergy list that the warning should be suppressed. Users also expressed the notion that alerts designed to assist in performing recommended preventive measures might be turned off in some circumstances (either automatically or optionally).

#8 Female Family physician: “I think it’s probably still good to have that. I think maybe if there could be a way for those of us who do track, like eighty-five percent or better of all the patients that we have that smoke, if there’d be a way to like turn that off if our stats stay up, because I’m going to track them all as best I can.”

Smoking, or tobacco, reminders are a category that seemed especially annoying to many people. Here a number of factors seemed to contribute to the annoyance including the great frequency with which the alert presents, the high likelihood that that information is already known and the clinician either already has or intends to address it, or in some cases has determined, for one of a variety of reasons, not to.

#37 Male Family physician: “I carry a cross about smoking. I think it’s – Never mind. Anyhow, so what I have to do is I have to stop every time and delete that screen, close that screen, before I go on to see the patient. And it’s not necessarily a major aspect in their care. In urgency care, for example, ... it gives you an opportunity to know that, but you still have to close it and close it and close it. Ninety-nine percent of the time, that’s of no use at all to me. It just gets in the way.”

Although they also received positive comments (as noted above) and were considered helpful by many, some users found alternative drug warnings annoying.

#33 Female Family practice PA: “...on and on and on, because you get them on all sorts of things constantly when you’re ordering single drugs. It’s becoming very tedious sometimes to order drugs.”

#35 Female Family physician: “Yeah, it seems like it’s rare almost anymore that you can actually go in and just order a drug without having to deal with some informational thing, or list of alternatives.”

#33 Female Family practice PA: “Right. Like Prozac is a good example. You cannot order Prozac now without having it come up with other options.”

#35 Female Family physician: “Even though you were just refilling the Prozac.”

#33 Female Family practice PA: “Right. A 10 milligram. Even though someone takes 10 milligrams, it will take you out to Prozac 20 milligrams and you have to cancel out of that and then go back and go into the 10 milligram to even order Prozac 10 milligrams. You can’t, no matter what you put in for Prozac, it comes up and that’s very irritating. Because I only wanted maybe the Prozac...Because they’re on 30 milligrams of it, or whatever. So I don’t need to know that every time. The drugs and also the methocarbamal, the Flexeril. I never give anybody Flexeril unless they’re allergic or have had a reaction to methocarbamal. So, they tell me that that is a problem and I should use methocarbamal alternative every time if I try to order Flexeril. The only reason I order Flexeril is because somebody has had a problem with methocarbamal, so I really need to know that. [Speaking sarcastically.] Does that make sense? Does everyone know what I’m saying?”

Still, these individuals recognize that under some circumstances these alerts can be helpful.

#34 Male Family physician: “Yeah. It’s a little tricky to design a system that doesn’t have consistent kind of feedback, because some people, you may want to direct them correctly in terms of the right order and practice, but you don’t want to drive them crazy by over alerting them all the time. It would be nice to be able to turn them off after the tenth reminder of methocarbamal being contraindicated in the elderly. I’ve seen that and I don’t need the reminder.”

#33 Female Family practice PA: “Right.”

#34 Male Family physician: “But there are some that are useful that there is a side effect that I wasn’t aware of. I think the idea is good. It’s kind of getting rid of the redundant annoyance of the messages.”

#35 Female Family physician: “Yeah, I think if it could get to the point where the system could recognize who’s using it and tailor the responses. That would be really nice...So when we get to talking about the future, that’s what I would really like to see is a system that can learn when #35 signs in, well, she’s already heard about methocarbamal five hundred times. [Laughs.] She probably has a reason for prescribing it.”

#33 Female Family practice PA: “Right”

There is also concern about multiple, especially sequential, alerts.

#3 Male Family Practice PA: “And if you have a fertile diabetic woman who smokes, you’re going to have to click through three screens...”

#8 Female Family physician: “Yeah. Click, click, click.”

Multiple keystrokes for any reason were mentioned unfavorably.

An interesting negative reaction that a number of people expressed was on a more emotional level. Clinicians generally take their work and their performance very seriously and apparently sometimes feel personally criticized by the alert.

#25 Male Internist: “The health maintenance ones, the downside for me is they have somewhat of a negative connotation. I mean, you click on it and it says, “No smoking advice within six months” and you haven’t even seen this guy for a year, so it’s on. Well, gee, sorry.” [Laughs.] I didn’t call them six months ago to tell them.”

Annoyance from the sheer repetition of an alert should be emphasized.

#21 Female Family practice NP: “Just the repetition. As I said, during one encounter with one patient, I don’t need to hear it three times. With the pharmacy, there’s stuff that is NO longer helpful. I know what causes sedation. I know we have a problem. Like, okay.”

About intrusive alerts, users said:

#3 Male Family Practice PA: “it disrupts the thought and it may seem like an inconsequential thing to realign your thought process, but it’s just one more thing.”

#8 Female Family physician: “Yeah. It might stop you for thirty seconds where you’re, “Oh! Well, okay. Wait. Where’s the mouse.” I’ve got to click because it can’t understand the typing.”

#3 Male Family Practice PA: “Right. Usually when I’m going to the order summary screen, I make an order right then. I’ve got my little mental list right there and I’m ready to go for it. You have to stop and deal with something and it loses the track. It’s a small thing, but it’s a bunch of small things.”

Question 7: “How could system developers best address the concern about time? If there were more than one alert or reminder applicable to a given patient, would you prefer to see them grouped or sequentially? What about the sheer number of alerts? How would we decide on an appropriate number?”

Users confirm that time is a concern. One approach to addressing this is to make fulfilling the alert easier. It should take you to the appropriate spot, and avoid multiple intermediary screens. Another suggestion is to have the computer, through making inferences from information within its database, and “knowledge” about disease states and care recommendations, be more proactive and automatically populate orders (for example, for a quarterly HgbA1c), perhaps even outside the patient encounter, rather than asking “do you want to do this”.

#1 Male Pediatrician: “when mine says, “Do you want to go to the Smartset?” and it seems like instead it should say, “Do you just want to order this?” If you say yes, then it just orders it. Then you don’t have to go Smartset, which you then have to accept and go back to the order summary screen.”

#5 Male Internist: “It would be nice if the computer recognized certain disease states and did all the ordering for you. And like for a diabetic, I mean, they know at the very least you’re gonna be ordering A1c’s once a year. I mean, don’t even have a reminder. Just have the computer do it, or have the computer do it four times a year, you know, quarterly. And then if you want to go in and change it, if they’re really well controlled or something, you have the option then of going in and--

#3 Male Family Practice PA: “But how does the computer notify the patients that they need to have their blood drawn? [Laughs.]”

#5 Male Internist: “It would be great if it could send them out a letter of reminder.”

#1 Male Pediatrician: “It tells you. You open it up and [it says [word?]] and] it orders it for you.”

#5 Male Internist: “It has the address. Theoretically we have the address for every patient.”

#3 Male Family Practice PA: “So send them?”

#5 Male Internist: “Yeah.”

#1 Male Pediatrician: “Having the computer generate a letter, it probably could be done. An order has been placed in the computer. You need to come in. You’re due for another visit.”

#3 Male Family Practice PA: “That’s interesting.”

Short of actually ordering and notifying the patient, there was the following suggestion:

#5 Male Internist: “Instead of popping up a reminder, you know, “this patient is overdue for hemoglobin A1c,” have it pop up a reminder, “We’ve ordered a hemoglobin A1c. Do you want this? Yes or no.”

Some users felt that alerts should allow simple keyboard equivalent commands, for those preferring not to use mouse clicks. They ought to be “ergonomically” designed, that is, constructed effectively from a human-computer interface point of view.

A significant improvement on the time impact would be removing redundant or unnecessary reminders.

#34 Male Family physician: “Well, I think part of it is some of the redundant reminders that we get consistently. If we could short-circuit those, or after five reminders of specific interaction not

have to go through that again every time we order it. It would be helpful. Things like the smoker, if we've already advised them of it in the last six months or a year, not to be reminded again. Going through that, so that there was some kind of loop to postpone that reminder for six months once you've made the order. Those would be helpful, I think."

Group 3 users raised the notion of distributing reminders or alerts among the members of the health care team, rather than directing them all to the clinician. This concept of spreading out the work and responsibility, and thus mitigating the time impact on one job category, could include presenting alerts at other times than simply in the clinician-patient face to face encounter.

#35 Female Family physician: "Yeah. And I guess the other time that it seems to me that some of these alerts and reminders that would be a good place for them to show up – I don't know – would be on phone calls. Would it be good if a diabetic is calling and they haven't had a hemoglobin...?"

#37 Male Family physician: "I guess. [Group laughter.]"

#34 Male Family physician: "From our point of view, it would be great, but the nurse answering the call, one more thing to do is probably one thing too many, but it would be nice certainly."

#35 Female Family physician: "Right. Yes. But, who's feeling more time pressure? We all are."

When more than one alert is applicable for a given patient, the overwhelming consensus is that they should be presented in a grouped manner, not sequentially.

#8 Female Family physician: "You know, one little list and then you say, "No, no, no," and boom it's gone."

Group 1 explored the idea of a non-modal, non-intrusive window on which multiple alerts could be presented and from which they could easily evaluate and dispatch them.

#5 Male Internist: "And if you could fit them all on one page – I mean, I think most everyone agrees that the place to put reminders is somewhere not on the charting module, but on the orders and diagnosis module. If you could put them all on one page, then really your only limit is how many you can fit on one page. I mean, in terms of speed, most people can read pretty fast – can read even faster than they can click. If you had it all on one page, then whether it was one item or six items – I mean, you don't want to fill the thing up with text, but if you had one item versus six items, that's easy enough to go through. And if you had the ability to complete the process on that page, not "this person is overdue for hemoglobin A1c, do you want to handle this now?" So you've got to click there and then it clicks you over to orders. But if you could just click the box for hemoglobin A1c right there and then, you know, you're typing along and you're, "Oh, and you need a bunch of labs. I've ordered them. Just go to the lab along with the other things we're ordering today." Do you see what I'm saying?"

#8 Female Family physician: “And you could even make it so it could be condensed at the bottom, and then if you wanted more information you could make it pop up, if you wanted to read more about it. So like stuff like diabetes reminders, heart disease reminders, labs and medications, immunizations. And then if you needed that to pop up to tell you what to order or what the recommendations were, you could, but if you didn’t need it because you do it so much that you know it and you already know what you’re gonna order, it doesn’t stop your train of thought.”

Dr. Krall: “So you’re talking about something which is popped up, but you don’t have to necessarily attend to?”

#8 Female Family physician: “Right.”

Dr. Krall: “You can see it and you can get enough information from looking at it to decide whether you need to get more information or not, is that what you’re suggesting?”

#8 Female Family physician: “Um, hmm. So it’s there. It reminds you and if you’ve forgotten something or you’re not sure what the latest recommendation is, you can always access it very quickly, but it doesn’t stop your workflow. And I’m thinking, in this case, about urgent care where you’re not gonna be doing all the routine stuff necessarily, and if it’s not something urgent it doesn’t slow you down. Or, you’re not ordering all the labs at urgent care that really the primary doc needs.”

Interestingly, Group 2, without prompting, came up with a very similar concept.

#23 Female Family physician: “It might be nice in some ways, instead of having the things that pop up right in your face to have them pop up on the order summary screen in such a way that you could kind of check through them. Those reminder lists...” “Oh, yeah. We should do that.” Or, “Yeah, but we did that.” You know? Or any, “I don’t need that,” or whatever. Instead of having them say you can’t do anything else until you answer yes or no, instead of when do you want to see the Smartset. To have things maybe pop up and then move over.”

#27 Male Internist: “Right. So you keep the alert, but you either have to say yes or no, and those ones come up in the middle of the screen. If you could keep that alert there and use it. I mean, it could obviously---“

#23 Female Family physician: “Yeah. Even when you go to switch back like to get off that screen they would say, “OH, did you want to do these today?”

#21 Female Family practice NP: “Or say they need tobacco advice and they need a Pap. It’s like, okay, and it comes up over like this. And you just double click on tobacco advice and it goes, poof, tobacco advice in your order summary. Any you’re like, got time for a Pap. Double click on the reminder and it goes poof and it pops up a Pap. I’d be like, okay!”

#23 Female Family physician: “Mammograms. That would be really helpful”.

#21 Female Family practice NP: “Yeah, it’s like, okay. Like mammograms and tobacco, that’s easy. It’s like, “Oh, yeah. I’m gonna go get you a time to get a mammogram, which is scheduled before you leave clinic.” Double click, double click. It’s added on the order summary and you’re like GOOD to go”.

#27 Male Internist: "I like the idea something can stay there that you don't have to either use by itself or get rid of it. It could stay there and as she was saying, just click on it. You could put the orders in and it'd do it for you."

<break>

#25 Male Internist: "And anything that you can simplify to satisfy the alert. Whatever is the least amount they have to do to satisfy it while you're in that screen. So like you say, just tobacco and you click on it and it just immediately put it in the counter thing."

#21 Female Family practice NP: "Or it's aspirin."

#25 Male Internist: "Or it's aspirin, and immediately somehow ran it to the point where you signed the pharmacy. I mean, anything that streamlines how you satisfy the alert."

#21 Female Family practice NP: "Or like the last four blood pressures are high and like the hypertension alert would go on. You double click on the hypertension alert and up comes the---"

#28 Male Internist: "Flow sheet."

#23 Female Family physician: "Choice of meds."

#21 Female Family practice NP: "Yeah. Up comes the choice of meds. [Group laughter.]"

#28 Male Internist: "Or just a flow sheet that shows you their pressure within the last..."

#21 Female Family practice NP: "Yeah. And then it comes up with a list. You know how on the telephone encounter how when meds are ordered and you forgot to click the okay? It says, "Did you really want to get out of this? Their meds have been ordered," or "They haven't been signed for," or something like that? Gosh, it would be nice if you double click on aspirin. Oh, yeah, I'll double click on aspirin. Double click on that and then they magically go over to the pharmacy list. I mean, you go to try to get out of it and you forgot to sign your name to it, and just the med list comes up and you're like, oh, yeah. I need to take care of those. I'm onto this bar thing on the side. [Group laughter.] I'd be willing to look at more alerts and act on more things, because I appreciate having the alerts. I just don't want to do that many mouse clicks. It makes a difference to me and it's taught me better care."

Surprisingly, the groups generally did not feel that the number of alerts per se is an issue, provided they fulfill the other requirements (accuracy, timeliness, appropriate level of intrusiveness, ease of fulfilling, and so on.).

#6 Male Pediatrician: "I don't see how you can decide [what the maximum would be]. If you decide that you're gonna use a reminder, how can you say, "Well, this person has six reminders. I'm only gonna give the clinician four today. We'll catch up the other two next time." I mean, I suppose there probably is a maximum that's feasible and beyond the point where the clinician will pull their hair out. It might be more of a decision of minimizing how many things you use reminders for than minimizing how many reminders come at one time."

#1 Male Pediatrician: "Yeah, but I think if it's important enough to generate and put in the system and impact everybody, it's probably important enough to tell them. If people are putting them in the system and are starting to get ridiculous about it, then you have to make decisions. Someone has to go back and say, you know, there's too much of this and these are the ones that we really don't need reminders for. They aren't done lightly; I know that. I know when someone decides to

put one into the system, it's for a good reason, whether it's for HEDIS or whatever is driving it, there's usually some good reason. Just good care or HEDIS and I agree, I don't think you can say, you know, let's limit to these four and then there were complications with the fifth one that wasn't recognized. It seems like if they're there, they're there for a reason and so you probably show them all."

#23 Female Family physician: "Sequential, in your face."

#22 Male Internist: "Yeah, we don't need them all..."

#21 Female Family practice NP: "That would be frustrating."

#28 Male Internist: "---instead of having them popping up and having to make a decision on each one individually like that, but where you can just quickly scan and choose the ones that are appropriate to do that visit. [Others agree.]"

Dr. Krall: "Should we limit the number or can we limit the number?"

#22 Male Internist: "Put them all there."

Users said it is unnecessary to present "redundant" alerts every time. However, they acknowledged that defining "redundant" might be very difficult and individual.

#33 Female Family practice PA: "... and how much is enough is a very difficult and very relative question, because it does relate to the patient. What if every time there's six alerts coming up on your diabetic, who takes Coumadin and has hypertension and all that stuff? I don't think you need it every time, because you've seen "Mr. X" for the last ten years."

#37 Male Family physician: "How many do you put on each patient? It seems so very individual. Either you do none or all. I mean, those would be the obvious. Otherwise, you have to do value judgments about what's important, and that's clinical, of course."

The idea of there being alerts and reminders of different priority was met with mixed judgment. Some thought it might make sense for higher priority alerts to be more intrusive and lower priority to be available and optional. However others felt that all alerts should be important.

#5 Male Internist: "alerts should only be used for really important stuff."

There was a concern that if some alerts were less obvious or presented as lower priority they might be overlooked.

#26 Female Pediatrician: "I think some would be missed then, because some people might just only view high priority, so some may never get recognized; especially on busy days."

Neither was there consensus in the domain of drug allergy or drug interaction alerts.

#27 Male Internist: "I think I'd want to see everything."

Dr. Krall: "So am I hearing that a little bit of the switch from what you were saying before, which is 'give me everything' to, at least in this circumstance, there might be a situation in which you don't want everything? [Group agrees.]"

#27 Male Internist: "Yeah, for every possible recorded drug interaction. Uh, huh."

#25 Male Internist: "I suppose. It would be nice if you could have even the minor ones easily accessible or something. Not necessarily intrusive, but available. [Others agree.]"

#23 Female Family physician: "Like a little ping that said... You know?"

#25 Male Internist: "Right. Minor interaction. Have them prioritize maybe."

#26 Female Pediatrician: "Have anything that's contraindications come up. [Others agree.] And they could be little bars that say, 'minor intolerance.' I don't know. You could click on those if the patient says, 'Now what could possibly happen?' Then you click that up and say, 'Well, it says here....' [Several talking and laughing at once.]"

#35 Female Family physician: "I guess what I would like to see is the same level of drug interaction that now prompts the pharmacist to call me. [Laughs.]"

#37 Male Family physician: "Oh, good point."

#35 Female Family physician: "Yeah. Where the pharmacist says, 'Did you know that drug X interacts with drug Y?' I don't even know that it would need to be either high priority/low priority. I would like a reminder if it's high priority and nothing if it's not."

Dr. Krall: "Okay. So, #35 is saying there is a threshold. How about the rest of you? Do you---"

#37 Male Family physician: "How do you know where the threshold is, #35, for every single patient? That would be a little cramp."

#35 Female Family physician: "Oh, but high priority, I wouldn't mind that as long as you could override it, because I'm sure some specialist, who actually ends up prescribing something, they're the ones who often have to override it. They're doing plenty combinations of things that I wouldn't try. But, no, I don't know. Multiple levels of priority---"

#33 Female Family practice PA: "Hmm, um."

#35 Female Family physician: "Particularly if it's sequential like it has been. It's just getting so many."

#33 Female Family practice PA: "Yeah."

#34 Male Family physician: "It's hard to know, but I would say there if it becomes too low, it becomes a problem rather than a help and that's hard to always put in words that are quantity. But you need to know certain things and other things like methocarbamol, for the tenth time is...."

#35 Female Family physician: "But in terms of the phone calls, I like those two levels. You know, high priority/low priority."

Question 8: “In what ways does using the EMR in the exam room change the likelihood that an alert will help or hinder you?”

Users recognize the different impact of receiving alerts and reminders in the exam room compared to in their offices. Most of this difference again relates to workflow differences.

#3 Male Family Practice PA: “Well, it’s pretty straight ahead. I do all my ordering in the exam room. I do all my charting in the office, so if an alert was coming up on a charting screen it doesn’t help me at all, because it’s after the fact.”

When the alerts present in the exam room, there is enhanced opportunity for discussions and shared decision making with the patient that these alerts prompt.

#1 Male Pediatrician: “From my point of view, it would seem like it should make a big difference. For example, I prescribe Claritin and then I talk to the patient. He asks, “Oh, Claritin. Sure. It sounds great. We’ll do that.” I go back to my office and I don’t have it in the exam room, then I’ll say, “You know what? You shouldn’t be giving Claritin. You ought to be giving Allegra, or any of the other twelve options.” Well, who wants to go back now and lose face. I’ve already committed that this is what I’m gonna do.”

#23 Female Family physician: “It’s much easier, because the patient’s right there and you get the alert. You’re, Oh, yeah. Are you still smoking?”

#25 Male Internist: “If you’re looking at the chart and the person’s there, “Oh, you’re here for your Pap smear” and then actually got it done. Saved a whole other appointment”

#8 Female Family physician: “It’s such a HUGE timesaver to have the computer in the room for those alerts, but especially for the pharmacy and formulary.”

One concern that was expressed is that sometimes an alert received in front of the patient may affect the provider’s confidence.

#6 Male Pediatrician: “The only negatives I can think of is that when they do come up, the nuisance ones that we’ve talked about, in the exam room, sometimes that makes the examiner look less confident or flustered a little bit. You know, the “I’m gonna order this for you...Oop!” Boop! You know, I think it makes a noise usually when you get one of those. I’m not really sure if the patients really perceive it that way, but not only does it slow you down, but it just sort of takes you down a level maybe as far as your confidence”

#27 Male Internist: “Or an allergy. If we had an allergy in these medication alerts, you’d do those in the room.”

#23 Female Family physician: “Yeah, instead of waiting for that phone call from the pharmacy twenty minutes later.

#27 Male Internist: “Right. When you’re doing it with the patient there. It might be embarrassing, but it’s better to do it then. [Others agree.]”

Furthermore, the notification in the exam room that there is an urgent (red) Patient Call message may be distracting.

#6 Male Pediatrician: “And then the only other one I can think of, and this is pretty mundane, is when I’m in an exam room and I see that there’s a new patient call, or especially a red patient call, it’s kind of like that part of the office follows me to the exam room where it didn’t before. And it may just try to push me out of the room quicker or it takes my mind off the patient who I’m seeing.”

#23 Female Family physician: “It can be very invasive to see that I have a patient call that’s red. It’s like I don’t want to be thinking about that when I’m in exam. I don’t want to do it with this particular patient that I’m with, but you only see those if you’re on that schedule screen and I’m not usually on that anymore.”

#28 Male Internist: “It’s a distraction. [Group agreement.] But it’s not a big deal.”

At times the wording of the alert may be phrased in a way that causes embarrassment or raises sensitive topics- especially in relation to cost considerations.

This may, however, sometimes lead to a positive discussion.

#5 Male Internist: “... the alerts are not always genteelly phrased. Sometimes cost is the number one reminder in the alert. And I’ve had patients before tell me, “Well, you shouldn’t be considering cost.” After which, I always say, “Well, of course, I should be considering costs.” [Laughs.] Sometimes that leads to a positive discussion and sometimes it doesn’t, but oftentimes there’s somewhat sensitive information on the alert. Not sensitive from a patient confidentiality standpoint, but from a business confidentiality standpoint.”

Finally, some users do note, however the possibility of confidentiality risks, if the patient has a parent or other relative or friend present in the exam room

#6 Male Pediatrician: “I suppose if there’s a teenager patient and the mom or dad is savvy enough to know when you would get a Pap on a sixteen or seventeen year old, that could create an uncomfortable situation as well.”

#27 Male Internist: “I don’t think so [that confidentiality would be a problem]. I can’t think of any instances with that concern.”

#21 Female Family practice NP: “If they have their family member there, or their neighbor.”

#26 Female Pediatrician: “I guess a Pap might be, for a young unmarried woman who’s with her mother or something.”

Question 9: “All things considered ...what key things would you tell system developers?”

A number of key messages emerged from the focus groups. These include simplicity; the right level of intrusiveness for the particular alert type (making it modal only in very select circumstances); intrusively alerting about only really important things; minimizing the steps involved in responding to an alert; providing an “effector arm” so that it is easy to fulfill the alert; time efficient; group multiple alerts together whenever possible; make it easy to glean the information necessary to evaluate the alert, without having to drill down or navigate to additional screens; take advantage of the patient specific data in the database, so that the alerts can be presented more appropriately for the particular patient; present the alert at the optimal time in the workflow;

#8 Female Family physician: “Prominent, but not overbearing. Have them in a workable spot. Prominent, but not overbearing.”

#3 Male Family Practice PA: “So that we can deal with it when we want to deal with this. [General agreement.]”

#6 Male Pediatrician: “Be able to defer or easily override.”

#1 Male Pediatrician: “Make it so it simply does the task you want. Instead of saying, “Do you want to go to the Smartset,” and then you have to do the task and then accept the Smartsets. “Do you want a hemoglobin A1c?” Yes. It does it. So sort of decrease how many steps it takes to get before me.”

#5 Male Internist: “And implicit in everyone’s comment, don’t make it slow you down or don’t let it slow you down. If anything, it should allow you to work as fast or faster, and that’s hard to do when you have screens popping up.”

#1 Male Pediatrician: “Make it to be able to do multiples, so it will allow you to do the multiples of work all at one time. Sort of cluster problems and dealing with them all at once, if you can.”

#21 Female Family practice NP: “Consolidate, simplify. Make it idiot proof, for me, and---“

#23 Female Family physician: “That’s hard, because idiots are ingenious.”

#21 Female Family practice NP: “They are? Make it complete, helpful, pertinent, individual---“

#22 Male Internist: “Trustworthy and loyal. [Group laughter.]”

#25 Male Internist: “I think the challenge is making it not too intrusive, but intrusive enough that you can still see it.”

#25 Male Internist: “ So again, I guess it goes back to the minimum. Anywhere you can minimize the steps involved to do what you have to do. [Others agree.] Just being creative that way; whatever that would involve.”

#21 Female Family practice NP: “Minimize mouse clicks. Minimize the verbiage, so I’m not reading like a couple of lines of stuff. It’s like, bam! Yes, no. Don’t give me this whole big, “Good guidelines recommend it. You do this.” So I guess it goes with simplify”

#23 Female Family physician: “Then having it link to whatever the expected action is on our part. There’s not much point in having all these reminders if we can’t easily make that happen.”

#25 Male Internist: “It seems like there’s more and more data in Epic on each patient, which seems like it should allow more individualization of alerts pertinent to a given patient. I mean, that’s on sort of a different level of how do you build that in the system, so that one person who has all of these specific problems and lab results might get a certain alert that something needs to be done differently. Trying to work toward using all that data that’s in there in a way that helps us do even more individual stuff.”

#21 Female Family practice NP: “To make it more meaningful to the individual.”

#35 Female Family physician: “I only want to be reminded about things that are really important. Now, the system, to a certain extent, really have to decide what’s really important, but you can’t be reminding me about everything or then it ceases to be an alert, because it’s happening all the time.”

#37 Male Family physician: “Put all the alerts on one page”

#34 Male Family physician: “ Yeah, I think batching the health maintenance in one pop-up thing, instead of having several things that are either highlighted or need to be looked at. So it’s not a repetitive kind of alert. And to not be reminded of things that maybe need a reminder every six months, be you’re reminded every visit. It’s to short circuit some if this.”

#35 Female Family physician: “And to have the alert show up at the time of the visit, that it is going to be the most useful.”

#33 Female Family practice PA: “Now, that’s a tricky thing, because that---“

#35 Female Family physician: “That may vary from person to person---“

#33 Female Family practice PA: “That’s tricky, because we open different things at different times. “

There is an acknowledgement of the difficulty of striking the right balance between appropriate and necessary intrusiveness and not being disruptive.

#6 Male Pediatrician: “Well, they have to be...I’m just thinking of the medication and what you want, cause I’ve missed that a few times, in pharmacy calls. I mean, I feel stupid and I don’t know how to make it more prominent... So, I mean, the important ones at least need to be made to really stand out and grab your attention. And then when they do, we’ll complain that they distract us from the task at hand.”

Screen shots were presented (Appendix 1). Then the following 2 questions were answered together.

Question 10: Do you prefer one of these Alert or Reminder presentation types?

Question 11. Are there presentation types that you especially do not like?

Users definitely indicate preferences for different types of alerts and reminders, but there is also recognition that each type may have its place, depending on circumstances. Nevertheless, there are improvements that can be made in each style.

The following quotations are illustrative of the recognition that different modalities have their place:

#6 Male Pediatrician: “Well, it’s not so much choosing one over the other, because they serve different purposes, but I like the top screen [non-intrusive reminders]. That’s what I’m used to. It’s what we see mostly in pediatrics, I think. So I would think it would be a good idea if there were additional alerts and reminders, to have them along the list there. Because they definitely notice that it’s...If it’s possible. If it’s in the workflow. Obviously if I’m trying to order Zoloft, it doesn’t do me much good to have the reminder go up there onto my schedule screen.”

#35 Female Family physician: “I think it would be different types of useful for different things.”

Others also indicated a preference for non-intrusive reminders:

#8 Female Family physician: “Yeah. I think the lab results and the pharmacy refill would possibly be a nice addition to kind of the workflow buttons up there [the non-intrusive reminders on the top most screenshot]. Then I think for individual patients, for the individual patient needs, having it go in the order summary section would be probably the most appropriate place for the reminders to pop up.”

#26 Female Pediatrician: “I like the “Patient calls in” messages in the corner. They’re easy to see. They’re easy reminders, but they don’t get in your face and you can just glance to them even.”

#35 Female Family physician: “Right. I mean, I like those upper right-hand corner reminders that we use these days.”

#37 Male Family physician: “Right.”

#35 Female Family physician: “That are the more passive ones, like you said, that are more silent. They don’t get in your way. That you can decide if you want to look at the screen or not.”

#33 Female Family practice PA: “Yes.”

#37 Male Family physician: “That’s a good point.”

#35 Female Family physician: “As opposed to the in-your-face ones, the bottom one, where you have to actively do something to get rid of it---“

#37 Male Family physician: “To squash it.”

#35 Female Family physician: “---if you don’t want to see it.”

However, there are contrary views, including a preference for the “pop-up” alerts, or at least an acknowledgement of its utility:

#22 Male Internist: “I like the “get in my face” ones. That’s when they get my attention during the day. Although, I don’t want the numerous clicks to get there. But, the passive ones are not active enough for me.”

Dr. Krall: “So do you tend to ignore the passive ones?”

#22 Male Internist: “Yeah. I’m bad. [Group laughter.] Hit me. I guess I’m relying on the flying in your face ones because I don’t like to go to the passive ones.”

#34 Male Family physician: “Well, from a system point of view, particularly if we’re being graded like on if aspirin is current as we use in the diabetic [word?], something like that showing up, I think, will probably get better compliance. Get a better system-wide kind of response.”

#33 Female Family practice PA: “That might be true.”

On the other hand, some users express a real dislike for “pop-up” alerts:

#21 Female Family practice NP: “Okay, I really hate those gray boxes. I really HATE---“

#27 Male Internist: “Yeah. Where you have to say yes or no. We’d like to have that off to the side and not a yes or no, but have a reminder.”

#21 Female Family practice NP: “And you can do all the stuff you want to do.”

Dr. Krall: “#27, what is it that you would like to have it do besides the yes and no?”

#27 Male Internist: “What we talked about; have it be off to the side where you can still work on your screen and it helps remind you what you want to do. Or, it is a click box that will then enter stuff for you. I usually say, “No. I don’t want to see the quick set.” I take note of the reminder, but again, partly because that diagnosis screen being another mouse click, because I never have the diagnosis screen filled in first. I usually---“

#28 Male Internist: “You’ve got three clicks to do.”

#27 Male Internist: “Right.”

#28 Male Internist: “If you click no, it’s just one.”

#21 Female Family practice NP: “Yeah, it’s three versus one click. Exactly.”

#28 Male Internist: “Yeah, it’s too many clicks.”

<break>

#33 Female Family practice PA: “They’re not accurate [the pop-up alerts] and you have to...My job is to know my patient a little bit, which the computer helps me do, and I think that it’s a really important communications to my patient that I sort of know her, or him, whatever. I know her. I know she smokes, but she doesn’t want to smoke now, so I don’t want to hassle her about smoking. I already know that she’s on aspirin; it just hasn’t been entered by somebody. I haven’t taken the time to do it, but I already know. Again, and I don’t want to pound them every time they come in. I want it customized to what I think is important, along with the computer, but I want to be able to do that. But the Smartset, it’ll take you out through all these different things and you have to customize it. I mean, it’s often inaccurate. I’ll tell you that. It doesn’t fit that person. That’s why I don’t use it. I tried to use them over and over again, and I just get frustrated with Smartsets.”

<break>

#35 Female Family physician: “And then the other thing that I always wondered was, for me, because of my workflow, this reminder doesn’t come up at a time when it would work for me to use the Smartsets, even if I wanted to use the Smartsets. Now, the information is useful to me. I mean, it’s useful to me to be reminded before I go in to see the patient that I might want to talk about these things. But, it’s not a time when I am ready to order anything.”

Other individuals express a preference for alternative medication type alerts. This is at least in part related to a preference for being able to take the action on the same screen as the alert:

#1 Male Pediatrician: “Well, I mean, if it’s work I need to do. I mean, I sort of like the format of the second one [medication alternative alert], but in fact I can chose what I want right off the list. You know, I don’t have to go somewhere else to get the choice. And that sort of goes to the idea that, you know, if you want a hemoglobin A1C, you want to do it, do it. Don’t take me somewhere else. Just let me do it at the moment you’re telling me it’s something that needs to be done.”

#5 Male Internist: “So you’re saying have the lower decisions for a reminder [BestPractice™, pop-up alert] look more like the medication reminder?”

#1 Male Pediatrician: “Yeah. Order a click box or radio buttons, or whatever it is. It’s yes, yes, yes, accept. And it won’t do it off from the screen. There’s just no need to have to keep swapping over to different places.”

#8 Female Family physician: “Yeah. Consider aspirin. Would you like to order? Yes, click, BOOM, it’s ordered. [General agreement.] And you don’t have to click, click again and finally decide.”

#1 Male Pediatrician: “I like it when it gives you the ability to do the work from the time it’s telling you the alert. It would probably be a hybrid of 2 [medication alternative alert] and 3 [BestPractice™ pop-up alert], something like that.”

<break>

#27 Male Internist: “ I like these alerts just fine.”

Dr. Krall: “The alternative medication---“

#27 Male Internist: “Right. I don’t find those intrusive. I can ignore it if I want and I can use it if I want.”

#21 Female Family practice NP: “ I like it because when you choose an alternative, it has the other sig for the medicine that you just ordered. Like on Zithromax there’s, I just put Zith and it just zips down to the bottom one and I didn’t have to type in the sig. I LOVE that!”

#26 Female Pediatrician: “Yeah, that’s nice. [Others agree.]”

#21 Female Family practice NP: “That way it saves me mouse clicks, or that one saves me typing.”

There were some specific suggestions for changes in the screen format or behavior.

For example here are some suggestions for the Alternative Medication reminder:

#6 Male Pediatrician: “There are sometimes boxes like where the non-formulary drug shows up on the example that aren’t nearly large enough and there’s either a lot of scrolling or I think sometimes you could click on the magnifying glass and expand. This screen, but it would be nice if when you got a reminder, you got all the information pretty much right away.”

Dr. Krall: “Where it would pop up and expand to the appropriate size if it didn’t all fit in?”

#6 Male Pediatrician: “If at all possible. I guess if there’s so much information, then it just might not fit on one screen.”

#3 Male Family Practice PA: “I have a problem visually with these medication alternatives. When there’s nine alternatives up there with all the various permutations and qualifications and such, and I’m...And again, it’s one of these dense moments when I’m sitting there, wait a minute. You know, wondering, “Wait, I’m supposed to pick one of these. Let me just...” And as you say, you can only see part of what the message is. What’s the qualifier here. I don’t know. I don’t know how you could make it any better though. It’s like you throw out ALL the alternatives here and all the options, and with all the information on each of those options it’s...it’s kind of dense.”

#8 Female Family physician: “Something else I think would be nice to have changed is when you do have the alternatives that the “accept alternative, continue with original cancel” aren’t right together.”

#3 Male Family Practice PA: “How many times do you hit the wrong one?”

#8 Female Family physician: “If you have that little cursor just slightly a little too high and you say, “accept alternative” and you meant “continue with the original,” you end up ordering something inappropriately or accidentally, and it would maybe be nice to have it---“

#3 Male Family Practice PA: “Separate.”

#8 Female Family physician: “---you know, “accept alternative, continue with the original and cancel filling process,” so you really kind of had to be in one area. So you’re not accidentally

clicking. I'm not sure if there's enough room to always have that down on the screen, but it would be nice. It would also be nice to separate when you go to say accept or cancel. Sometimes those are close together and if you get going too fast, I've cancelled a few things that I've typed in. It's with like x-ray and referral stuff that orders, and the "cancel" and the "accept" are right by each other, and I've accidentally just been a millimeter too high and it canceled and lost the information. Then I have to go type it again. But with these alternatives, having it clear---

#6 Male Pediatrician: "Yeah. I think that's another situation. I haven't thought about this until tonight, but if you had these three choices be choose-able by hitting one letter. "A" for accept alternatives, "O" for original and "C" for cancel. That would be great. That would take away the cursor, so it would be speedy and there's less chance of hitting the wrong box."

Dr. Krall: "So you've got a keyboard alternative."

#6 Male Pediatrician: "Um, hmm."

Likewise, there are suggestions to improve the non-intrusive "Patient Call" alert:

#21 Female Family practice NP: "Would it be too weird to put the number? What I do is, I might have one patient call in there, so it's lit, or the message. Maybe I couldn't get a hold of that person, so I left it in my message, or just for some reason it's in my box, but I'm not gonna address it at this moment. But, I want to keep UP with my stuff."

#23 Female Family physician: "So you have to be clicking this. Like there's more than one---

#21 Female Family practice NP: "So I keep clicking. I'm in my in-box a LOT, because I want to see what's happening. I want to make sure that things aren't getting away from me, even though that message is lit. But then I worry that, gee, forty-five patient calls, forty-six patients calls. It's like the little ticker going. I worry, or whatever."

Dr. Krall: "So bring more information up to the front and give a number? [All agree.]"

#27 Male Internist: "How many calls are waiting."

#23 Female Family physician: "Or, to have a place where you could store a message without having it remaining."

#21 Female Family practice NP: "Without postponing until the next day. I don't know if I want it postponed to the next time, because I'll do that when I'm...as soon as the patient call comes up. I postpone it or I'll print it out. [#23 agrees.] As soon as I can see it coming up!"

#28 Male Internist: "For me, I think the best thing would be just to have the number of calls that are waiting in the box. [Others agree that that would be really helpful.]"

There are a variety of other suggestions:

#25 Male Internist: "I wonder if there is an option of tailoring the alert to the preference of the clinic provider?"

Dr. Krall: "So besides the different type that we just talked about, what other things would you tailor if you were going to tailor them?"

#25 Male Internist: "I'm just thinking in the way that they would be presented. Maybe if there were two

different options”.

#27 Male Internist: “And the customizable ones, so you could create your own alerts, basically, easily.”

#21 Female Family practice NP: “Like a patient with a splenectomy needs a pneumovax, so then you’re reminded that, oh, gosh, it’s time for your pneumovax.”

Dr. Krall: “Are there other parts about alerts that you would like to be able to control if we could somehow give you that control?”

#23 Female Family physician: “How many times you get one. I mean, like the one about the cyclobenzaprine causes sedation in the elderly.”

#21 Female Family practice NP: “I don’t know if I’d want that much. I’d want it just gone, but it would be nice if it’s like, yeah, I’ve heard this one enough.”

#25 Male Internist: “It’s kind of like on the computer it’d say, ‘Please don’t show me this message again.’ [All agree, talking and laughing.]”

#26 Female Pediatrician: “Don’t show any for one month or two month, or whatever.”

#27 Male Internist: “Or never. [Others agree.]”

Question 12: How likely are you to respond to a completely passive Reminder?

There appear to be several characteristics that determine whether and to what extent individuals will respond positively to non-intrusive alerts and reminders. These include user interface, workflow, and topical domain or category issues, with many of the remarks crossing two or more of these boundaries.

In relation to user interface, some focus group participants said they were more likely to respond to a non-intrusive alert if it was colored red. This stated tendency is apparently related both to the fact that such an alert is more likely to be noticed, and that it is presumed to be of a more urgent nature.

#1 Male Pediatrician: “Well, like #6, I often have some stuff that’s sort of falling over from previous days, so it doesn’t give me any sense of priority or reason to go looking there. If I have a patient sitting in my office and there may or may not be new work in there, but I don’t know, then I go see my patient. Unless it’s red.”

However, it's not just the color that seems to matter, as the excerpt below indicates. In the current design, non-intrusive health maintenance reminders are *always* red when they appear on the schedule screen, whereas the other alerts mentioned below may be blue or red depending on urgency. So, there appear to be factors of both priority and domain that determine whether an alert will be noticed and addressed.

#28 Male Internist: "I see the phone calls and the message ones, but I don't really notice the health one there. Every once in awhile I say, "Oh, that's a pretty color," but that's about as far as I look at it.

An interface and workflow issue, users also indicated that being able to determine easily, at a glance, when there were new items of a particular category would be helpful. Often they are aware of a particular work item, such as a patient call, that they have evaluated and decided to defer. The way the system currently works, however, the only way they can then tell if there are new items of the same work type is to click open the In-basket and then determine whether the number of items of the type in question is the same or more than the last time they checked. This was seen as an unnecessary extra step. (Although many users learn to keep the In-basket open on their desktop, minimizing this effort, this tip did not emerge from the users during any of the three groups.) Users said they were more likely to be satisfied with non-intrusive alerts and respond to them favorably if they could, at a glance, tell when an alert represented new activity of a particular type (such as a new phone call), or if they could easily glean additional information from the alert itself.

#3 Male Family Practice PA: "Some sort of indicator, because I agree with what everyone has said. I may look at a message or look at a patient call and choose not to respond to it at that time, and then because I haven't responded to it at that time or cleared it out, then the reminder remains an indicator, but I don't know if new stuff has come in on top of that...."

The suggestion was made that there could be a number by the alert category indicating how many items of that type were in the In-basket, possibly even indicating the number reviewed and the number new.

#25 Male Internist: “So you get calls that say, “three new, two pending,” or something?”

#28 Male Internist: “To me, if I just knew the number of calls that were waiting. I would know that information, because I know how many were there the last time I accessed the screen. [All agree.] So if it just had the number of calls that are pending or that are in the box, that would be plenty for me. [Others agree.]”

Focus group participants did some creative design brainstorming. What they came up with is quite similar to what Epic has developed in an upcoming version of EpicCare™. Here, participants are talking about how they would like to see the non-intrusive Health Maintenance reminder. There remarks also indicate how different clinician workflows are so very pertinent.

#28 Male Internist: ”No. To me, it would be more useful if it was actually under a tab on the charting screen.”

#23 Female Family physician: “Where you could use it occasionally.”

#28 Male Internist: “---like the medications is. That would be useful to me, in terms of acting on it and responding to it.”

Dr. Krall: “So are you more in the camp of preferring the pop up alert or not necessarily? [Several respond, no.] No.”

#28 Male Internist: “No. I’d rather have another tab on the top of the charting screen that had the health maintenance that could turn colors, depending on if something needed to be done, because I would look for that.”

#21 Female Family practice NP: “Like we have it on the order screen.”

Dr. Krall: “So you would---“

#28 Male Internist: “I know. There is a health maintenance button already that changes. It kind of fades white, or something.”

Dr. Krall: “Right. Right.”

#28 Male Internist: “But even that, I don’t see well. You know, what I’m looking at.”

Dr. Krall: “So what would you see well?”

#28 Male Internist: “If it was a tab that would be red. One of these tabs here would be red when it needed attention.”

#26 Female Pediatrician: “Would be red instead of gray.”

#23 Female Family physician: “Um, hmm.”

#25 Male Internist: “There is one on the order screen? I haven’t even noticed that. [Laughs.] I wouldn’t find it helpful at all being on the charting screen, because by the time I get to charting the patient’s long gone.”

#21 Female Family practice NP: “It’s too late.”

#26 Female Pediatrician: “Um, hmm.”

#25 Male Internist: “When I’m with a patient, I’m usually in the order screen. If there was a place that I could click on it and it would just pull up the health maintenance and I could satisfy those while I’m doing orders, that’s when I’m in the room. So for me, that would work, because charting may be after I get back or it may be at the end of the half day, if it’s been a bad day for me. That’s tough. So the charting screen isn’t really good.”

#28 Male Internist: “For me, I’ve learned to always go through the charting screen to get to the order screen though. I always go that direction.”

#25 Male Internist: “See, I don’t do that. [Laughs.] It’s interesting. It’s just different. That’s where the challenge is here. I think everybody uses this stuff differently. [All agree.]”

Users indicate that some categories of non-intrusive alerts take precedence over others and are more likely to receive early and frequent attention. This view is supported by several remarks.

Dr. Krall: “Patient calls, lab results, refill request messages, health maintenance and so on, are you more likely to respond to one if you see one of those red versus another one red.”

#35 Female Family physician: “Oh, patient calls.”

#33 Female Family practice PA: “Patient calls are mandated by the nurses.”

#35 Female Family physician: “That’s a priority.”

#37 Male Family physician: “Yeah, that’s---“

#33 Female Family practice PA: “We have to answer them.”

#8 Female Family physician: “I’d probably put patients calls on the top and the pharmacy refill requests second. I mean, if you’ve thought about maybe reorganizing the structure. [Maybe enter?] new categories to put up there and then like lab results and then messages at the bottom, just to kind of prioritize what you see.”

#23 Female Family physician: “Well, the messages – particularly the patient calls – are more of an

immediate time thing. Health maintenance, they might have been due for something for six months. I just haven't really trained my brain to pay much attention to those. Whereas I'm always looking to see if there's messages or phone calls."

Dr. Krall: "So you pay attention to phone calls and you're saying that you don't particularly pay attention to the health maintenance alerts?"

#23 Female Family physician: "Yeah, not always."

It appears there are special issues in the domains of lab results and pharmacy refill requests.

Dr. Krall: "Now, imagine down the road when you're getting lab results into your In-basket. If lab result is a category of this type of alert, is there information in that that you would like to see in the banner about types of labs, or numbers of labs, or urgency, or give you an answer?"

#21 Female Family practice NP: "Yeah. I'd like them prioritized. I'd like the abnormalities on the top."

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#28 Male Internist: "For the prescription authorization that ought to be up on there, because that doesn't show up. I've had them sit there for like half a day because I didn't get any phone calls or messages to make me want to go in my in-box and there's a prescription waiting to be authorized."

Dr. Krall: "So other than that there is a prescription, is there other information that you would like to know about from the alert, related to prescriptions?"

#28 Male Internist: "Just that it's there."

Dr. Krall: "Just that there is one? [Others agree.]"

These users anticipate that lab results and pharmacy refill requests into the In-basket, with an associated non-intrusive alert, will have an impact on workflow. (The Kaiser Permanente Northwest EpicCare™ implementation does not currently include these work types in the In-basket.)

#3 Male Family Practice PA: "Yeah. It goes to your In-basket. Every time, so you're always gonna...I mean, because they do things in batch. You know, labs come in all the time, so you're always gonna have lab up there, so how much reminder is something that is always gonna be there?"

Dr. Krall: "That's a good point. It wouldn't always necessarily be a high priority one."

#3 Male Family Practice PA: "Or a good one. I mean, obviously a lab that's a panic level. Well, of course, that's already dealt with."

#5 Male Internist: “Yeah. I would almost put pharmacy requests and labs in the same category as charts. In other words, you don’t get a reminder that the chart is there. The only things you see up there that are in your In-basket, the only reminders are messages and patient calls. And so you have to...If you don’t have any messages or patients calls, you can often have a stack of charts in there that you are not aware of unless you actually check your In-basket. I might say that for the majority of pharmacy requests and lab results. I guess what I’m saying is I’d only want to know about the urgent pharmacy requests or the urgent lab issues.”

In addition, there are different workflow characteristics depending on the site of care.

Urgency care, for example, has its unique demands, and patient, staff and clinician expectations.

#35 Female Family physician: “And in urgency care...[pause]...That’s a good question.”

#34 Male Family physician: “I would be less likely to do that, because I’m trying to focus on one given item---“

#35 Female Family physician: “Yeah. Yeah.”

#34 Male Family physician: “---though as best you can.”

#35 Female Family physician: “A pop-up reminder probably is a better thing for urgency care, even if I don’t use the Smartset, I mean. I have been forced to look at what they’re due for.”
<break>

#33 Female Family practice PA: “Well, I would say it’s a very situational. I think it depends on how does the urgency care...I mean, it’s how stressed am I. How overwhelmed do I feel, and that’s true just in general. If I’m having an overwhelmed day, I am less likely to be paying attention to any of the health maintenance reminders.”

Question 13: How likely are you to evaluate and respond thoughtfully to an active, more intrusive pop up alert or reminder?

Here, too, comments sort into a few categories and workflow and user interface are both prominent issues. Responsiveness to workflow means not unnecessarily interfering with the train of thought or task at hand, and presenting information “just in time” and in the optimal context. Time efficiency is one component of getting workflow right. But in addition to lost time, mental fatigue or cognitive burden and annoyance or “hassle” are consequences of getting this wrong.

#8 Female Family physician: “If it fit logically into the workflow and, again, eliminated stuff as opposed to creating more.”

#5 Male Internist: “Yeah. I find that people get most irritated when there are intrusions on their time, and I think most people see these as intrusions on their time.”
<break>

#8 Female Family physician: “Um, hmm. “

#5 Male Internist: “And disrupters. I mean, that’s the sense I get for people who really don’t like them. I don’t know how other people feel, but they don’t really bother me one way or the other. I mean, it just takes a quick keystroke if you don’t want to deal with it right then.”

#6 Male Pediatrician: “I don’t hardly ever see those boxes, but just looking at it now reminds me of the newer versions of Microsoft Word with that annoying anthropomorphized paperclip guy, and I hate those, so my initial response is negative to that just by association with that.”

Dr. Krall: “What is it about the paperclip that you find especially annoying?”

#6 Male Pediatrician: “It’s assuming, or it’s not assuming, but it’s unnecessary reminders. And oftentimes in that system – I’m not sure if I can think of an analogy in EpicCare™. You know, it stops me from doing what I’m doing. Like I say, I could use some... You know, I’m doing something and I know exactly what I’m doing, but this paperclip thinks that I should have inserted a capital or that I need to know this helpful tip right now, which I really don’t care to know.”

#3 Male Family Practice PA: “Yeah. It’s an interruption and it’s not crucial.”

#6 Male Pediatrician: “Yeah. There are just more of them.”

#3 Male Family Practice PA: “You’d want to know if like when you’re typing and you’re about to close out it says, ‘Do you want to save what you just wrote?’”

#6 Male Pediatrician: “Sure. Sure.”

#3 Male Family Practice PA: “That’s a useful reminder, but like when you’re writing a letter and it says, “I see you’re writing a letter. Would you like the format for letters,” as if I care about that.”

Also a part of workflow is presenting the alert at the appropriate place within application, as we have seen before, acknowledging the difficulty in getting this right for all users.

Dr. Krall: “Okay. So suppose it popped up in order summary---“

#35 Female Family physician: “I would be much happier if all these popped up into order summary. All right, look. If it popped up in order summary---“

“Dr. Krall: Now if it pops up in order summary, it says, ‘They’re due for aspirin, influenza and a mammogram. Do you want to order those? Yes/no?’”

#35 Female Family physician: “I would be much more ready to do that, because when I’m in order summary I’m there because I’m ready to order things.”

#37 Male Family physician: “Good job. I agree.”

Dr. Krall: “So for you, it sounds like it’s really almost entirely a workflow issue.”

#35 Female Family physician: “Yeah. If it showed up when I got to order summary, instead of when I opened charting, it would be more useful and less annoying. And I would probably be much more likely to use the Smartsets.”

There were some user interface suggestions to help deal with pop-up alerts. Giving users some control of when and how they present was one suggestion. Another was that the system could present reminders differently to individuals based on their past performance on the specific quality indicator. A very creative idea was that the system could monitor this and adapt based on real time clinician performance.

#3 Male Family Practice PA: “Well, again, it’s the windows thing. The model. Cause they do have screens that come up and say, ‘Do you not want this screen to come up?’”

#8 Female Family physician: “Yeah. Do you want to turn off the reminder.”

#3 Male Family Practice PA: “Yeah. So maybe we just need to put little boxes on the bottom that say click here if you don’t want these reminders.”

Another theme that was repeated here was that the alert would be more useful if it made it easy to carry out its recommendation, and didn’t insert additional, extraneous screens or questions between the recommendation and the action.

#23 Female Family physician: “I think if there were a simple way to get the thing ordered, or done that it’s asking you about.”

#28 Male Internist: “Well, if it didn’t want the second message after the first message. [Others agree.] “If you really want to do this, because there’s no diagnosis in the chart yet.” That helps.”

#27 Male Internist: “I don’t care. [Laughs.]”

#21 Female Family practice NP: “Don’t ask follow-up questions in the pop up boxes.”

Here too, individuals expressed the desire for a non-modal alert, that the individual could easily see, evaluate, and then decide whether to perform immediately or at a later time.

#27 Male Internist: “Well, and then it’s not all or nothing. I think that’s a thing that I could have. It’s not yes or no, it’s deal with it and stay there---“

#21 Female Family practice NP: “Deal with it now or deal with it later.”

#27 Male Internist: “---but allow you to deal with it. Right.”

#21 Female Family practice NP: “Deal with it later without having to make a mouse click.”

#27 Male Internist: “Right.”

#21 Female Family practice NP: “Like, yeah, it’s important. I agree, but I need to unburden myself of these other thoughts I have right now.”

#23 Female Family physician: “So maybe instead of just saying yes or no, it should say, yes/no/later.”

The requirement that the alerts are important, accurate and up to date was emphasized.

#34 Male Family physician: “I think they’re useful, but I think they need to be very selective and I think if you’ve responded to it once within the timeframe, it doesn’t pop-up again. So that they you aren’t slowed down or aren’t battered and kind of forwarded.”

#35 Female Family physician: “Right, because for all of these there’s a certain time lag before the reminder is turned off.”

Question 14. All things considered, if you could tell system developers one thing to remember when designing electronic alerts and reminders, what would that be?

The major themes here are speed; efficiency; non-intrusive and non-modal; supportive of workflow; flexible and customizable; brief and succinct; convenient, accessible, compact; meaningful and important.

Participants reiterated many of the opinions they expressed earlier. First, they said the alerts should be efficient and must not slow them down. Part of achieving this goal is designing the alert so that it makes it easy to accomplish it’s recommendation.

#5 Male Internist: “It should make things faster.”

#23 Female Family physician: “The idea of with the reminder or an alert, not just having it be a reminder or an alert, but having it be an easy way to get the job done that it’s reminding you about.”

#28 Male Internist: “Well, for me, if I’d pick one thing it would be that the alert would actually do something actively when you clicked on it, or whatever is going to help complete the task. That still, I think, would be the most important for me.”

User interface or presentation suggestions were again heard and these included the convenience, and accessibility of evaluating and performing the alert.

#5 Male Internist: “I shouldn’t have to click on anything to go someplace else or to go to another box.”

User interface suggestions to support or at least not disrupt workflow were again prominent.

#3 Male Family Practice PA: “They shouldn’t be a barrier. They should be something that you don’t have to stop to deal with and then go on. They should be a sidebar.”

#8 Female Family physician: “Right. Don’t stop my train of thought. Don’t stop my workflow.”

Noteworthy also were more general workflow concerns.

#22 Male Internist: “I think timing is important. In the exam room, I think that’s where I’d want to hear about the Pap and the mammogram.”

The substance, richness and adaptability of the alert content were prominently mentioned as was the requirement that the content be meaningful and important.

#27 Male Internist: “Well, I agree with customizing the content and the presentation. Because we’ve heard different ideas of what people like in here and it seems like... Let us do a little bit of it ourselves. Let us modify things a little more, I guess is what I would say. Allow more user modifications of some of these things that we just get stuck with.”

#35 Female Family physician: “Well, to me, the one thing I say is be selective and you choose what things are really important to have alerts and reminders for, because if we end up with alerts, or reminders, or choices we have to select every time we have to order something, it’s real...I don’t know. It isn’t just that it slows us down, but it’s SO aggravating. Be selective. And don’t make things red unless you need to attend to them right now.”

#37 Male Family physician: “Mean it.”

Themes

If one examines the focus group data, across all questions, there are consistent themes or threads that emerge (Table III). These predominant themes can be characterized as “Efficiency”, “Usefulness”, “Information Content”, “User Interface”, and “Workflow”. In addition, there are findings that may be described as “New Ideas.” These themes will be discussed and illustrated with quotations below, a few of which will be repeated from prior excerpts.

Table III. Themes

	Sub-themes
Efficiency	Minimize/ simplify Pre-populate alternatives Computers in the exam room
Usefulness	Accurate Not repetitive Necessary Important/ selective Succinct
User Interface	User interface design principles More information with less effort Optimal intrusiveness User control/ preferences
Information Content	Timely Rich Accessible Information at a glance
Workflow	Appropriate time Appropriate place At user’s discretion In the exam room In context Directed to the optimal person Grouped/ batched

Efficiency

Clinicians, at least in most settings, are typically very busy with multiple competing demands for their time and attention. Their workdays are usually, if not always, long, intense and both mentally and physically exhausting. It is natural, therefore, that any

innovation in their environment will be first judged according to whether it helps or hinders their efficiency and ability to get their work done.

#5 Male Internist: “Yeah. It should add value and I think most clinicians consider it the number one value item, time.”

A frequently noted approach to increasing efficiency was “minimize”. This extends to minimizing keystrokes, typing, the use of the mouse, the numbers of steps to accomplish a task and the verbiage that has to be read. Other users expressed it as, “simplify.”

#3 Male Family Practice PA: “And if you have a fertile, diabetic woman who smokes, you’re gonna have to click through three screens...”

#8 Female Family physician: “Yeah. Click, click, click.”

#3 Male Family Practice PA: “---three gray screens to where you want...”

#25 Male Internist: “ So again, I guess it goes back to the minimum. Anywhere you can minimize the steps involved to do what you have to do. [Others agree.] Just being creative that way; whatever that would involve. [Chuckles.]”

#21 Female Family practice NP: “Minimize mouse clicks. Minimize the verbiage, so I’m not reading like a couple of lines of stuff. It’s like, bam! Yes, no. Don’t give me this whole big, “Good guidelines recommend it. You do this.” So I guess it goes with simplify.”

#6 Male Pediatrician: “Or just having it take one keystroke to continue with what you were doing. A lot of the reminders are you’re trying to do something, “Are you sure you don’t want this medication,” or “Are you sure you want both of these orders?” And #1 will agree with me, instead of having to go by the mouse and hit over the “accept original” or maybe tab a few times to get there – Maybe there is a shortcut I don’t know – just “R” for refuse or “C” for cancel, which I guess there isn’t ... So it’s a little more time consuming. It may be just a matter of seconds, but it’s kind of, you know, you’re cruising through and what should take you five or ten seconds, all of a sudden a reminder stops you short in your tracks.”

An important suggestion intended to increase efficiency was to make it easy to complete the recommended or required action by providing a convenient, accessible, and where possible pre-populated, alternative action.

#1 Male Pediatrician: “... it seems like instead it should say, “Do you just want to order this?” If you say yes, then it just orders it. Then you don’t have to go to the Smartset™, which you then have to accept and go back to the order summary screen.”

#21 Female Family practice NP: “I like it because when you choose an alternative, it has the other sig for the medicine that you just ordered. Like on Zithromax there’s, I just put Zith and it just zips down to the bottom one and I didn’t have to type in the sig. I LOVE that!”

These clinicians, who all have had at least some experience with and without a computer in the exam room, emphatically endorsed the greater efficiencies conferred by having one.

#21 Female Family practice NP: "I just wanted to say that that saves the pharmacist time, system time, saves the patient time, and makes us look like we know what we're doing. Having the computers in the exam room makes it a lot more slick."

#1 Male Pediatrician: "Or, I'm gonna order an MRI and it turns out, you know, really given what this patient has, it's probably not the appropriate test. You've already told him you're gonna order the MRI and you've left the room. It's hard then to go back and say, "You know, I've just been thinking, maybe you don't need an MRI." I mean, I think it's a difficult thing. I think most people would just as soon continue on with whatever the decision they made was. Whereas, I think if it comes up and then you can make the decision right then and there and discuss it with the patient, I think you're more likely to follow the recommendation. That's my intuition about it. I don't know that that's true."

Usefulness

Users indicated that the perceived usefulness of an alert will largely determine its acceptance and they had many things to say about what constitutes a useful alert. First, it should be accurate and this has quite a few dimensions. For one thing, the patient must be correctly selected or assigned to eligibility for the alert. Whether the patient is selected by off-line processing of various databases (such as from pharmacy, lab or an electronic medical record data extract), or is selected via an on-line, real time inference process, rigor needs to be applied so that specificity is high enough to minimize false assignment.

#25 Male Internist: "I think one problem has been if the wrong group... We ran into with the aspirin thing when there were people who did not really need to be on aspirin. Somehow the coding meant they fell into the group either for the wrong reason. People would get upset because they were being told, "Oh, you forgot to put this guy on aspirin," and they didn't need to be on it anyway. So when there's some inaccuracy of whether the right patient is getting the right alert, it tends to be fairly aggravating."

When new information is obtained, such as a patient eligible for a smoking cessation reminder now stating that he quit 2 months ago, it should be very easy for the user to indicate that the patient is incorrectly assigned, and this should be followed by very rapid

correction of the assignment. Furthermore, once the alert is satisfied through usual mechanisms, eligibility for the alert must be updated rapidly. This may be a one-time eligibility that is now canceled, or it may be a periodic eligibility that is now postponed for the appropriate interval, usually months to years. A particular challenge is created when the alert is satisfied not by an order but by a result. This may create an interlude of up to weeks, and occasionally longer, when the clinician may be alerted on something that has already been addressed but is pending the return of a lab result or the scheduling and performance of a test. For those procedures for which the interval between order and result may be relatively long (such as referral for a mammogram or flexible sigmoidoscopy), the alert might potentially appear many times after it has been addressed but prior to the loop being “closed”. This, of course, would prove annoying to both the clinician and patient. It suggests that reminders should have the feature of “postpone pending result”. Such a feature would set an interval that could vary by reminder, during which time the reminder would automatically not reappear even though it has not been definitively satisfied. An institution that knew a routine referral for screening flexible sigmoidoscopy could be expected to take 6-8 weeks before result availability could set the “postpone, pending result” interval to 2 months. During that period, the alert would not reappear. If however, by the end of the 2 months a result were still not recorded, the reminder would be reactivated

#35 Female Family physician: “Right, because for all of these there’s a certain time lag before the reminder is turned off. Just ordering it doesn’t turn it off. I’m not sure what the time lag is.”

#37 Male Family physician: “Good question. It should extinguish and then it should do it.”

#33 Female Family practice PA: “It’s the result.”

#35 Female Family physician: “The result? So then---“

#33 Female Family practice PA: “So it’s not an order and then tell the patient they have it done, and the patient actually has to have it done.”

#37 Male Family physician: “I guess that makes sense, doesn’t it? Because they walk in---“

#33 Female Family practice PA: “There’s the problem.”

Being able to easily enter exceptions or mitigating issues is another accuracy issue.

There are many situations that cause an alert not to apply to a specific individual. For example, a new member might have had the recommended procedure within the specified time frame but with their former provider, and thus this information is not yet in the database available to the reminding system. Or, the patient might have persistently refused a procedure, despite clear recommendation and risk discussion. A terminally ill patient might no longer be a candidate for a variety of otherwise applicable screening tests. In each of these instances, if the case finding routine had not already taken these circumstances into account, the clinician should be able to easily enter the exclusion and the reason from the same window he is presented with for the alert itself. The entered reason should rapidly update the eligibility database, and the appropriate history section of the chart. Someone (the clinician or the institution by policy) would need to decide whether exclusions entered in this manner were permanent (such as in the case of the terminally ill patient), just for the duration of the periodic alerting cycle (such as in the case of the patient who received her mammogram on the outside), or temporary for a specified duration possibly equaling the usual screening interval (such as for the patient who had refused a recommended screening procedure).

#25 Male Internist: “I mean, sometimes it’s frustrating when you know you’ve satisfied the order, but it’s still there. I had someone the other day and the alert was on for both needing a mammogram and a Pap smear, which had both been done outside of Kaiser a year ago, so I sent little reminders. The Pap smear got taken off, but it was still there a week later because the mammogram one hadn’t been taken off. It’s still red, so you have to look at it.”

There are still other accuracy issues. One user termed one of these the matter of “alert inflation”. This is the problem of routine messages (such as for certain calls or other patient related tasks) that are sent erroneously as “urgent”. This is not a significant problem when it is an occasional occurrence or when caused by a sincere belief that the issue was urgent. However it is an issue when there is a pattern, due to a lack of agreement on standards or because of a perceived problem of delayed responsiveness, in which senders use a different threshold than receivers of messages. This is not a computer system problem, but a concern of people and work groups. Nevertheless, it is seen as an acceptability criterion for users. An issue that is a computer system problem is that of “duplicate orders”. EpicCare™ provides duplicate order checking, so that if the same order is entered on the same patient two or more times in the same visit a pop-up alert is activated asking whether that was the intention. This is generally considered helpful in so far as it prevents, for example, two orders being generated on the same specimen such as might happen if both a nurse and a clinician entered a urinalysis order for a patient. However, what users said was annoying is when the system alerts the user when they enter an order for “now” and for “future” or “standing”, as one might do if it was desired to have a test today and a repeat test in one week. Users noted that it was specifically indicated in the second order that it was a “future” and the system should be “smart enough” to recognize that this does not constitute the kind of duplicate that is a problem.

#1 Male Pediatrician: “It prompts you either way. I mean, you specifically made it standing or future. I mean, it made an acknowledgment they’re not ordering it for now. It shouldn’t ask you if you’re sure.”

Similarly, they indicated that there are other instances where they would expect the system to “be aware” and utilize information that exists about the patient in its database

to more accurately and appropriately target the alert to only eligible patients. For example, if the patient has allergies to Penicillin and Sulfa clearly documented on her allergy list, the system should not pop up a recommendation to use the first line drugs Penicillin or Sulfa when the user has, appropriately, entered an order for a second line drug. Even more basic, the system should not present a warning about a drug causing sedation in the elderly, when it is prescribed in a young adult. Warnings related to prescribing in pregnancy are not appreciated when treating men, the elderly, or women who have had hysterectomies. Finally there is another issue that is partly dependent on human behavior and partly a feature addressable through computing system design. This is the dependence of drug interaction screening and alerting with an accurate patient active medication list. Maintaining an accurate and unambiguous medication list is very difficult for a variety of reasons, but unless achieved, drug interaction screening becomes very problematic. Although users in our focus groups have not experienced real time interaction screening yet, they have already identified this as a potential significant usefulness and usability issue. Among the requirements for useful drug interaction screening will be clear accountabilities and conscientious action on the part of users to ensure an accurate medication list.

Beyond accuracy, there are other usefulness concerns. A very important category here is when the alert provides information that is already well known by the clinician.

Although it has been convincingly argued⁴⁰ that the value of alerts sometimes is precisely in the circumstance where something is known, but might otherwise be overlooked or forgotten, users complained vociferously about annoying repetition and being told things they are already aware of. In some cases these are prevention or health maintenance

reminders that are so frequent the clinician feels the subject is internalized. If one sees 22 patients a day, 5 days a week in adult primary care, it is probable that he will receive as many as 20-40 messages a week to discuss (and document) smoking cessation.

#37 Male Family physician: “Well, I think anything that keeps recurring to me is [annoying]. If somebody who comes in who is smoking and it doesn’t seem to matter when you last talked to them. I think that comes up in any circumstance, does it not? That screen? I think every time a smoker comes in, you get that screen.”

#33 Female Family practice PA: “Yes.”

Many users find this repetition both annoying and unnecessary. Particularly if data shows that they are doing well with performing this documentation (and this is tracked and reported back to clinicians at KPNW), they ask “shouldn’t I be allowed to turn this off, at my discretion?” Similar sentiments are expressed for other repetitive reminders, especially related to certain commonly prescribed drugs that have recommended alternatives or general safety reminders. On, the other hand, there may be some users who appreciate these same reminders, and might choose to continue them. A slightly different variation of this annoyance can be described most succinctly as “I know what I am doing, thank you very much.”

#6 Male Pediatrician: “Pharmacy reminders for me are sometimes at least a nuisance, maybe a hindrance. When I decide to use an antibiotic, other than a first line, I’ve already thought it out. We prescribe antibiotics enough that we know what the first line is, but then you always get that alert that the first line is this and then you have to either continue with the original or accept the alternative.”

#8 Female Family physician: “It would be nice if maybe it didn’t do that when if you have a patient who is allergic to penicillin and Septra and they’ve had rashes, and so you’re going for your third line and they say, ‘No.’ Okay, you know? I’m not gonna use that because the kid’s allergic to it.”

These people also would argue that if their performance shows appropriate utilization, they should be able to “turn off” certain reminders. If their data suggests they might benefit from evidence-based reminders, then this performance issue could be addressed through the usual quality assurance and utilization mechanisms the institution might

employ. In such a situation a component of a remedy might be reinstating the reminders. In this scenario, the computer system rather than being the “policeman,” becomes an appreciated assistant.

Users offered other characteristics of a useful alert or reminder, some of which are addressed more fully in other sections of this discussion. They said the alert should be “important” and that they should, therefore, be used selectively. They said that it would be useful if there were links from alerts to additional knowledge resources so that you could easily access this in case either the clinician or the patient desired additional information, for example about medication side effects. They said the reminder message should be succinct and straightforward. The alert should be designed so that it is easy to carry out the recommendation without having to navigate somewhere else to get additional information or perform additional tasks. The alert should present or allow addressing within the users’ workflow. As suggested earlier, the alert should to the extent possible be within the user’s control.

User Interface or Presentation Mode

The focus group participants had very interesting and important comments about the physical and cognitive experience of interacting with the alerts themselves. First, they established the importance of adherence to basic principles of user interface design^{22,23,25}. This includes minimize scrolling, mouse clicks, reading, and minimize the requirement to switch between keyboard and mouse. It also entails maximizing flexibility of action so that those who prefer keyboarding and those who prefer using the mouse are both accommodated. And it means ensuring that the size and placement of buttons and other controls are adequate to achieve desirable speed while minimizing error.

#21 Female Family practice NP: “Minimize mouse clicks. Minimize the verbiage, so I’m not reading like a couple of lines of stuff. It’s like, bam! Yes, no. “

Second, users said that they would like to have more information available with less effort so that they could evaluate and act on alerts and reminders more easily. We heard, for example, that they would like to know by glancing at a non-intrusive reminder not only its very broad category (e.g. Health Maintenance) but also something rather more specific (e.g. perhaps, Tobacco, Pap, Mammography, Diabetes or other disease related).

#27 Male Internist: “Like that health maintenance one is probably not intrusive enough.”

#25 Male Internist: “Well, it’s... Yeah. You see it, but you have to do something to even find out what it means. [Others agree.] It’s a real pain.”

The potential threat to privacy that this might pose in some settings (for example if a patient inadvertently saw the name and associated specific reminder associated with a person’s name other than their own) would have to be reckoned with. This might be addressed in part via the use of abbreviations for the specific indications (e.g. Tob, Pap, Mamm, DM, etc.). We also heard that clinicians would like more information, at a glance, about their In-basket activity. In particular, they wanted to be able to tell when they had new alerts in each In-basket category. The approach to doing this might be as simple as providing the total number of each category item (e.g. Patient Calls: 3, Messages: 2). Or it might be somewhat more complex (e.g. Patient Calls: 3 New 5 Total). Presumably if one or more of the alerts in each category were of an urgent nature, then the associated number would appear in red (and/or in a different shaped icon for color blind users).

Dr. Krall: “ I mean, if you walked into your office and you pulled up your schedule, and you saw something like that up there in the corner [non-intrusive alerts] and your patient was ready to be seen, how likely would it be that you would respond to one or more of those alerts?”

#1 Male Pediatrician: “Well, like #6, I often have some stuff that’s sort of falling over from previous days, so it doesn’t give me any sense of priority or reason to go looking there. If I have a

patient sitting in my office and there may or may not be new work in there, but I don't know, then I go see my patient. Unless it's red."

#8 Female Family physician: "It would be nice, --- if the old stuff was black. You looked at it and then if there was something new, so you walk in and, oh, there's new labs. Well, okay, they're all fine labs. And then there's abnormal labs or the red dot phone call, then there's something red and then there's kind of something urgent."

<break>

#1 Male Pediatrician: "If I have some way of knowing that there's work I hadn't seen yet, then I would go looking. But I HATE going in there and, oh, it's the same phone calls."

Generally, users do not want to have to click to get enough information to make at least an initial triage decision (i.e., "is this something I want or have to deal with now"), and they find it frustrating to waste precious time rechecking the same category alerts multiple times only to find it is the same issue that they have been aware of and previously decided to defer. They also indicate they would like, whenever possible, to do everything required "on one screen", and not have to navigate to other screens, with the attendant costs of time for the screen to be fetched and opened, and the user becoming reoriented to the new screen and task.

A third class of issues here relate to the optimal degree of intrusiveness for a given alert or alert type. A related issue is whether the alert should present as a modal window (thus requiring immediate attention before the user is able to address anything else) or a non-modal window (and is thus deferrable without specific action). There was a range of reports on how likely users were to respond to completely non-intrusive alerts, especially of a less urgent nature (such as health maintenance as opposed to patient calls). Some users acknowledged that they were unlikely to respond, or perhaps even be aware of alerts, unless they were intrusive. On the other hand even some of these users, and certainly others, acknowledged that "pop-up" alerts can be very annoying, especially when they are "not right" for some reason (related to content, workflow, or other issues).

There appeared to be consensus that if intrusive, and especially modal, alerts are going to be utilized, this must be done very selectively.

#3 Male Family Practice PA: “They should be something that you don’t have to stop to deal with and then go on. They should be a sidebar . ”

#8 Female Family physician: “Unobtrusive.”

#3 Male Family Practice PA: “They should be unobtrusive. You should be able to work around them.”
<break>

#35 Female Family physician: “And don’t make things red unless you need to attend to them right now.”

#37 Male Family physician: “Mean it.”

On the other hand it appears to be equally true that when timely attention to an alert is deemed to be crucial, an intrusive alert will increase awareness, and possibly compliance, compared to a non-intrusive alert.

Users discussed the dilemma and apparent contradiction between the desire to not be interrupted unnecessarily or at the wrong time, and the requirement that alerts be sufficiently conspicuous so that they are not ignored or indefinitely deferred to the detriment of the patient or clinician. One proposed model was of a window available by a single click (such as via a tab representation) on which the alerts and reminders for the given patient accumulate before, during and after the patient visit as new information triggers related rules. That the tab was populated with information would be conspicuously indicated, such as by turning the tab bright red. Most users indicated the most important (but not necessarily only) place in the application to provide access to this tab is where orders are performed, which is on the Order Summary screen in EpicCare™. Another similar suggestion was instead to pop up this “accumulator”, at least on the orders screen, but to do so in a non-modal fashion. This “floating” window could be

resized, repositioned, and probably even dismissed (back to a tab) but would be a visible reminder of the recommended activities for the patient. In this respect it would have some of the more desirable properties of the Microsoft Office Assistant, with which most people are familiar today. In either case, it could also have behavior as described below:

#28 Male Internist: “Yeah, I think for the health maintenance it’d be nice to have that as a sort of a little strip or something along the side where it would be either lit up if it had been done within the timeframe or not, and just clicking on it if it needed to be ordered or satisfied.”

Finally, users would like to have the ability to customize and control the when, how, and where alerts present to them, acknowledging that there are different user preferences, needs and requirements. Rather than creating a “one size fits all” approach that will somehow try to accommodate everyone, the other options are to create a system that automatically adjusts to the user, or give the user the ability to set and maintain preferences. While there may be a lot of appeal to an automatically adjusting system, and more will be said about this below in the “new ideas” section, creating such a system would not be trivial and in any case would likely include allowing users to set certain preferences. It is presumed that there would be constraints within which these preferences could be set. It might allow, for example, users a different level of control over an organization’s “business rules” (which might be enforced, when necessary, using other means than the electronic reminders) than it would for “safety rules”. The latter, at least beyond a certain threshold of evidence, might not be optional so as to more reliably prevent safety violations.

Information Content

Alerts and reminders contain information and it is the timeliness, richness and accessibility of that information that determines its value.

#35 Female Family physician: “The patient call alert, I use. And like #33, I like the fact that urgent calls show up in red, because as soon as I boot up my computer I’ll go look at that call. I won’t necessarily deal with, depending on what I think. I find that very useful.”

Sometimes the information is specifically sought after or solicited by the clinician. Users said that alternative medication reminders are frequently helpful, especially with respect to cost, dosage and formulary information.

#8 Female Family physician: “Is it Prozac 10 or Prozac 20 this week, you know? Yeah.”

#5 Male Internist: “Yeah, yeah. And even within classes of medications for particular problems. For example, I’m treating someone with gastro-esophageal reflux and I want to see all my choices. You know? So you can type in the most expensive medicine knowing you’ll get all the choices. [Laughs.] I use that trick a lot.”

#6 Male Pediatrician: “With the sig and the dose and just click the alternative.”

#5 Male Internist: “Right. Right. You know, I put with the sig for such and such. If some patient wants cimetidine, and since cimetidine isn’t on our contract anymore, I don’t remember the dose, but I know I can type it in there. I can type in Protonix and I’ll get all the choices, or sometimes I’ll have a patient on a calcium channel blocker. Two dozen calcium channel blockers and I can’t remember which is the Kaiser has the contract with or which ones are the most cost efficient.”

On occasion the information presents unsolicited as a “value added” by-product of an event or action.

#26 Female Pediatrician: “I had the pharmacy alert help me today. I was putting somebody on QVAR, switching them, and I’m not real familiar with that dosage and so it pops up that they were on Azmacort...It was how much to put them on, so that was great. I didn’t have to leave to go look up something. It was right there.”

Sometimes it assists in the “discovery” of an unknown, or overlooked aspect of a patient’s history (see quote by clinician #3 under question #4, page 25), and often it assists in information gathering, leading to a more complete or more well informed decision.

#26 Female Pediatrician: “Well, I was just thinking about in general when you need to gather information, such as with the pharmacy alerts, or even just with the patient themselves. I guess with the health maintenance alerts, if you’re seeing somebody, say, in urgent care, that’s gonna give you information about the patient and what their status is. But in general, I think they’re helpful for gathering information.”

Dr. Krall: “So things that you might otherwise forget?”

#26 Female Pediatrician: “Um, hmm. Especially in busy situations.”

This information gathering is not always successful, however. Some individuals noted that they don't find the pop-up alerts, followed by the pre-populated order sets (SmartsetsTM), helpful for exactly this reason.

#33 Female Family practice PA: "Because you need more information. That's my feeling. I need more information. So, if I get a hemoglobin A1c, I'm exactly like #35, I have to go out and see if they actually need everything or for a variety of reasons. Actually, this happens quite a bit. I have tons of new patients at Tualatin. They've been entered as a diabetic, they've only been in the system for three months and it still flags the hemoglobin A1c, even though they may have brought me in papers that says they've just had it two months ago, or something, or whatever, right before they came. So, I don't need that. In other words, I have to go find out more information every single time I see one of those. That's what she's saying. You want to know what the whole story is before you start... That's why I don't use SmartsetsTM, because then I have to go and take them off."

Individuals appreciate the ability to link to other knowledge resources across an intranet and the Internet, especially when this is seamlessly accomplished from within the application. They see additional opportunities for such links.

#6 Male Pediatrician: "I think that point of more options, you can extend that to more information. I mean, I remember seeing a demonstration of some type of reminder system for antibiotic choices or even not choosing the antibiotic for ear infections at a national convention a few years ago. And it was something like you get a little bit of information and then you can choose article references, more information. I mean, this would be great. You can have the patient in the room and maybe hit a button to go do a short information on why Prozac is just as good as Zoloft, and have the latest institute of medicine studies."

#5 Male Internist: "So some hypertext option like you have on the Internet where you're reading an article and it allows you to double click on something that takes you someplace else."

Dr. Krall: "So a brief message, but with options of getting additional information?"

#6 Male Pediatrician: "Exactly".

#3 Male Family Practice PA: "And even to handouts."
<break>

#21 Female Family practice NP: "Or you could click and it goes to the Internet. Then you just click on that and it will go to the guidelines, and then click there. I love that. If it could click over to the PDR on the internet or something that pops up to that screen. That's sort of like wishing."

#26 Female Pediatrician: "Well, the pharmacy alerts do that sometimes. They'll put you into the internet."

Users say they want to have enough information to be able, whenever possible, to at a glance be able to determine the type, urgency, and status (e.g.: new, pending, reviewed)

of alert and reminder flags. For example, we heard earlier (user #25, page 63) that the non-intrusive health maintenance reminders don't provide enough information at face value.

A non-intrusive alert that these users have not experienced yet but that is expected in the near future is for lab results in their In-basket. They are concerned that there will be very large numbers of these and again there will not be enough information from such an alert to allow discrimination and thus be helpful.

When an alert presents in the exam room, it may result in a productive conversation between clinician and patient, and an opportunity for shared decision-making.

#8 Female Family physician: "I think it's also real helpful with the alert reminders in that when I am in the room with the patient with the computer and I can say, "Well, here's what neurology actually recommends that we do. Here's what orthopedics actually recommends we do," and sometimes I even show them on the screen, you know, "Recommend, duh, duh, duh," and I can say, "I can put in the referral to you and you can wait six weeks to see him, or they can tell you the same thing, or I can get it started today. And then if it fails, then you can go to a specialist." I find patients are swayed by that nine times out of ten, because, gosh, they're getting the specialist's recommendations right there. They can actually see it. It's in print and that's very helpful. It's a timesaver for me and, I think, for the patient, and gets them going in a streamlined manner of care."

In addition to assisting in shared decision making, the information provided by alerts and reminders may at times provide valuable information and opportunity for patient education.

#26 Female Pediatrician: "Well, it seems like it would be easy too to run just through that right with the patient there. If you get into the habit of saying, "Okay, here's your list. Let's go through it," and they could see it too...[Others agree.] "

#23 Female Family physician: "Yeah. I could see it as real helpful. Actually, a patient teaching tool. Like, "Okay. Well, here's the things that we really want to make sure we check on each year or in six months," or whatever it is."

Workflow

A large number of the issues that emerged during the focus groups comprise a broad workflow or “timing” category. Users said that for an alert or reminder to be ideal it must appear either at the appropriate time for consideration and action, or in a manner in which the user can determine if and when to evaluate and respond to it. They said that pop up alerts particularly were annoying or unhelpful if they popped up “too early” in the encounter, or on the wrong screen. Part of this concern is because of the disruption of the thought process that this engenders, and part of it is simply that the clinician may need more data or may need the opportunity to speak with the patient first. The alerts were most likely to be helpful if they presented on the Order Summary screen (when the users were posed to be doing orders), in the order entry pathway as they were actually performing orders, or otherwise at the point of making a decision about the issue in question or closely related issues.

#5 Male Internist: “The thing that got you there was you were ordering an antidepressant, and you typed in some antidepressant and you hit return, and it popped you to that box. You’re still gonna be able to order your antidepressant there and it hasn’t slowed you down at all.”

Users also said that depending on their specific workflow, using the EMR in the exam room usually improves the likelihood that they will get certain alerts at a helpful time, that being as they are performing orders with the patient in the room. This cuts down on rework, the embarrassment of having to revisit decisions with the patient based on information they receive following entering orders in their office, and increases the likelihood they will follow the recommendations of the reminder. On the other hand, alerts that are triggered by visits to the charting rather than the ordering module may not

be seen in the exam room workflow, as many clinicians complete their charting outside of the exam room, often after the patient has left.

Sometimes given the presenting or emerging problem(s) of the visit a particular alert or type of alerts may be seen as not relevant and inappropriate.

#23 Female Family physician: “It’s an unusual situation, but if I’m seeing somebody who’s like having an acute stress reaction or their life is falling apart, or something like that, that’s not the time I need to be talking to them about quitting smoking, or if they’re due for a hemoglobin A1c. I mean, yes, it’s important to know that, but that’s not what we’re dealing with at this issue at this time.”

It would be nice if the system were “smart enough” to recognize at least some of these situations and suppress the reminders under such circumstances, although developing an algorithm to reliably do this would be non-trivial.

An interesting observation that users made is that sometimes the alerts may present to the wrong, or at least, not the most optimal individual. This represents a desire to logically stage the work, distribute the work burden, and utilize the most cost-effective strategy for delivering care. Reminding nursing staff in some instances, for example, might be more effective for the patient and certainly less burdensome for the clinician.

#34 Male Family physician: “Well, I wonder about even sending the alert and reminder to the nurse or somebody else who might be able to handle some of the issues like health maintenance issues or scheduling things.”

Dr. Krall: “So not necessarily give it to you at all, but give it to somebody else?”

#35 Female Family physician: “In fact, for example, do any of these alerts come up for the medical assistant? Like does the tobacco alert come up for the medical assistant? Probably not.”

#37 Male Family physician: “That would work as well, maybe better.”

#35 Female Family physician: “I would rather have the alert come up to the person that puts the patient in the room and who should be getting that history. Then they can say, ‘Oh, yeah....’”

One workflow as well as user interface issue that the participants responded uniformly about, was the desire to see multiple alerts on the same patient grouped and presented

together rather than sequentially. Of course, different categories of alerts and reminders might not always be appropriately presented together since it would be difficult to do this while still adhering to the principles of appropriate timing and presentation mode for widely different alerts types such as drug allergy and health maintenance reminders.

A final workflow or timing issue, which was touched on earlier, relates to alert presentation in relation to satisfying the alert and updating the alert triggering database. Depending on how the alert is satisfied (for example whether by an order or result), and how the database is updated (real time, or batched and delayed by hours, days or longer), the situation may well occur where the recommended action has been taken, perhaps even more than once, but the alert continues to present for a period of time. To the users this appears to be an inaccurate or perhaps “broken” alert, and causes annoyance and loss of confidence in the alerting system. Ideally, the alert should be updated rapidly. Perhaps even in the case of an alert ultimately fulfilled by a result, it could be suppressed for a period following the order until the result was considered “overdue”, that is, “postponed, pending result”.

New Ideas

In the course of the focus groups there were a number of times when users had very innovative or creative thoughts about how to make the alerts and reminders more useful or usable. While these suggestions were seldom completely new, they did represent inventive approaches and were frequently spontaneous responses to problems perceived by these users. Although most of these ideas have been noted previously in other areas of this manuscript, it will be useful to highlight them further here.

Users had a variety of ideas driven by the strong conviction that alerts should not be presented more often than necessary. We heard repeatedly the notion that users would like to be able to have some control over the alerts. They would like to be able to indicate for a specific alert or perhaps even a category of alerts, “don’t show me this again”.

#34 Male Family physician: “So fine, I don’t want to hear this message on methocarbamal after all, for the tenth time, or something. So that there may be some modifications or individual kind of patterning in what I need to be reminded of.”

Dr. Krall: “Some individualization?”

#34 Male Family physician: “Yeah.” [Others agree.]

#33 Female Family practice PA: “Yeah and like when you’re on the Internet they say, “Do you want to see this box again?” [Group laughter.] “Yeah!”

#37 Male Family physician: “Oh, that’s right. The little check thing and it just goes away forever.”

#33 Female Family practice PA: “Yeah! And you can check no, because if you don’t want to see this, whatever, again, I don’t know. So that might be a way you could customize it.”

#37 Male Family physician: “Well, now, that’s a great idea.”

Having said this, there was recognition that there should be limits to this ability. They said that fundamentally there is a difference between alerts for safety and reminders for “business” considerations. Even within “safety” rules however, there might be different levels of priority or perhaps evidence, such that lower priority rules might be configurable whereas higher priority ones might not. This might be true, for example, in the domain of drug-drug interaction, where the threshold for alerting could be set so low that there would be an alert on virtually every medication, or higher such that only those interaction which had substantial evidence or concern would be displayed. There was also recognition that such control would carry some risk and certain responsibility.

We heard the suggestion that certain types of alerts might be presented on an intermittent schedule so that users would not get the same message every time they

carried out a particular action such as prescribing a common medication, but perhaps every 3rd or 5th time instead. We also heard that alerts should be individualized according to clinician. Different alerts might be presented depending upon one's specialty, or user category such as by degree, full time or part time status, or whether one was a resident or locums clinician. Although the participants of these focus groups were all primary care clinicians, it is anticipated that specialty specific alerting will be even more important to the non-primary care specialists. Many alerts today are oriented toward health maintenance, traditionally seen as more of a concern and responsibility of primary care clinicians. An ophthalmologist or dermatologist is even more likely than a family physician to be annoyed by repetitive reminders about overdue Pap smears or mammograms. By the same token, there are certainly reminders that these specialists might find useful which would, in turn, be of no use to a primary care clinician. Certain types of alerts or reminders could be based on a user's past performance, such that a user who predominantly prescribed or ordered according to guideline would not receive a reminder that another user would receive. If the first user's performance dropped below a certain threshold, the reminder could be reactivated. One method of administrating such a variable reminding system would be to select eligible users based on applying filters to a data extract from the electronic medical record, and turn a "flag" within the electronic medical record off or on in a batch, non-real-time, manner, say weekly, monthly or quarterly. An especially novel idea was that the system could essentially monitor and "learn" user behavior with respect to designated alerting performance areas, and based on a real time assessment of this performance, determine whether to alert or remind.

#8 Female Family physician: "Or, if you could correlate it with, gosh, you know- --

#3 Male Family Practice PA: "Their scripts."

#8 Female Family physician: “---she tracks ninety percent of the smokers she sees, so you can let her turn off the track-smoking reminder, because she’s already doing it. Over eighty percent of her females have their Paps and...”

#3 Male Family Practice PA: “Maybe it’s because of their reminders.” [General laughter.]

#8 Female Family physician: “No. No.”

#6 Male Pediatrician: Well, then when you go below ninety percent they come back.

#3 Male Family Practice PA: “There you go.”

#8 Female Family physician: “Yeah. Yeah.”

#5 Male Internist: “So what you’re saying is a system that would basically know you and learn about you and make adjustments.”

#8 Female Family physician: “Yeah.”

#1 Male Pediatrician: “An adaptable system.”

Throughout these discussions, it is understood that optional or variable alerting would not apply to alerts of a high risk or significant safety nature.

Another approach to decreasing unnecessary alerts and reminders was the notion that the system could automatically order, or at least stage for ordering, certain tests or procedures that were due. If it determined that a diabetic patient was due for her Hemoglobin A1c test, for example, why not just order it, or at least automatically add it to the order screen, rather than ask first? It was even suggested that this could be taken as far as ordering the test and printing a letter for mailing to a patient who was due but not in clinic. Obviously in order for such mechanisms to work, particularly in a closed loop manner (without direct human intervention), there would have to be extremely accurate data and algorithms on which these decisions were based.

Other new ideas were essentially suggestions for new types of alerts and reminders. Just as there was the conviction that alerts should be more individualized by clinician, so

too was there the belief that alerts should be individualized by patient. The electronic medical record database contains an increasingly rich description of the patient, and users remarked that “it ought to be smart enough” to utilize and make inferences about this data. This could be as simple as filtering alerts by the age and gender of the patient, to more complex inferences based on the diseases or other conditions (such as pregnancy) that appear on the patient’s active problem list. Utilizing available data to alert that a blood pressure is high, or that it has been trending up over the last several visits would be helpful. So would an automatic risk calculator that would present the information that the patient was a high cardiovascular risk.

A number of users said they would like the ability to create their own alerts and reminders. Users said they used techniques to create “tickle files” for their patients, so that they would remember to recheck a test, for example, in 6 months. Pediatricians offered that users could add sexually active teenagers, who might not otherwise (by current age criteria) be candidates for Pap smear reminders, to a specific reminding schedule.

#26 Female Pediatrician: “And I would like the option of creating health maintenance, especially for teenage girls. I have no way of tracking whether they’re coming in for their Pap’s or not. I haven’t sent myself any staff messages about it, because they don’t show up half the time anyway.” [Laughs.]

#23 Female Family physician: “Yeah.”

#26 Female Pediatrician: “So that would be helpful to be able to create that in the population in which it isn’t designed for...So if we could create those for those patients who do need them, because I’ve started them and they’re sexually active at fifteen, they’re gonna need three years worth until they turn eighteen.”

Finally, users suggested that they might be allowed some flexibility in selecting the presentation mode for alerts and reminders. Rather than assuming “one size fits all” for display characteristics, users might be able to do some customization. They could decide

whether or not prevention alerts, for example, are presented intrusively. They might decide on which screen they would prefer alerts presented. They might select certain presentation characteristic such as color, and whether there was an auditory alert or a flashing indicator.

A user interface suggestion offered by one individual and endorsed by others is a health maintenance indicator by the patient's name on the appointment schedule that would appear without having to specifically select that patient. Thus users could tell with a glance at their schedule which patients were due for prevention interventions.

Discussion

Determinants

A primary research goal of this study was to establish what distinguishes a helpful from a hindering alert or reminder. Users told us that alerts are helpful when they make good use of time and conversely they are seen as barriers when they do not. Clinicians said that alerts are helpful when they are accurate and relevant to both the patient and the clinician, and they hinder when they are not. We were told that alerts are helpful when they remind about things that might otherwise have been overlooked and that they are annoying when they are overly repetitious and obvious. Users said that alerts are likely to be helpful if they adhere to basic user interface usability principles and they are likely to be troublesome when they don't. They said that alerts are helpful when they have just the "right amount" of intrusiveness for a particular situation. Alerts are helpful when they give enough information to make a decision without overwhelming, but also facilitate links to further discretionary information sources. Finally, alerts are helpful when they appear at the right time in the user's workflow, preferably proximate to the point of decision making. They are hindering and disruptive when they present too early or too late. They are likely to be perceived as helpful when they can be addressed at the user's discretion.

Surprises

Many of the findings in this study corroborated the experience and expectations of the researcher. There were results, however, that were unexpected in direction or degree. Among the surprises were the extent to which some users responded emotionally to the alerts, some users appeared to lack an understanding of how to fulfill or manage the alerts, and some long time Kaiser Permanente clinicians had apparently not fully

endorsed the “Kaiser culture” with respect to the importance of cost conscious and evidence based medicine. Particularly surprising was the apparent diminished importance of quantity of alerts, at least in comparison to the overriding significance of workflow. Finally, it was the enormous importance of workflow in relation to the usefulness of alerts and reminders that was the most significant unanticipated finding.

It probably should not have been a surprise to anyone who understands the earnestness with which most clinicians approach their work that they might at times have an affective response to alerts and reminders. Although users said they often appreciated having their memories assisted, they sometimes also felt criticized, or even embarrassed by the alerts, especially when this occurred in front of patients.

#21 Female Family practice NP: “We take these alerts personally, and they’re like a slam. It’s like, ‘Well, they just got here and I haven’t even had a chance to do anything, and I’m getting the ALERTS!’”
<break>

#25 Male Internist: “You know, the mammogram stuff, like it was done outside, or this patient says she will never have another mammogram in her life, but it’s yelling at you. So there’s sort of that side of it. It sometimes depends on the mood I’m in if it’s more punitive than helpful.”
[Group laughter.]

Another emotion users reported sometimes experiencing is guilt. This may be the response when the user decides not to address something, for whatever reason, that the computer suggests should be dealt with.

#3 Male Family Practice PA: “ I feel guilty if I click it no, because it’s almost as though I haven’t dealt with it, but I always do deal with it.”

Sometimes the emotion experienced is frustration, annoyance or even anger.

#33 Female Family practice PA: “Well, #33, has already read about Paxil, or Prozac, or Zoloft six times, so I don’t need to see it every time. Yeah, I feel a little bit pounded by all the notes.”
<break>

Dr. Krall: “So these little annoyances don’t make you more likely to do what it is that’s recommended, so that you don’t get the thing the next time?”

#37 Male Family physician: “It just makes you angry.”

The previous example suggests another somewhat surprising finding. Users frequently do not know about, or chose not to utilize, strategies to effectively cancel or postpone the alerts. A striking illustration of this is the expiring password alert. This alert presents with each log on beginning one week prior to actual password expiration. When it appears, the user can either immediately update his password, thereby postponing the alert for 30 days, or chose to override the alert, thus ensuring that he will experience it again at next log in. In this instance, it may be assumed that the user knows how to deal with the alert, but may nevertheless persist in taking a maladaptive approach to it. (It is possible that some users do not realize they can change their password before it actually expires.)

#34 Male Family physician: “Yeah, well, I think part of it is that certain things kind of get to you. Like, my password is gonna expire in a week and I don’t need to know about it every single day for a week.”

#33 Female Family practice PA: “Exactly.”

Sometimes people take the reverse strategy, taking the action recommended by an alert more often than necessary as an avoidance reaction. This may be equally maladaptive as it creates unnecessary work and documentation and may be confusing.

#28 Male Internist: “Does the aspirin one stay there forever or does it disappear after a while?”

#21 Female Family practice NP: “It disappears. So every time I see them, I write the aspirin. I order it every time.”

#28 Male Internist: “I request it for two years, so it has it two years.”

#27 Male Internist: “But you only have to do it once every two years.”

#21 Female Family practice NP: “I just put it in every time. Every time I see them it’s back on, and that way maybe it won’t come up. [Group laughter and all talking at once.] That’s my whole thing is like fighting them off.”

In this and similar instances it is tempting to find fault with the users and point out how they should be using the system and what they should know or do differently. However, an enlightened system developer will understand that if the user is confused or misinformed there may well be some design opportunities. System implementers will understand that there are likely some training opportunities as well.

“Kaiser culture” is an expression used to describe the values and practices that generally are shared by individuals who practice within the Kaiser Permanente group, particularly if the clinician has been with the group more than a short time. These values include the importance of delivering quality, evidence based care in a cost-effective manner and within finite resources. The values are driven by shared peer experience and by leadership and are reinforced in a variety of non-coercive ways. The electronic medical record achieves a significant part of its benefit by being a tool that supports these values and assists the clinician in “doing the right thing.” It was therefore somewhat of a surprise to hear from some long term Kaiser Permanente clinicians that the electronic medical record was annoying when it was the vehicle delivering the message that peer groups such as the Pharmacy and Therapeutics Committee recommended based on these quality, evidence, and resource values. It was surprising, and somewhat disappointing, to hear the inference that it was “them” doing it to “us”, rather than “us” helping “us” with the use of the electronic medical record “tool”.

#33 Female Family practice PA: “The drugs really bug me, to tell you the truth because, hey, I pick Prozac for people because I like it better. I never liked Paxil, so I pick Prozac in general. But, if someone comes on, they’ve been on Zoloft for two years, by gosh, I’m gonna order it for them. [Laughs.] ... But one example that REALLY bugs me now in pharmacy is all the Ortho products. They lost the contract. So now the pharmacy, every time I bring up any Ortho product, they tell me that they’ve lost the contract. Please pick something else. Well, I’ll be darned if I’m—“

One of the elements that previous work and experience suggested would be an important criterion for usefulness of alerts and reminders is the quantity of them. Users in a prior study had indicated limits for both optimal and maximal numbers of theoretical alerts⁸. In the present study, focus group participants tended to minimize the importance of number, provided that the alerts are important and assuming they're in the right place within the workflow. They also responded with suggestions about how to optimally present the multiple alerts. It is worth noting, however, that these users have not seen large numbers of intrusive pop-up alerts to this point, although they have seen rather large numbers of less intrusive, alternative drug order messages.

Dr. Krall: "So if your patient was due for all seven of them, would it be reasonable to tell you all seven in one fell swoop?"

#8 Female Family physician: "Sure, if they're due."
<break>

Dr. Krall: "Any [other] thoughts on the appropriate number or the maximum number?"

#6 Male Pediatrician: "I don't see how you can decide. If you decide that you're gonna use a reminder, how can you say, "Well, this person has six reminders. I'm only gonna give the clinician four today. We'll catch up the other two next time." I mean, I suppose there probably is a maximum that's feasible and beyond the point where the clinician will pull their hair out. It might be more of a decision of minimizing how many things you use reminders for than minimizing how many reminders come at one time."

#21 Female Family practice NP: "Give them all to us. See how far we can get."

#28 Male Internist: "Well, they're probably important. That's why they're there."

Workflow as a topic has already been extensively discussed. Prior to these focus groups it was understood that workflow context was important in determining the usefulness of an alert. What was not appreciated, however, was that it has the ability to trump just about anything else, assuming at least a minimal degree of accuracy and relevance. In those situations in which workflow is predictable, such as presenting an applicable alert or reminder in the order entry pathway, the likelihood is much greater that the alert will be appreciated. Where workflow is variable and unpredictable,

however, it is likely that an intrusive, modal alert will interfere with the flow at least some of the time. Users clearly said whenever possible give them control via user preferences or via a non-modal alert that they can address at the time that is most convenient and efficient for them.

Requirements

The second primary research objective of this study was to discern the requirements of a helpful alert or reminder. User centered design is an important practice in modern software development. The focus group participants gave us information from which, across all the themes, we can extract requirements for usable and useful alerts and reminders. User input can be further modulated with design and systems principles and knowledge

Users said the most fundamental usability requirement is that alerts and reminders should not waste time. If they consume time, there should be the perception that this time was well spent. Ideally they should be at least time neutral. In fact, there is the expectation that appropriately designed and timed alerts frequently should save time. In response to this requirement, participants said minimize keystrokes, typing, mouse clicks, scrolling, window changes, the number of steps required to accomplish a task and the complexity of information one needs to read and assimilate in order to make a decision. They said to support both keyboard and mouse control wherever practical, but minimize required switching between the two. Users asked that as other technologies such as voice control become available that they be supported as well. In short, adhere to principles of good modern user interface design. Optimal screen design includes ensuring the appropriate size, placement and identification of buttons and other controls to maximize

speed and minimize error. Users also asked for facilitated alert completion with pre-populated alternatives. In other words, make it easy and efficient to do what the alert recommends.

Users consistently said that alert accuracy is important. In support of this requirement, they said assign patient alert eligibility correctly and make updates easy and rapid. This means that whatever databases and “case finding” algorithms are used must be meticulously constructed and quality controlled. The database and alert status should be rapidly updated whenever eligibility changes, whether this occurs through user-initiated reassignment, or through routine update following performance of an action that fulfills the alert. Because with some types of orders (e.g.: screening flexible sigmoidoscopy) there may routinely be a significant lag between ordering an event that will fulfill the reminder and when the result of that action actually completes the requirement, it should be possible for the system to automatically “postpone pending result” some types of reminders. Another requirement is for facilitated entry of exceptions or mitigating circumstances so that users may easily correct or update eligibility. This should ideally be done from the alert screen and with minimal need for data entry.

A related requirement is that the alerts should be carefully targeted toward appropriate patients and clinicians. To achieve this, focus group participants said to utilize stored patient data to more precisely target patients. Age, gender, and known allergies, at a minimum, should be included in this secondary eligibility filter. Disease and condition history and medication lists are additional data elements that should be utilized. A similar requirement is to selectively target users based on department, degree, employment or training status, and other characteristics possibly including past performance on specific

quality or utilization evaluations. This should help minimize unnecessary and repetitive alerting. Because the system will make imperfect inferences, give users more control of reminders, via user preferences and the ability to dismiss them for a period, so that they can minimize unnecessary ones. Give the users maximal (but probably not absolute) discretion about when and how they choose to address the alert. Users said they would like to be able to decide to tell the system “don’t show me this again” for certain types of reminders.

Focus group participants said to utilize intrusive, modal alerts very selectively and only for very important and timely information. Such alerts are tolerated and even appreciated when they meet these criteria. More generally, users said alerts should be important and not overused. Especially in routine prevention and general drug (but not patient) specific medication reminders, users find receiving the same reminder, sometimes several times a day, annoying, unnecessary and hindering.

Another requirement that surfaced in the groups was providing the right amount of information to make an effective and efficient decision. Participants said to provide enough information with the alert to allow users to make an “at a glance” triage decision. This would include such data as the specific type of prevention reminder and whether there are new messages or calls in an In-basket. Having such information would better support the clinician’s desire to optimally stage his or her work. Users also said they would like enough information along with the alert such that they could make a definitive decision without having to seek data from elsewhere in the chart or other sources. Making readily available relevant labs along with a message to renew a medication, recent lab trends along with an alert about an abnormal lab, or patient preferences along

with a prevention reminder are examples of additional data that can assist and enhance decision making. Users requested facilitated links to other information resources in the record or to knowledge resources on an Intranet or the Internet. While users wanted to minimize complexity of decisions and “information overload”, they also requested ready access to additional information for those circumstances in which this was required.

Finally, because receiving alerts and reminders at the optimal time and place within their workflow is so important, and yet this may be difficult to always anticipate or predict, requirements emerged to present alerts and reminders within the workflow, at the point of decision, or at the user’s discretion. The first two conditions imply an adequate analysis and control over these elements, a circumstance that will pertain only part of the time. The third condition addresses this uncertainty by interposing the user and implies a non-modal presentation with access from a variety of points within the application. Although not strictly an alerts and reminders design issue, users strongly endorsed the importance of the greater proximity to decision making afforded by receiving alerts and reminders in the exam room.

Other Suggestions

While not specific requirements, users advanced other suggestions that deserve consideration. They said that alert accuracy would be improved if the computer system distinguished between orders specified as “now” and those specified as “future” or “standing” and did not consider them to be duplicates. A suggestion to minimize the impact of redundant alerts was to utilize an intermittent alert schedule in which specified alerts or reminders would be presented only periodically, such as every other or every fifth time they were triggered. Presumably, an intermittent schedule would be applicable

only for informational reminders and not for high priority safety or business alerts. With respect to optimally targeting alerts, in addition to the patient specific factors discussed above there was a suggestion that alerts might be filtered according to specific up to the minute patient circumstances. For example, if the Chief Complaint or Reason For Visit was depression, or “suicidal ideation”, it might be reasonable for the alerting system to suppress a reminder to discuss tobacco cessation at that visit.

Another suggestion for selectively targeting alerts was to make an effort to direct them to the most appropriate member of the health care team. This might mean, for example, that some alerts and reminders should go only to advice or treatment nurses, and others to medical assistants or other staff. This could increase the effectiveness of the alert and decrease the hassle factor from misdirected or unnecessary alerts. An especially innovative idea for minimizing unnecessary alerts was that the alerting system could actually track clinician performance on a variety of quality and utilization measures, modifying its alerting behavior based on this information.

Several new types of alerts and reminders were offered including blood pressure and laboratory value trend alerts and an automatic cardiovascular risk calculator alert. Another suggestion for automation was the notion that the computer system could set up (“pend”) or possibly even place an order without specific clinician involvement if it determined by inference that a patient was due for a given test or immunization. It was even offered that the computer might do this outside of a office visit, perhaps mailing the patient a letter or placing a phone call to ask the patient to come in for the procedure. Finally, several people said they would like the capability to create and assign patients to

custom alerts and reminders, advising them to call patients back at certain intervals or perform certain tests on them when they returned.

Larger Context

The clinician participants of these focus groups generally endorsed alerts and reminders. They had many things to say about how they could be made better and more useful, but as we have seen they also asked for additional alerts and reminders types and functions. Users asked for additional control of alerts, but often so that they could increase or improve them and not only so that they could turn them off.

My previous work and the work of others had suggested that alert presentation characteristics might be a factor in their acceptance⁹ and effectiveness²⁶. In the previously cited questionnaire study, results suggested that drug related alerts were more highly rated than health maintenance or disease state reminders⁹. In that study greater than 70% of respondents thought drug-allergy, drug-drug or drug-disease/condition alerts would “always” be useful, compared to 36% or fewer for overdue health maintenance, due health maintenance, or disease state management reminders. It is interesting to reconsider the interpretation of that data in light of the findings of the present study that workflow is perhaps the crucial determinant of acceptance. In the implementation of EpicCare™ at Kaiser Permanente Northwest, and thus in the experience of the respondents of the aforementioned questionnaire study, drug related reminders were presented in the order entry pathway, and thus in the workflow. This is in contrast to the health maintenance and disease state reminders that these users were familiar with. Those were presented without regard to workflow. Rather than endorsing drug related alerts, per se, it may be

that the users were actually endorsing alerts and reminders that are not disruptive and therefore more likely to be a help rather than a hindrance. User comments in that study supported the assertion that the degree to which alerts support or disrupt workflow affects their acceptability.

As important as the findings of the present study are, it is understood that not all alerting quandaries can be solved by design of alerting systems alone. In the specific case of drug-drug interaction screening, for example, there is an enormous dependence on an accurate and reliable active medications list in the electronic medical record. Achieving this difficult and elusive target requires both adequate computer tools and human policies, procedures and diligence. Similarly, for some types of alerts and reminders to be of maximum benefit and acceptability there must be operational agreements, and on-going discipline within work teams to adhere to them. An example of this could be to define what constitutes a routine or urgent message and when and how messages should be escalated to higher priority or to different recipients. We must, after all, not lose sight of the limits of technology and that the electronic medical record is ultimately just a powerful and sophisticated tool.

Limitations

This study has inherent strengths and limitations. Qualitative study design is fundamentally different from quantitative studies, but properly conducted these studies are no less rigorous or valid. In this study, internal validity, or “the extent to which the study is free from design bias that threatens the interpretation of the results³⁰”, was maximized via the prescribed process of study conduct and analysis including the formal challenge to interpretation afforded by comparison of independently developed codes.

External validity, or “the extent to which the results ... generalize beyond the setting in which the study was conducted³⁰” may be more problematic in qualitative studies. In this study, the focus group participants, a small nonrandomized sample, were exclusively from Northwest Permanente and were all users of the EpicCareTM electronic medical record. It is the impression of the investigator that the sample in the groups represented a reasonable cross section of the target population, with which he is very familiar. Therefore, generalizing to the population of Northwest Permanente primary care clinicians is probably reasonably safe. However, attempting generalization to other practice settings, other implementations of EpicCareTM, and other medical records must be done with great caution.

The principal investigator moderated the focus groups and the risk this presents, as well as the approach to mitigating the risk, has been acknowledged and discussed above. Finally, in any study there is the risk of “interpretation” or “cognitive” bias: that the researcher will “see” or “interpret” the data, knowingly or unknowingly, in a biased manner. Arguably, this risk may be greater in a “subjectivist” study, where the data is not quantitative or subjected to statistical analysis, and where interpretation may play a greater role. However, the “principle of qualitative objectivity”, which “holds that an experienced, unbiased observer is capable of making fundamentally truthful observations³⁰” is fundamental to qualitative research.

Summary and Conclusions

Prior to this study there had not been an extensive discussion of the characteristics, determinants, and interrelationships of alert usefulness and usability criteria in the setting of a comprehensive outpatient electronic medical record. This study brought together primary care clinician users to help us develop a framework for understanding. A qualitative study and analysis was performed in order to gain a richer representation of the breadth of properties and dimensions that determine these requirements. Overall, there was general endorsement of alerts and reminders and no participant completely rejected them. From a substantial volume of responses to specific questions emerged five major themes including Efficiency, User Interface, Usefulness, Information Content, and Workflow. Across these categories a number of specific requirements and design elements emerged. Although some of these requirements will be more difficult to achieve and will require more analysis than others, system developers that consider and respond to these requirements should be more successful in designing alerting and reminding systems that users find both usable and useful.

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Appendix 1. Focus Group Question Guide

Let me start with some very brief introductions. Most of you already know Kati Traunweiser and/or myself. I'm a family physician and have been with NWP for over 18 years. For the last 10 of those, I've been fortunate enough to work on various Clinical Information Systems related projects. Kati and I were among the first users to go-live on the EpicCare™ system at the Sunset clinic in June 1994 with Kati being my clinic assistant at the time. Since then she has moved through several roles and has been both an EpicCare™ trainer and analyst, and currently works for the Kaiser Permanente Northwest Clinical Strategies Implementation Group and the National Kaiser Permanente Care Management Institute. In addition to seeing patients as part of the float pool, I have continued working on EpicCare™ related projects and have taken on a position with the National Kaiser CIS Project.

I'd like to thank all of you for taking the time to join our group this evening, I'm looking forward to our conversation, and I hope you are as well.

Tonight our discussion is going to focus on the ability of the electronic medical record to alert and remind us.

The purpose of these groups is to help us understand user's points of view so we can design better alerting and reminding systems. There are no "right or wrong" answers tonight. We are very interested in all opinions.

While you are all experienced users of EpicCare™, I want to encourage you to “think out of the box”, and not feel constrained by what exists in EpicCare™ today. Assume that we have free reign and unlimited resources and can develop the ideal system, whatever that is.

Before we get started, I need to remind you that we are recording the group today, and that we all need to be mindful of not discussing any patient identifiable information.

O.K.?

1. Let’s start by going around the room and having each person state his or her name, specialty, where you practice, how long you’ve been with Kaiser, and whether or not you have access to and use Exam Room Computers. Also, just for fun, I’d like each of you to offer the name of a favorite movie or book. (I’ll go first).

2. Great. Let’s spend a few minutes talking about what words, ideas, or reactions come to mind when we say “electronic Alerts and Reminders”. Anyone?

3. There are a number of different types of Alerts and Reminders that people may be imagining. How many different types of Alerts and Reminders can you think of? Why don’t we make a list?

{Assistant moderator writes the ideas down on a flip chart that remains visible throughout the group and serves to remind the group of the range that we are discussing. Listen for:

Health Maintenance (or prevention) reminders,

Drug Allergy Alerts, Drug Drug Alerts,

Alternative Medication Reminders,

Disease State Reminders (such as HgbA1c or ASA for diabetics, Inhaled Steroids for Asthma),

Alternative Lab/Imaging/Referral/Order Reminders ...}

4. Now, we have already heard expressed a number of different views and feelings about Alerts and Reminders. Let's focus for a few minutes on the circumstances where electronic Alerts or Reminders are *helpful* in your work. Can anyone think back to a recent example where an Alert or Reminder was helpful? What made it helpful?

5. So, can we generalize from this conversation? Are there specific clinical areas or circumstances in which Alerts or Reminders might be especially helpful or important?

6. Great. Now lets look at the other side of the coin. Can you think back to a recent example where an Alert or Reminder was a *hindrance* to your work? What made it a hindrance?

7. Several people have mentioned (or, if not, say "An area I have not heard mentioned, but often do in this context, is") that time is at a premium and that Alerts and Reminders must not slow clinicians down. How could system designers best address this concern?

If there is more than one alert or reminder applicable to a given patient, would you prefer to see them grouped together or presented sequentially?

Another concern we sometimes hear about is the sheer number of alerts or reminders.

How would we decide on an appropriate number of these?

8. In what ways, if any, does using an EMR in the exam room with the patient present (instead of in your office, without the patient) change the likelihood that an alert will help or hinder you?

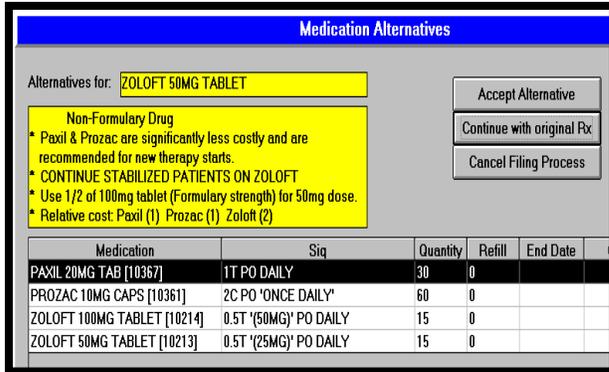
9. You have told us about circumstances when Alerts and Reminders are useful and others where they are a hindrance. All things considered, if your job was to help system developers understand how to make Alerts and Reminders more useful, what key things would you tell them?

Let's switch our attention now and talk about presentation style.

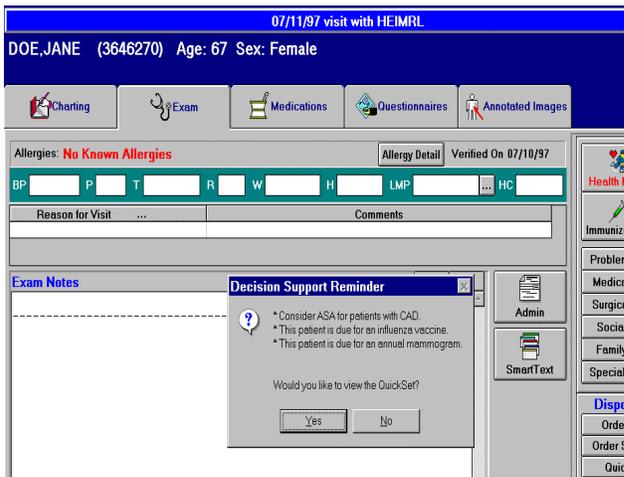
As you know, there are a number of alternatives for presenting Alerts and Reminders. For example, they may have a very passive presentation such as by means of a word or icon appearing quietly in the corner of the screen <show screenshot>.



Or, they may take a more active appearance such as a reminder that is presented as an on screen message during ordering medications, labs or referrals <screenshot>.



Or they could be a pop-up alert you might see if your patient was due, overdue or eligible for a test, medication or procedure or if you were about to prescribe a contraindicated medication or procedure <screenshot>.



10. Do you prefer one of these Alert or Reminder presentation types? If so, why?

11. Are there presentation types that you especially do not like? If so, why?
12. How likely are you to respond to a completely passive Reminder that is displayed in the periphery of the screen, such as one that says “health maintenance”, or “phone message”? What would make you more likely to respond?
13. How likely are you to evaluate and respond thoughtfully to an active, more intrusive pop up Alert or Reminder? What would make you more likely to respond favorably?
14. All things considered, if you could tell system developers one thing to remember when designing electronic Alerts and Reminders, what would that be?