ORIGINAL RESEARCH

Physician Information Needs and Electronic Health Records (EHRs): Time to Reengineer the Clinic Note

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Background: **Primary care physicians face cognitive overload daily, perhaps exacerbated by the form of electronic health record documentation. We examined physician information needs to prepare for clinic visits, focusing on past clinic progress notes.**

Methods: **This study used cognitive task analysis with 16 primary care physicians in the scenario of preparing for office visits. Physicians reviewed simulated acute and chronic care visit notes. We collected field notes and document highlighting and review, and we audio-recorded cognitive interview while on task, with subsequent thematic qualitative analysis. Member checks included the presentation of findings to the interviewed physicians and their faculty peers.**

Results: **The Assessment and Plan section was most important and usually reviewed first. The History of the Present Illness section could provide supporting information, especially if in narrative form. Physicians expressed frustration with the Review of Systems section, lamenting that the forces driving note construction did not match their information needs. Repetition of information contained in other parts of the chart (eg, medication lists) was identified as a source of note clutter. A workflow that included a patient summary dashboard made some elements of past notes redundant and therefore a source of clutter.**

Conclusions: **Current ambulatory progress notes present more information to the physician than necessary and in an antiquated format. It is time to reengineer the clinic progress note to match the workflow and information needs of its primary consumer. (J Am Board Fam Med 2015;28:316–323.)**

Keywords: **Decision Theory, Electronic Health Records, Information Systems, Medical Informatics, Qualitative Research**

Electronic health record (EHR) use is increasing in primary care practices, partially driven in the United States by the Health Information Technology for Economic and Clinical Health Act. In 2011, 55% of all physicians and 68% of family physicians were using an EHR system.[1,2] In 2013, 78% of office-based physicians reported adopting an EHR system.[3]

EHRs can, however, be a source of frustration for physicians. A 2012 survey of family physicians revealed that only 38% were highly satisfied with their EHR.[4] Among the barriers to EHR adoption and satisfaction are issues with usability, readability, loss of efficiency and productivity, and diver-

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gent stakeholder information needs, which all are crammed into 1 form factor.[5]

Physicians often come to an EHR with precise information needs that depend on the clinical situation. One important function of the clinic note is to allow physicians to prepare for an upcoming visit by understanding what happened during a previous visit. For example, a physician may be preparing to see the next scheduled patient and notices that the patient was seen by another physician last week. The natural question is, What happened? The physician looks at the note title and sees that it says "strep throat." The physician now has a good idea of what happened during the visit last week without extensively reviewing the visit. However, if the patient is now presenting with a rash that the physician suspects may be an allergic reaction, the considerations are more complex and the physician may want to know a little more, including what treatment was prescribed. Nonetheless, the physician's information needs are goal-directed. Excessive information cluttering a visit note can impede information retrieval by increasing nonessential cognitive processing.[6]

Presenting users with information they want and need in a prioritized manner could improve EHR information review and cognitive processing, which could reduce cognitive load, error, and fatigue.[6] The first step to better information presentation is determining what the physician user wants and needs from the patient's record for ambulatory clinical care.[7] Therefore, with the aim of informing better information display, we interviewed physicians viewing typical acute and chronic care visit notes in preparation for a patient visit and asked them to explain their approach. We sought to understand how physicians reviewed notes, their perceptions of the most and least important parts of those notes, and how they thought the EHR display could be improved.

Methods

We used cognitive task analysis methods to help characterize the information processing and information needs of physicians performing a typical clinical task that required processing complex information, namely, reviewing notes to prepare for a visit.[8] Cognitive task analysis involves defining a typical task and observing the user performing that task, often using supplemental data collection methods such as interviews. Cognitive task analysis involves "characterizing the decision making and reasoning skills, and information processing needs of subjects as they perform activities and perform tasks involving the processing of complex information."[8] Cognitive task analysis has especially been used to help understand whether technology systems are meeting user information needs, which made it an ideal method for our purpose.

An early step in cognitive task analysis is defining a scenario. We chose a representative activity of primary care physicians: preparing for a patient clinic visit by reviewing the patient's recent clinic notes.[8] We presented physicians with an acute and a chronic care visit note representative of EHR documentation typically generated by physicians. The acute clinic visit note concerned a patient with a cough, and the chronic clinic visit note was a follow-up visit for a patient with type 2 diabetes, hypertension, hyperlipidemia, and depression. We asked the physicians to highlight the sections of each note they would review in preparation for a return visit of a patient in 3 different scenarios reflecting the patient's primary care physician and who last saw the patient: (1) you are the patient's primary care physician and you last saw the patient; (2) your partner is the primary care physician and your partner last saw the patient; and (3) you are the primary care physician and your partner last saw the patient. We anticipated that these 3 scenarios might produce different information needs for the physician participants.

The physicians were presented with tasks to highlight important parts of the note and then to highlight parts of the note they found unimportant. While highlighting, we asked the physicians to communicate their cognitive process using think-aloud prompts.[8] After highlighting, we interviewed them using a semistructured interview guide, asking about their preparation process, what they looked for in a note, what they considered extraneous, what they thought about the structure and function of current progress notes, and how current notes suited their information needs. A second interviewer was present and made field notes on the task analysis.

We studied 16 primary care physicians practicing in community clinics associated with a medical school department of family and community med-

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icine and a division of general internal medicine. Physicians were sampled for maximum variation in sex, years in medical practice, and experience with EHRs. Attending family medicine physicians formed the sample majority; smaller numbers of internal medicine attending physicians and resident physicians were sampled for confirmatory purposes after reaching saturation.

Interviews were audio-recorded and transcribed and then analyzed by 3 qualitative coders: a family physician clinical researcher (RJK), a human factors engineer (LMS), and an information and interaction design scientist (JLM). Coders also referenced and coded highlighted documents and field notes. This blend of analysts brought an "insider" clinician perspective, which was balanced by "outsider" human factors engineering and information science perspectives. All 3 coders independently coded the first 3 transcripts; they met after each transcript to come to consensus on codes and meaning and to create the codebook. The remaining 13 transcripts were independently coded by dyads of 2 coders, again with coders meeting to come to consensus on codes and meaning using a thematic analysis approach.[9] Analysis was aided by NVivo 9 qualitative analysis software (QSR International, Doncaster, Australia). The study was reviewed and approved by the University of Missouri Health Sciences Institutional Review Board.

After analysis was completed, we engaged our physician sample and primary care colleagues in a focus group with an interactive presentation of our findings. This informant feedback served as a member check.[10] We also presented prototypes of 3 different note displays that might improve presentation of information needed at the point of care; these displays were based on interview findings. Another source of feedback was presentation of these findings at an international primary care research conference.

Results

Participants included 14 family medicine physicians and 2 general internal medicine physicians. Among these 16 physicians, 5 were women; 12 were attending physicians and 4 were residents. Five had <5 years in practice, 3 had 5 to 10 years, and 8 had >15 years. All had used an EHR for >1 year, with 10 using an EHR for >5 years.

Emerging Themes

Eight themes emerged from the analysis and are presented below. Themes, definitions, and supporting quotes are summarized in Table 1.[11–15]

Understanding Context Drives Visit Preparation

To prepare for an outpatient clinic visit, physicians reported viewing typically the last 1 to 3 contacts with the health system, including visit notes, phone messages, and urgent care or emergency visits. Preparation was influenced by prior knowledge of the patient, the reason for the current visit, the complexity of the patient's problems, the volume of transactions, and amount of time since the last visit with the primary care physician. Increasing complexity and time since last visit increased the effort needed to establish context for this visit. The reason for the current visit also influenced what sections of the previous notes might be most pertinent; for example, procedures history was generally not important but gained importance if the chief complaint was abdominal pain.

Forces Driving Note Content

Physicians expressed that clinic visit notes have become more structured, lengthy, and complex over time in response to a multitude of evolving demands from diverse stakeholders. On top of this, they noted that the EHR has now added poor syntax and has lost the story narrative because of note construction templates and structured data elements. Physicians perceived the following as current drivers of note construction:

- Billing (checklists for each section, especially review of systems)
- Quality improvement measures (eg, diabetic foot examination)
- Avoiding malpractice
- Compliance (eg, documenting informed consent, patient education)
- Relating what happened during the visit

Physicians lamented that most of these drivers do not support the physician's information needs for the care of the patient. They expressed frustration that text responding to external drivers has come to dominate the clinic note.

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Table 1. Themes, Definitions, and Supporting Quotes

Themes	Definitions	Supporting Quotes
Understanding context drives visit preparation	The main reason to review prior clinic notes was to understand past events and that might help the physician understand the problem being addressed in the current visit.	"So it's pretty context dependent. I always read my last note or the last note, and usually any other recent notes that anybody has written. And then if there's a particular problem that I identify then I go searching for other details." (Physician 1)
		"If there was, like, lung cancer in the family history I might want to know that. That might make somebody kind of [worried] . . . 'I'm worried that this might be lung cancer and there's, like, somebody else in the family.' And then smoking history would probably be important, that they're a former smoker, not a current smoker." (Physician 11, speaking about a patient presenting with a cough)
Forces driving note content	Clinical, legal, and billing requirements all contribute to note content, often with lengthy results.	"You know, I appreciate this effort but we're swimming upstream here, and the stream is the torrent of billing-related regulations, right? First and foremost, this serves the god of billing and it has to continue to do that, and I wish it didn't, you know?" (Physician 14)
The assessment and plan is the main information needed	The Assessment/Plan was viewed as the most important and informative part of the note.	"I open a new note I immediately scroll down to the assessment and plan to get a broad view of what I'm gonna be looking at. . . . I maybe didn't realize it but that is always the first thing I look at." (Physician 7)
A narrative HPI supports the assessment/plan	The HPI was viewed as a secondary narrative source of information, as an adjunct to the Assessment/Plan.	"I will just read the assessment and plan and then if something doesn't jibe with what I remember sending them for I'll go back up to the history of present illness and be, like, if they got a different history than I did or they didn't get a piece of information that I knew, then I'd probably go back up to that." (Physician 10)
ROS is "useless"	The physicians did not regard the ROS as particularly useful. Many identified this as a source of note clutter.	"And the review of systems I skip entirely because hopefully somebody told me something in the HPI that was gonna be important for that visit. Otherwise, I hate the review of systems. I think it's useless. . . . I do it in my notes to satisfy billing requirements because I can't bill without it. . . . I'd rather be able to get a short story here and have things like the hypoglycemia and other stuff, technically that could be considered a review of systems but our billers tell us that they want us to mark it out separately so that way we have to get audited but it's not dinged that you don't have it, but it doesn't add anything to my medical decision making." (Physician 3)
		"I think the review of systems is greatly oversold and practically worthless. . . . We have to do it for billing, so it's got to be there, but as I review this note, getting ready to see the patient in follow-up, I would just skip over that section." (Physician 6)
Role of a patient summary dashboard in workflow	Physicians reported finding most information on this patient dashboard screen rather than navigating to specific parts of the chart or past notes to find this information. Thus, the visit preparation workflow is now different with an EHR with a useful dashboard screen.	"We also have a patient summary [dashboard] sheet that's printed off, too, that has all the meds on there that actually much more concise, it's all on one sheet, what their last vitals and, you know, everything else is on, their diagnoses, everything else is on there, too." (Physician 11)
		"But again, though, I would probably have gotten that information before I even look at the progress note by looking at the, a summary [dashboard] page of some kind. I try not to scan notes for any of that information anymore." (Physician 3)
Relationship building	Sometimes physicians wanted to see small amounts of "medically irrelevant" information to help them create or preserve the patient relationship.	"I picked the married two children this time. It might help me do a little chit chat at the beginning of the visit, which is a nice thing to do." (Physician 1)
		"I would note that she was in the Peace Corps and congratulate her for doing that, or him." (Physician 2)
		"I actually probably would find this interesting either because I knew that they were going and I, you know, it's just nice to talk to people about their lives more. . . . Oh, I didn't know it, had a class reunion. So I, I'd probably, so probably I would pay attention to that." (Physician 9)
Emotion and frustration	Many physicians began to become emotionally charged during the interviews, reflecting how poor note construction and display hindered them in their important but mentally challenging tasks. Much of the frustration centered on the ROS.	"It's my life's goal to eliminate the review of systems from all clinic visits and all notes. It is a way of getting paid. It is not a way of taking good care of patients. If you wish for me to expound on that I'd be happy to. It represents much of what is wrong with medicine, meaning to take a good review of systems you have to talk more than you listen, and that's wrong. You should listen more than you talk. It is an unprompted fishing expedition, and it's not helpful to do unprompted fishing expeditions and it is a bizarre way of getting paid, which has absolutely nothing to do with the complexity of the patient." (Physician 14)

EHR, electronic health record; HPI, history of the present illness; ROS, review of systems.

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The Assessment and Plan is the Main Information Need

The assessment/plan was viewed as the most important and informative part of the note. Physicians routinely jumped to the assessment/plan as their starting point when reviewing an old note. They suggested that it be set at the top of the progress note to facilitate review.

A Narrative History of the Present Illness Supports the Assessment/Plan

The history of the present illness (HPI) was considered the next most important part of the note, mostly as an accessory to the assessment/plan. Physicians lamented "losing the narrative" of the patient's story in the HPI generated from an EHR note template. Physicians said that template notes do not tell as rich a story as dictated or written histories, consistent with previous work.[12–14]

Review of Systems is "Useless"

The physicians almost totally ignored the review of systems (ROS). Physicians strongly expressed resentment at its required presence in the note, citing billing requirements; it was largely viewed as not contributing additional clinical knowledge during a retrospective review of the note. Physicians concluded that any important information about the patient's condition should be included in the HPI, and that having information only in the ROS might lead to it being missed in the large amount of information that was being reviewed.

Role of a Patient Summary Dashboard in Workflow

The patient dashboard is an EHR-generated single screen that provides essential information for the ambulatory context.[16] It includes the active problem list, current medications, allergies, recent vital signs, and selected recent laboratory results. Many physicians described protocols for nurses to print out the ambulatory summary dashboard as part of their usual workflow. This occurred after vital signs had been recorded and just before the physician sees the patient. These physicians reported using the printed dashboard as the static equivalent of a second monitor, reducing navigation within the patient's chart and reducing demands on working memory.[17] It also was described as a convenient space for handwritten notes, calculations, and checklists.

Physicians reported finding most information on this patient dashboard screen rather than navigating to specific parts of the chart. They reported usually finding vital signs, medications, problem list, and recent labs on the dashboard. Thus the visit preparation workflow is now different with an EHR with a useful dashboard screen. Medications and allergies also were reviewed when prescribing from the medication screen and usually not as part of a previous note.

Relationship Building

Despite concerns about extraneous information in clinic notes, sometimes physicians wanted to see small amounts of "medically irrelevant" information to help them merely create or preserve the relationship. This information could also give important context for the visit.

Emotion and Frustration

Many physicians began to become emotionally charged during the interviews, particularly when asked about the utility of the ROS, which was the object of much expressed frustration. The poor construction and display of extraneous information in notes has created a dissonance between what is present and the information needed, and physicians found this to be quite distressing. Much of this distress centered on the ROS, but physicians also expressed how the overall appearance of documentation frustrates and confounds them when performing work that is already quite mentally challenging.

Member Checks

When we presented our findings in a focus group with our physician sample and their departmental colleagues, we received vigorous confirmation of our conclusions. Presentation of the interview findings at an international primary care research conference led to the same type of emotive affirmations from a national sample of physicians and researchers.

As part of the iterative design process, we presented our local member-check focus group with a potential solution to clutter: a hide/reveal function to streamline information display. Physicians were divided on the hide/reveal display; some agreed with the idea to decrease clutter, but there also was strong opposition to potentially obscuring relevant data.

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Discussion

From a clinical care and patient safety perspective, the main purpose of the clinical note remains to describe what happened during the visit. Our interviewed physicians described how they come to these notes with specific information needs that help them establish context for the visit at hand, to continue a plan of care, and to understand important factors that may influence the care of the patient. However, evolving stakeholder demands have led to impossibly cluttered notes that can obscure the most relevant information. This increases the mental workload of physicians, which our sample identified as a source of frustration.

Creating an optimized display of information in the context of an ever-increasing barrage of information becomes an issue of safety and quality of care.[18,19] The presentation of too much information versus too little information is already a conundrum with current EHRs and will only increase as more information comes in from health information exchange. Furthermore, health information exchanges bring in information with different structure and organization, further confounding efforts to understand the information. It is easy to imagine how important information can be missed when hidden in an electronic mountain of documentation, especially when poorly organized.

EHR users, especially clinicians, experience information overload on a regular basis. Sociologist and communications scholar Everett Rogers defines information overload as "the state of an individual or system in which excessive communication inputs cannot be processed, leading to breakdown."[20] The possible responses that individuals exhibit when they feel that they are overloaded with information include failing to process some of the inputs, processing information incorrectly, delaying the processing of information, accepting lower-quality information, and giving up the search for needed information.[20,21] None of these clinician responses are desirable for good patient care. Taking the concept of information handling problems one step further, "information chaos" encompasses information overload, information underload, information conflict, erroneous information, and information scatter.[22] Estimates suggest that 29% of family medicine errors are related to information handling.[23]

One solution to the information overload problem might be to create cleaner, more streamlined notes that present the most pertinent information at the top, specifically the assessment/plan and the HPI, and hide information irrelevant to the user, as suggested by some of our participants. Hidden information could be found by expanding a "hide/reveal" bar. While this might seem a simple solution, it might also meet with resistance from the end-user physicians themselves, who, despite identifying a need for more streamlined display, are afraid that hidden information may contain information important for the care of the patient. This was the case in our member-check focus group, where opinions were divided on this issue. When dealing with the information overload of cluttered notes, there is tension between the need to display the bare minimum to set the context versus the need to "see it all" and be assured nothing has been missed. Proving to clinicians that they actually can perform better with strategic display of the most relevant information by hiding distracting, nonessential information may be necessary. Fear of the need to use too many mouse clicks to get to needed information may also be a barrier to cleaner display.

EHRs also need to be reengineered to keep up with the emergence of electronic dashboard summary screens that improve physician workflow. Initial EHRs were developed to look like paper charts, with tabs of different sections that were found in paper notes such as progress notes, vital signs, and labs. This may have been a strategy to help physicians be comfortable in their transition from paper to electronic records. Emerging summary dashboards actually mimic what often was found on the left side of a paper chart: a summary of the patient's medications, problems, allergies, and recent labs.[16] As voiced by physicians in our study, these dashboards create a different workflow that relies less heavily on information in individual progress notes. The workflow can effectively be summarized as follows: review summary dashboard, scan recent note visits for the assessment/plan and HPI, return to dashboard for specific information, see the patient. The inclusion of lists of medications, allergies, recent labs, and problems in each progress note has become redundant and contributes to clutter, potentially obscuring the most relevant information.

New EHR designs need to minimize the time and cognitive effort required to pull together the different pieces of information that inform decision

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making. We need to minimize the amount of information that a physician needs to hold in their working memory while searching through other parts of the chart to find complementary information. In addition, for physicians there is a tension between being fully present with the patient in the examination room and the information needs that might draw the physician's eye to the chart and away from the patient,[11] emphasizing the need to make information presentation as efficient as possible.

Several limitations should be acknowledged. First, while we purposefully sampled both family medicine and general internal medicine physicians with different levels of experience, as well as both attending and resident physicians, our study was limited to a single academic center and thus a single EHR. However, the notes they reviewed were typical of most EHR documentation. Patient summary dashboards also are becoming prevalent in EHRs. Second, we asked users about their information needs in a scenario designed to simulate their visit preparation routine rather than observing them in their actual work. Observation alone would not have allowed our in-depth cognitive interview about their process and goals for the information. Last, the review of prior progress notes is in many cases only a small part of satisfying the information needed to prepare to see a patient. However, understanding these information needs can help to inform the design of a better progress note format.

Conclusion

It is time to dispose of the old paper paradigm in EHR design and move to interactive designs that optimize information exploration and display necessary for patient care. Patient summary dashboard screens and interactive interfaces create a different physician workflow that we should support to promote efficient and safe patient care. The challenge will be to accommodate the needs of stakeholders requiring a comprehensive document on demand, including information needed for billing and legal uses, while at the same time providing clinicians with prioritized information that they have told us they need. Understanding physician information needs will allow us to provide the right information to care for patients and present it clearly when it is needed.

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