

Determining Primary Care Physician Information Needs to Inform Ambulatory Visit Note Display

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Keywords

Primary Care Physicians, Information Seeking Behavior, Information Needs, Electronic Health Record, Data Display, Attitude of Health Personnel, User-Computer Interface

Summary

Background: With the increase in the adoption of electronic health records (EHR) across the US, primary care physicians are experiencing information overload. The purpose of this pilot study was to determine the information needs of primary care physicians (PCPs) as they review clinic visit notes to inform EHR display.

Method: Data collection was conducted with 15 primary care physicians during semi-structured interviews, including a third party observer to control bias. Physicians reviewed major sections of an artificial but typical acute and chronic care visit note to identify the note sections that were relevant to their information needs. Statistical methods used were McNemar-Mosteller's and Cochran Q.

Results: Physicians identified History of Present Illness (HPI), Assessment, and Plan (A&P) as the most important sections of a visit note. In contrast, they largely judged the Review of Systems (ROS) to be superfluous. There was also a statistical difference in physicians' highlighting among all seven major note sections in acute ($p = 0.00$) and chronic ($p = 0.00$) care visit notes.

Conclusion: A&P and HPI sections were most frequently identified as important which suggests that physicians may have to identify a few key sections out of a long, unnecessarily verbose visit note. ROS is viewed by doctors as mostly "not needed," but can have relevant information. The ROS can contain information needed for patient care when other sections of the Visit note, such as the HPI, lack the relevant information. Future studies should include producing a display that provides only relevant information to increase physician efficiency at the point of care. Also, research on moving A&P to the top of visit notes instead of having A&P at the bottom of the page is needed, since those are usually the first sections physicians refer to and reviewing from top to bottom may cause cognitive load.

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Introduction

Patient-specific information needs, such as information on diagnosis, treatment, and medication [1–6], arise for physicians during patient consultations [7]. If these information needs remain unanswered at the time a physician is making a clinical decision, it may result in delayed, uninformed decisions, which can contribute to medical errors, such as wrong diagnosis, error in administering treatment, or failure to provide prophylactic treatment [8, 9]. In this pilot study, “information needs of physicians” is defined as an expression of missing information that is required to manage patient care [10].

Primary care provides health care services for most patient visits for a large majority of common illnesses [11, 12]. Approximately 46% of all ambulatory care visits between 2009 and 2010 were to primary care physicians [13]. Medical advances and social and demographic changes demands greater primary care performance, which suggests that primary care physicians’ information needs may also increase [14]. In a study done by Gonzalez-Gonzalez et al, primary care physicians only try to find an answer to 23% of clinical questions related to patient care occurring during consultation. The low percentage for seeking answers to questions may be due to a time limitation in patient care for these physicians [15], or suspecting a lack of usable information, or not finding the information needed when they do seek answers [16].

A survey by the Commonwealth fund shows that physicians believe that spending more time with their patient is effective in improving patient care and they are not satisfied with the limited time available for patients during consultations [17]. One of the main goals of Healthcare Reform is to increase quality of care and patient access to care while making healthcare more affordable [18]. The average time patients spend with family medicine and internal medicine physicians are 19.5 minutes and 21.5 minutes [19]. With the healthcare reform underway, the increase in patients, and the shortage of primary care providers, physicians’ time with patients is decreasing [18]. Allowing physicians to quickly find needed information and integrating those essential information needs within each physician’s workflow would relieve a part of the time constraints they experience while treating patients.

The role of health information technology (HIT) in clinical practice is growing and more physicians are using electronic health records (EHRs) extensively because of the promise of Medicare and Medicaid financial incentives [20]. EHRs are defined as “patient records of health information created by encounters in any care delivery setting” [21]. A National Center for Health Statistics (NCHS) data brief shows that 72% of primary care physicians have adopted EHRs in their practice in 2012 [22]. Adopters of EHRs report that the benefits of having an EHR include: remote access to a patient’s chart, alerts to critical lab values, and an overall enhancement to patient care [23]. However, there are potential disadvantages to EHRs, which include: financial burdens, workflow misalignment, and loss of productivity affiliated with EHR usability issues [24]. Usability is defined as how well a product can be manipulated by users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use [25]. For an EHR to be used effectively and efficiently, the system should allow physicians’ to satisfy their information needs without causing information overload.

Physicians often have unique information needs they are seeking from the EHR that depend on a specific clinical situation. For example, sometimes a physician wants to review a patient’s entire record but more often, the physician wants to get a quick snapshot of what happened. In order to present each physician with appropriate and timely information, it is important to assess their information needs as the clinical environment moves towards a paperless setting and information becomes more accessible through many electronic sources. However, there are concerns that information overload in EHRs can contribute to bad decision-making and poor patient outcomes [26]. Bawden et al. suggest that information overload occurs when potentially useful information being received becomes more of a hindrance rather than a help [27]. Zeng et al., attributes information overload to increasing amounts of patient data, which are more accessible and available with the adoption of EHRs. They state that clinicians have limited time to review and process patient data, which may result in errors during the information retrieval and decision-making processes [28]. Information chaos may occur when physicians cannot determine whether information they receive is correct, false, or when they have to search multiple sources for information, which may increase workload

and reduce the safety and quality of patient care [29]. The possible responses that individuals exhibit when they believe they are experiencing an overload of information are: failing to process some of the inputs, processing information incorrectly, delaying the processing of information, accepting lower quality information, or giving up the search for needed information [30]; therefore, it is important to present information in a manner that suits the needs of physicians [31].

Objectives

Visit notes are records about a patient's medical condition that are made during or after a physician-patient encounter [32]. In this pilot study, simulated visit notes of acute and chronic care were employed to collect quantitative data of information needs from primary care physicians from the Department of Family and Community Medicine (FCM) and the Department of Internal Medicine (IM) at University of Missouri Health Care (UMHC). The overall objective of this pilot study was to determine the information needs of primary care physicians in an electronic visit note, specifically the importance of content within patient visit notes. The study addresses four specific research questions:

1. What information do physicians rate as important in an acute clinic visit note compared to a chronic care visit note?
2. How does information needs vary when physicians are reviewing a note written about their patient versus their colleagues' patient?
3. Are there differences in information needs when physicians are reviewing a note that they wrote compared to a note that a colleague wrote?
4. What sections of patient notes contain information most frequently identified as not important?

This pilot study was focused on the content evaluation of the visit note and we did not include other confounding variables by design, such as information dumping of extraneous data by copying and pasting, poor information design formatting, and duplicate information contained in other screens in the EHRs. These exclusions were made to avoid unnecessary distraction of physician participants from critically reviewing the information in the visit notes.

Methodology

Study Design

To identify physicians' information needs, data collection was conducted through individual semi-structured interviews with thirteen family medicine and two internal medicine physicians by completing tasks based on acute clinic and chronic care visit notes. Data collection was conducted in conference rooms or in physician's offices located at the University of Missouri Health Care (UMHC) hospital or clinics. Each data collection sessions lasted for approximately one hour, and consisted of one participant physician, an interviewer (MAC), and an observer (SMC or JAT; listed in the Acknowledgement section) throughout the study to maintain consistency. Quantitative analysis was applied to examine the information needs among the physicians in an EHR. This pilot study was reviewed and approved by the University of Missouri Health Sciences Institutional Review Board.

Organizational Setting

UMHC is a tertiary care academic medical hospital in Columbia, Missouri with 564 total beds. The Healthcare Information and Management Systems Society (HIMSS), a non-profit organization that evaluates hospitals' progress in implementing health information technology, including EHR, has awarded UMHC with Stage 7 of the Electronic Medical Record (EMR) Adoption Model [33]. Stage 7 means the hospital has a complete EHR, Continuity of Care Documents (CCD) that are used to share data, data warehousing used to analyze clinical data, and the hospital demonstrates summary

data continuity for hospital services [34]. With more than 70 primary care physicians at UMHC clinics throughout mid-Missouri, UMHC had an estimated 540,835 visits in 2011. The Department of Family and Community Medicine (FCM) manages six clinics with annual patient visits at these clinics totaling nearly 100,000, while the Department of Internal Medicine (IM) manages two clinics [35].

Participants

The sample of physicians was selected from UMHC FCM and IM because of similar clinical roles and responsibility as primary care physicians. Two of the team members (JLB and RJK) have great entrée with these two provider groups. Initially, to promote the study, group emails were sent to 70 physicians in both departments. For increased participation, individual reminder emails were then sent once, five weeks later, to each physician within both departments. Based on a physician's intention to participate and availability, individual data collection sessions were scheduled with thirteen FCM and two IM physicians. Physicians were not paid for their participation.

Development of acute and chronic care visit notes

To determine the information needs of primary care physicians in an electronic visit note, two FCM physicians (JLB and RJK) who are experienced with clinical use of EHR initially created fictitious but typical acute and chronic physician's documentation (visit notes) with reviews from other research team members. Two common cases of an acute clinic visit for a cough (► Figure 1) and a chronic disease follow up visit for diabetes (► Figure 2) were developed by copying a template from the current EHR used in the UMHC primary care clinical setting. These two cases were selected to reflect common visit types; the National Ambulatory Medical Care 2010 Survey identified progress visits as the most frequent principal reason for visit, general medical examination as second, and cough as the third most frequent principal reason for visit [36]. There were seven sections in the visit notes: *Chief Complaint (CC)*, a patient's description of the symptoms or other reasons for seeking medical care from a provider [20]; *History of Present Illness (HPI)*, an explanation given by the patient of the character of the current problem [51]; *Past Medical History (PMH)*, a list of a patient's past health problems, procedures, social and family history [52]; *Review of Systems (ROS)*, an inventory of body systems [53]; *Physical Exam (PE)*, documentation of the process the physician uses to investigate the patient's body for signs of disease [54]; *Assessment*, the physician's evaluation of the disease or condition [47]; and *Plan*, where the physician records treatment for the patient's problems [48]. An additional section, *Significant Lab Data*, was a part of the chronic care visit note. *Significant Lab Data* are lab values from tests that are done in a laboratory where the appropriate equipment, supplies, and certified expertise are available [46]. When an acute clinic visit note and a chronic care visit note were compared, the additional note section was not used during comparisons. When chronic care visit notes were compared among physicians, this section was included.

Twelve independent physician users of eight other EHRs in other health care organizations offered a review of the draft of the visit notes to evaluate the face validity of each of the two visit notes. These reviewers considered the contents of the notes and readability and structure of the note to ensure the simulated visit note would be representative of the industry. It is important to note that because the aim of this pilot study was to identify information needs based primarily on the content of the visit note, the notes were developed to be somewhat optimal in terms of readability, and therefore every attempt was made to avoid clutter that may distract from participants being able to critically review the information. Therefore, the visit notes did not include common vulnerabilities, such as, incomplete editing, copying, and pasting of extraneous data, poor syntax based on clicking on words to form sentences. The note creation also intentionally avoided vendor and user specific traits such as information design formatting to produce more generalizable visit notes.

Development of information needs analysis tasks

To assist in answering the four research questions, three tasks were conceptualized for the data collection by an interdisciplinary research team (► Table 1) [37]. The tasks were fairly well constrained

with a clear objective that physicians could follow in order to avoid excessive clinical cognitive challenges or ambiguity. In this pilot study, two sets of classic cases were presented: a cough and a chronic disease follow up. The first task was to identify the major note sections that contain important information based on three scenarios:

1. you were seeing your partner's patient a week or two after your partner saw them,
2. you were seeing your own patient a week or two after your partner saw them, and
3. you were seeing your patient for a follow-up visit, and you are reviewing your last note.

The second task asked physicians to identify the major sections of the note that are generally not needed. The third task asked physicians to identify major sections of the note that were included to adhere to health system or regulatory guidelines.

Data collection process

The physician was asked to read a task description and was encouraged to think aloud as he/she completed each task (► Table 1). During each session, the physician read each visit note, then identified and highlighted with markers the key pieces of information in the note that are most relevant to their information needs during guided review of the notes. Two pages of an acute care clinic visit note and three pages of a chronic care visit notes were printed on one-side of 8½" x 11" paper. For every task conducted, the physician received a clean copy of visit note to highlight with markers to avoid confusion. The facilitator (MAC) sat across from the physician providing oversight during data collection and guiding the physician throughout the session. The observer documented user comments that could not be captured through highlighting and asked the physician follow-up questions to clarify their responses to each task. Due to limited physician time, two physicians were not able to complete both acute and chronic visit note and only the chronic visit note was completed. Thirteen of the fifteen physicians were able to complete the acute visit note and all fifteen physicians were able to complete the chronic visit note.

Data analysis

The overall objective of this pilot study was to determine the information needs of primary care physicians in an electronic visit note. Binary data of whether the physician highlighted a major section or not, was used for analysis. If the physician highlighted the title of the note section, highlighted the entire section, or drew a line down the entire note section with the highlighter, the note section was identified as important.

The study addresses four specific research questions. The first research question was to identify information physicians rate as important in an acute clinic visit note compared to a chronic care visit note. In order to address research questions one, a comparison of each physician's highlighting of major note sections between two notes was conducted using McNemar-Mosteller's test. McNemar-Mosteller's test is generally used when the data consist of nominal paired observations [38] and was used in Microsoft Excel 2010[®] (Redmond, Washington) (► Table 1). Results were considered significant at $p < 0.05$.

The second research question was to identify how information needs vary when physicians are reviewing a note written about their patient versus their colleagues' patient. The third research question was to identify differences in information needs when physicians are reviewing a note that they wrote versus a note that a colleague wrote. In order to address research questions two and three, the Cochran Q test was used to identify whether or not different information needs arise during different patient scenarios in Task 1 (► Table 1). The Cochran Q test is used for statistical testing of three or more related, binary variables [39]. These three questions were achieved by asking physicians to identify the major note sections that contain important information based on three scenarios:

1. if you were seeing your partner's patient a week or two after your partner saw them,
2. if you were seeing your own patient a week or two after your partner saw them, and
3. if you were seeing your patient for a follow-up visit, and you are reviewing your last note, and identify major sections of the note that they believe were included to adhere to health system or regulatory guidelines.

The fourth research question was to identify the sections of patient notes that contain information most frequently identified as not important. This question was achieved by asking physicians to identify the major sections of the note that are generally not needed. To calculate Cochran's Q test, SPSS[®] 20 (Armonk, New York) was used for all three tasks. Again, results were considered significant at $p < 0.05$.

Results

Participants

Thirteen family medicine and two internal medicine physicians participated in the study (► Table 2). Eleven of the 15 physicians (73%) interviewed were male and all physicians identified their race as white. The age of physicians ranged from 30 to 64 and the mean age was 44 years. Five (33%) physicians have been in practice for over 20 years, two (13%) have been in practice for 16 – 20 years, three (20%) have been in practice for 5 – 10 years, and five (33%) have been in practice less than 5 years.

What information do physicians rate as important in an acute clinic visit note compared to a chronic care visit note?

In analyzing research question 1 (what information do physicians rate as important in an acute clinic visit note compared to a chronic care visit note?), the results show that the most frequently highlighted section for importance among all three scenarios in an acute clinic visit note were *Assessment* [Scenario 1: 12/13 (92%), Scenario 2: 12/13 (92%), Scenario 3: 9/13 (69%)], followed by *Plan* [Scenario 1: 12/13 (92%), Scenario 2: 12/13 (92%), Scenario 3: 10/13 (77%)] and *HPI* [Scenario 1: 10/13 (77%), Scenario 2: 8/13 (62%), Scenario 3: 8/13 (62%)] (► Figure 6). In a chronic care visit note shown in ► Figure 7, the most frequently highlighted section for importance among all three scenarios is *Plan* [Scenario 1: 13/15 (87%), Scenario 2: 12/15 (80%), Scenario 3: 12/15 (80%), $p = 0.61$], followed by *Assessment* [Scenario 1: 12/15 (80%), Scenario 2: 10/15 (67%), Scenario 3: 10/15 (67%), $p = 0.45$], and *HPI* [Scenario 1: 12/15 (80%), Scenario 2: 9/15 (60%), Scenario 3: 7/15 (47%), $p = 0.01$]. While other sections of the visit note did not show any statistical differences ($0.13 < p < 1.00$) across scenarios, there was a statistical difference in *Chief Complaint* ($p = 0.02$) and *Assessment* ($p = 0.04$) across all three scenarios in an acute clinic visit note and *HPI* ($p = 0.01$) across all three scenarios in a chronic care visit note.

When physicians were asked what information contained in the visit notes were included for regulatory purposes, such as billing (► Figure 9), physicians identified *Plan* [A: 10/13 (77%), C: 7/15 (47%), $p = 0.63$] and *ROS* [A: 9/13 (69%), C: 10/15 (67%), $p = 1.00$]. Overall, there was no statistical difference between acute and chronic care visit notes of each major section. However, there was a statistically significant difference among all major section of the visit note in acute ($p = 0.01$) and chronic ($p = 0.03$) visit notes.

How does information needs vary when physicians are reviewing a note written about their patient versus their colleagues' patient?

When physicians were asked what information was important to them in Task 1: Scenario 1 "You were seeing your partner's patient after your partner saw him/her and your partner wrote the last note." (► Figure 3), the most frequently highlighted sections within both acute (A) and chronic (C) care visit notes were *Assessment* [A: 12 (92%), C: 12 (80%), $p = 0.50$], *Plan* [A: 12 (92%), C: 13 (87%) $p = 1.00$], and *History of Present Illness (HPI)* [A: 10/13 (77%), C: 12/15 (80%) $p = 1.00$].

Physicians were asked what information was important to them in Task 1: Scenario 2: "You were seeing your patient after your partner saw them and your partner wrote the last note." (► Figure 4) and results show similarity in importance of visit note section between Scenario 1 and Scenario 2. The

frequently highlighted sections within both acute (A) and chronic (C) care visit notes were *Plan* [A: 12/13 (92%), C: 12/15 (80%), $p = 1.00$], *Assessment* [A: 12/13 (92%), C: 10/15 (67%), $p = 0.22$] with the *Assessment* a little less important in Scenario 2 than Scenario 1 and *HPI* [A: 8/13 (62%), C: 9/15 (69%), $p = 0.25$].

In Task 1: Scenario 3 “*You were seeing your patient and you wrote the last note.*” (► Figure 5), when physicians were asked what information was important to them, the most frequently highlighted sections within both acute (A) and chronic (C) care visit notes were *Plan* [A: 10/13 (77%), C: 12/15 (80%), $p = 1.00$] and *Assessment* [A: 9/13 (69%), C: 10/15 (67%), $p = 1.00$], with the *Assessment* a little less important in Scenario 3 than Scenario 1 or 2. *HPI* [A: 8/13 (62%), C: 7/15 (47%), ($p = 0.69$)] was more frequently highlighted in acute clinic visit notes than within the chronic care visit notes, but the difference was not significant.

In analyzing research question two, overall, the physicians’ highlighting to identify differences in information needs when physicians are reviewing a note that they wrote versus a note that a colleague wrote demonstrates that the three most frequently identified sections in a visit note regardless of who wrote the note were: *Assessment*, *Plan*, and *HPI*. There was a statistical difference in physicians’ highlighting among all seven major note sections in acute ($p = 0.00$) and chronic ($p = 0.00$) care visit notes in all three scenarios in task one:

1. if you were seeing your partner’s patient a week or two after your partner saw them,
2. if you were seeing your own patient a week or two after your partner saw them, and
3. if you were seeing your patient for a follow-up visit, and you are reviewing your last note.

Are there differences in information needs when physicians are reviewing a note that they wrote or a note that a colleague wrote?

The third research question asks how does information needs vary when physicians are reviewing a note written about their patient versus their colleagues’ patient. The three most frequently identified sections in a visit note regardless of whether the physicians were reviewing a note written about their patient versus their colleagues’ patient were: *Assessment*, *Plan*, and *HPI*. There was a statistical difference in physicians’ highlighting among all seven major note sections in acute ($p = 0.00$) and chronic ($p = 0.00$) care visit notes in all three scenarios in task one:

1. if you were seeing your partner’s patient a week or two after your partner saw them,
2. if you were seeing your own patient a week or two after your partner saw them, and
3. if you were seeing your patient for a follow-up visit, and you are reviewing your last note.

“What sections of patient notes contain information most frequently identified as not important?”

In analyzing third research question, when physicians were asked what information contained in the visit notes was generally not needed (► Figure 8), physicians identified *ROS* [A: 7/13 (54%), C: 9/15 (60%), $p = 0.25$]. Overall, there was no statistical difference between acute and chronic care visit notes of each major section. However, there was a statistically significant difference among all seven major section of the visit note within acute ($p = 0.00$) and chronic ($p = 0.00$) care visit notes.

Discussion

Assessment and Plan as the most important information in ambulatory care visit note

Our results identified *Assessment* and *Plan* as sections of a visit note frequently identified as important by physicians across the visit notes. These findings are similar to results of articles that identified information needs among primary care physicians during a clinical encounter being information on diagnosis [2–6, 8, 15, 40–49], medications [2–6, 8, 31, 42–45, 49–53] and treatment [2–6, 15, 40, 41, 46–50, 54, 55]. Diagnosis information is usually found in the *Assessment* section of the visit note where the physician documents his/her evaluation of the disease or condition based on the in-

formation reported by the patient and symptoms that the patient presents [56]. Medications and other treatment information can be found in the *Plan* section, which usually documents what the physician will do to treat the patient's condition [57]. A review study by Davies [58] also seeking the clinical information needs of doctors, conducted an analysis on 15 research studies that suggested the top categories of information needs of doctors were treatment, diagnosis, and drug therapy/information. In a study by Cogdill et al. [43] investigating the information needs of primary care physician and students, 162 questions indicating information needs were generated with both physicians and medical students. Questions most frequently asked were related to diagnoses and drug therapy. Also, in a video recorded observational study by González-González et al. [15], whose aim was to determine the information needs of 112 primary care physicians during the patient consultation, the most frequent questions physicians had were related to diagnosis (53%) and treatment (26%). Our study supports these previous findings, however is differentiated in that it identifies information needs specific to a clinical visit notes and not general questions that arise during a patient encounter.

Previous research has not explicitly stated that physicians found *HPI* useful [15, 43, 58, 59]. The *HPI* may be important to physicians because it includes a summary and background of what the patient is feeling, which can be helpful for diagnosis and treatment. Putting the *HPI*, *Assessment*, and *Plan* in close viewing range in a visit note may be beneficial to physicians and may increase efficiency when viewing visit notes. A study by Zheng et al. [59], analyzed the usage data of resident physicians from a homegrown EHR, in order to capture comprehensive user interface (UI) interaction events. This study showed similar results to our study in that residents often accessed three paired features in a bundle together in a continuous sequence: “*Assessment* and *Plan*” and “*Diagnosis*,” “*Order*” and “*Medication*,” and “*Order*” and “*Laboratory Test*.” However, our data collection of information needs were through face to face interactions with users while Zheng et al., gathered their analysis from EHR usage data.

The current structure of the EHR visit note has the *Assessment* and *Plan* located at the end of the visit note. It may be beneficial to move the *Assessment* and *Plan* at the top of visit notes since those are usually the first two sections physicians refer to which is confirmed by our studies and other studies as well. This may reduce cognitive load because physicians will not have to scroll up and down when comparing the *Assessment* and *Plan* to other sections when reviewing the visit note. Future studies can evaluate the effectiveness of this change and how it may affect the logical progression of a visit note. While we found significance between the different sections of the note, we may not have had sufficient power to detect smaller effects between acute and chronic visit notes. With this being a pilot study with a low number of participants, future work could include a larger sample to find significance that a smaller sample size may overlook.

There is a recent effort by the Bipartisan Policy Committee (BPC) on information sharing and health information exchange. Although our study does not address information sharing and rather was focused only on visit notes assumed to be inside the physician user's own EHR, BPC also found that over 50% of respondents prefer to only receive “essential” information with the option to retrieve nonessential information through a query [60].” By identifying information needs of physicians, our study, while focused on information needs in one healthcare organization, may provide value to the discussion of exchanging information across multiple organizations.

Varying Information needs between their patient versus their colleagues' patient and between note you wrote versus colleague wrote

Physicians did not treat information in a visit note when it is not their patient differently than information for their own patients. When it is not their patient, the physician may only be looking for a snap shot of the visit so the physician may not feel the need to read all the information contained in a visit note. Also, when the patient is their own, the physicians may be more likely to remember their patient and the medical problems they may have, and thus may not need to reread the patient's information every time they see the patient.

“What sections of patient notes contain information most frequently identified as not important?”

Results showed that *ROS* was viewed by doctors as mostly “not needed,” but could have relevant information when the *ROS* contains positive results and other sections of the visit note, such as when the *HPI* lacks relevant information needed for patient care. Information contained in the *ROS* may have been deemed less important by physicians in this study because, the *ROS* contains clinical information not relevant to the current visit, and any abnormal findings in the *ROS* could also be found in the *HPI*. Further research should revisit the value of the *ROS* based on the lack of studies mentioning this section of the visit note during primary care patient encounters.

Limitations

This study was limited to primary care practice and the results may not be generalizable to specialty practice because of specific information needs of specialty physicians [61, 62]. The sample size was small and consisted of physicians from one healthcare system, and may not be able to represent all primary care practice. However, this is a well-controlled pilot study and instructions were clear to the physicians who had prior experience with EHRs, which made it easy for them to share their experiences during data collection.

Although visit notes were reviewed by independent reviewers to be representative of industry, during the study and for data collection, only providers in one health care institution where only one EHR system is used participated in the study. As such, the study’s findings may have limited generalizability to other ambulatory clinic settings due to the selection of different types of EHR applications and physician practice settings.

We collected preference/like data (subjective data), and not actual usage data as the Zheng et al study. By physicians knowing that they are part of a study (Hawthorne effect) their responses may have been affected [63].

There may be specific information needs that were not present in these particular patients described in our study that may occur in more complex patients. Complex patients require additional information not found in the visit note and it was not our goal to understand physicians’ information searching outside of the clinical note. We were interested in the narrative part of the visit note and what is deemed as extraneous that is causing information clutter.

For a simulated note, it may be difficult for physicians to think aloud and highlight the sections they would think as important. Imagining that “they wrote the note,” with obvious absence of their writing style and any sort of recall, makes this task difficult. To assist in alleviating this limitation, this task was the last of three so that physicians would already be familiar with the information contained in the simulated note, to assist in minimizing the difficulty in recall of the information.

Our aim was to identify what information content truly matters in an electronic visit note. While there are other known vulnerabilities such as, copy and pasting, information dumping, and duplicate information contained in other screens in the EHRs that may contribute to information chaos and information overload [29], it was beyond our scope to address these vulnerabilities.

Conclusion

Overall, this research was able to identify primary care physicians’ information needs in a visit note and will assist in the ongoing research in this area. These results can help guide EHR vendors on how best to create visit notes for physicians to use effectively, which may in turn improve clinicians’ performance and make better use of their time. As a pilot study, this preliminary work identifies important results and establishes methods for future work, which will expand the participant scope to include specialist physicians and other clinicians. Future studies should include research on how moving the *Assessment* and *Plan* closer to the top of visit notes will affect workflow, because current physicians are accustomed to *Assessment* and *Plan* being at the bottom of the page. In addition, there is a lack of studies mentioning this section of the visit note during primary care patient encounters; thus further research should revisit the value of the *Review of System (ROS)*.

Clinical relevance statement

This pilot study primarily focused on identifying information needs of primary care physicians in a visit note. These results can help guide EHR vendors on how best to create visit notes for physicians to use effectively, which may promote effective and efficient clinical performance that leads to the increased quality of patient care.

Conflicts of interest

The authors declare that they have no conflicts of interest in the research.

Protection of human and animal subjects

No human and/or animal subjects were included in this review.

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Patient: Chris Stone
Date: 07/18/2011 **Time:** 1430 hr
Physician: Jane Smith, MD
Chief Concern: Cough

Subjective

History of Present Illness

52 year old MU professor with 10 day history of persistent dry cough keeping him awake at night. In good health until onset of runny nose, dry cough, body aches, and malaise. The cough gradually worsened in frequency and intensity over the past week.

No fever, chills, shortness of breath, or chest pain.

Exacerbating factors: lying on his back, exertion.

Alleviating factors: non. Tried OTC cough medicine, whiskey, lemon and honey, and zinc nasal spray without benefit.

Past Medical History

- **Medications:** Levothyroxine 125 mcg daily for hypothyroidism, chlorthalidone 25 mg daily for hypertension.
- **Allergies:** none
- **Past Surgical History:** Appendectomy
- **Past Medical History:** Hepatitis A in Peace Corps

Family Medical History

- **Mother:** Breast Cancer
- **Father:** Coronary Artery Disease with Stent, age 54
- **Sister:** Colon polyps
- **Paternal Grandfather:** alcoholism

Social History

- Former smoker, stopped age 48.
- **Alcohol:** 3 drinks weekly
- Married. Two teenage children at home.

Review of Systems

- **General:** No weight loss or night sweats.
- **Respiratory:** No orthopnea or paroxysmal nocturnal dyspnea.
- **Cardiac:** No palpitations, syncope, or dizziness.
- **Gastrointestinal:** No nausea, vomiting, diarrhea.

Fig. 1 Acute clinic visit note for a cough for physician highlighting during interview

Objective

Physical Exam

- **BP:** 136/88; P 82; R 14; **Weight:** 82 kg (181 lb); **Ht:** 175 cm (5'9")
- **BMI** 26.7; **Temp:** 37.1° C.
- **General:** 52 yr old Caucasian male in mild distress, coughing frequently
- **Head:** Sinuses not tender.
- **Eyes:** Normal conjunctiva.
- **Ears:** Normal canals and TMs bilaterally. Hearing intact.
- **Nose:** Congested, red nasal mucosa. No discharge. No bleeding.
- **Throat:** Mild injection of pharynx. No exudate.
- **Neck:** Small anterior cervical nodes. Non-tender.
- **Chest:** Clear to percussion and auscultation. No wheezing.
- **Cardiac:** Regular rate and rhythm. No murmurs.
- **Abdomen:** No masses or tenderness. Liver and spleen not enlarged.

Assessment

1. Cough, viral bronchitis, interfering with sleep

Plan

1. Patient education about expected course of this illness and lack of benefit from antibiotics.
2. Rx: promethazine with codeine, 10 ml every 4 hours as needed to suppress cough. 240 ml dispensed.
3. Contact office if worsening or no better in 4 more weeks.
4. Influenza vaccine today.

Patient: Chris Stone

Date: 07/18/2011 **Time:** 1430 hr

Physician: Jane Smith, MD

Chief Concern: Cough

Fig. 1 Continued

Chief Complaint: follow up diabetes and others.

Present illness

53 year old man to follow up on his chronic disease, needs refills. Has a new problem. Diabetes is doing well. Home blood sugars are in the target range. Infrequent hypoglycemia. Tolerating meds well. Good compliance with diet and medications. Last A1C was 6.9.

Occasionally checks home blood pressures, which are infrequently greater than 130/80. Tolerating meds well. Good compliance with medication and lifestyle modification.

Had some muscle aches on simvastatin 80 mg daily. Patient reduced the dose on their own back to 40 mg and the muscle aches went away after about 3 weeks. Did not call us to report that. Otherwise complying with diet well, except for class reunion 2 weeks ago. Suspects triglycerides are high for that reason.

Mood is back to normal. Some reduced desire, but not problematic in the relationship. Good compliance no other adverse effects.

Sleep OK. Some reduced interest in activities. No guilt. Normal Energy. Normal Concentration. Appetite normal. Normal activity. Not suicidal.

Past medical history

Problems

Type 2 Diabetes mellitus, Hypertension, Hyperlipidemia, Depression, Osteoarthritis of the knee, Actinic keratosis

Procedures

Colonoscopy 2008, Appendectomy, Cholecystectomy, Arthroscopy R knee 1997, Vasectomy

Medications

- metformin 1000 mg oral tablet, take 1 tablet BID; qty 60 x 12 refills
- chlorthalidone 25 mg oral tablet, take 1 tablet daily; qty 30 x 12 refills
- lisinopril 10 mg oral tablet, take 1 tablet daily; qty 30 x 12 refills
- simvastatin 40 mg oral tablet, take 1 tablet daily; qty 30 x 12 refills
- citalopram 20 mg oral tablet, take 1 tablet daily; qty 30 x 12 refills
- aspirin 81 mg oral tablet, take 1 tablet daily
- multivitamins 1 oral tablet, take 1 tablet daily

Allergies

- codeine; Penicillin caused rash.

Habits

Denies cigarette use. Alcohol 3 drinks weekly. Denies other drug use. Exercises 3 days a week 30 to 60 minutes at the gym. Married, 2 children.

Fig. 2 Chronic care visit note for diabetes follow up and other diseases for physician highlighting during interview.

Review of symptoms

- **General:** Denies fatigue or significant weight change.
- **HEENT:** No hearing loss.
- **Cardiac:** No angina, claudication, palpitations, syncope.
- **Respiratory:** No cough, wheezing, orthopnea, or PND.
- **GI:** No nausea, vomiting, constipation, diarrhea. No rectal pain or bleeding.
- **GU:** No dysuria, frequency, urgency, nocturia, or incontinence.
- **Musculoskeletal:** No joint pain. No back or neck pain.
- **Neurologic:** No headaches, dizziness, unsteadiness, weakness, or language difficulties.
- **Psychiatric:** No depression or anxiety.
- **Skin:** No changes in skin lesions.

Physical exam

- **General:** 53-year-old white male in no acute distress who appears stated age.
- **Vital Signs:** T 37.2 °C; HR 74; RR 14; BP 132/78; Wt 82 kg; BMI 26
- **HEENT:**
- **Eyes:** Normal conjunctiva. Pupils equal & reactive.
- **Ears:** TMs normal. Canals clear. Grossly normal hearing,
- **Nose & throat:** Nose normal. Lips normal. Normal pharynx. Wears dentures. Buccal mucosa pink and moist.
- **Neck:** No thyromegaly or lymphadenopathy. Carotid pulses normal.
- **Lungs:** Clear to percussion and auscultation
- **Cardiac:** Regular rate and rhythm. S1 is normal, S2 is normal. No murmurs. PMI normal.
- **Abdomen:** Soft, non-tender, no masses, no organomegaly. Normal bowel sounds.
- **Genitals:** Normal male external genitalia. No hernias. Digital rectal normal. Prostate not enlarged or nodular.
- **Musculoskeletal:** No joint deformities or limited motion.
- **Feet:** Normal appearance. Normal pulses. No deformity. Normal sensation by monofilament exam.
- **Skin:** No jaundice, rashes, or skin lesions.
- **Neurologic:** DTRs normal. Gait normal. Speech fluent.
- **Psychiatric:** Affect normal. Not suicidal.

Significant Lab data

- **A1C** 6.9; 3 days ago
- **ALT** 38; 3 days ago
- **Total cholesterol** 212; 3 days ago
- **HDL** 42; 3 days ago
- **LDL** 114; 3 days ago
- **Triglycerides** 165; 3 days ago
- **BUN** 18; 3 days ago

Fig. 2 Continued.

Assessment

1. Type 2 Diabetes, well controlled
2. Hypertension, controlled
3. Hyperlipidemia, adequately controlled, I don't think it is worth adding a new drug
4. Depression

Plan

1. No new lipid agents.
2. Repeat A1C in 6 months.
3. See me in 6 months.
4. Refer for DM eye exam.
5. Discussed controversy of PSA testing and patient declines.
6. Noted that immunizations are up to date.

John Smith, MD
 4/11/11; 1523 hr
Electronically authenticated

Fig. 2 Continued.

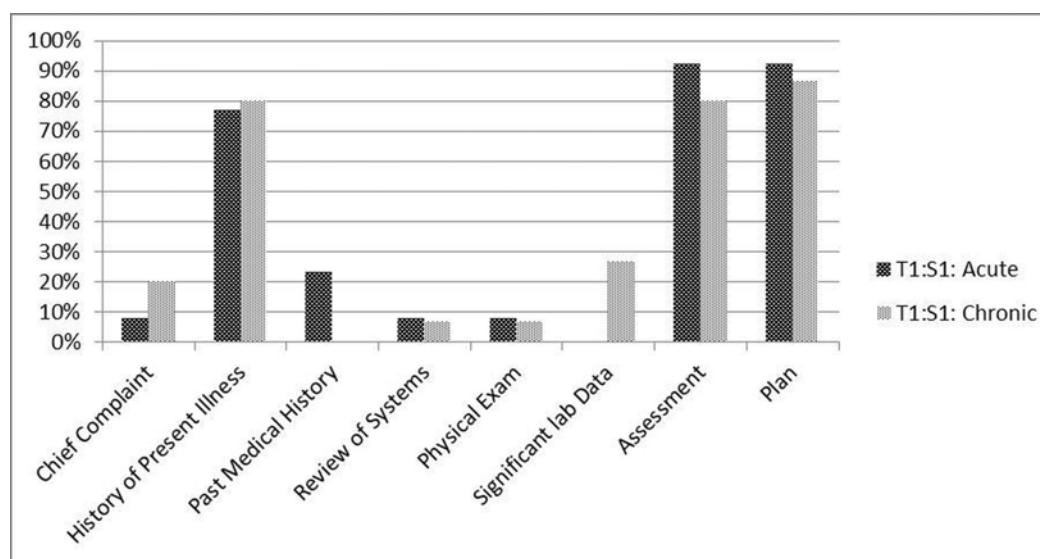


Fig. 3 Comparison between percentage of primary care physicians highlighting of important sections of an acute clinic visit note and a chronic care visit note in Task 1: Scenario 1: "Please highlight the parts of this note that are important to you for each of these scenarios if you were seeing your partner's patient with a cough a week or two after your partner saw them.." Sections were sorted by how they appear in a visit note. S1 indicates Scenario 1.

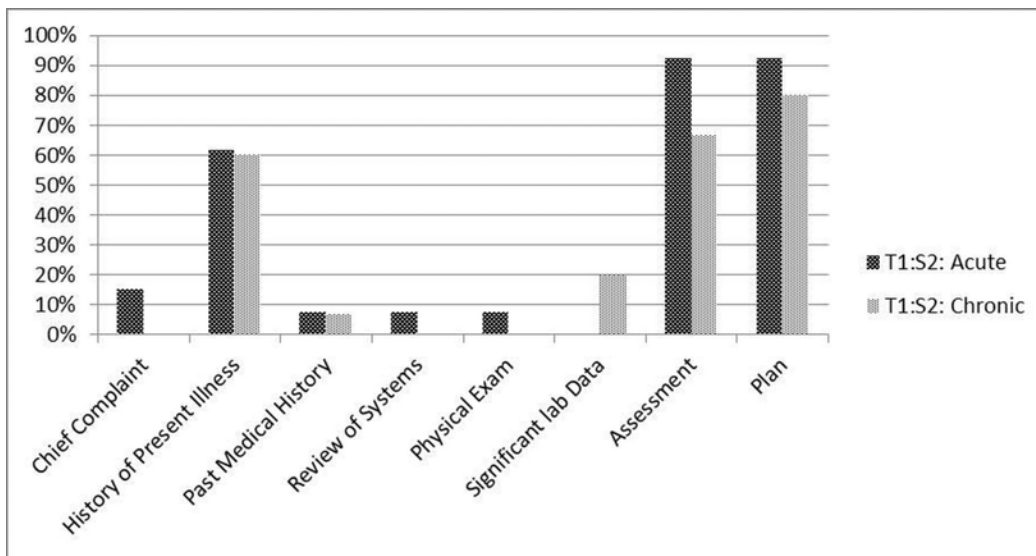


Fig. 4 Comparison between percentage of physicians highlighting of important sections of an acute clinic visit note and a chronic care visit note in Task 1: Scenario 2: "Please highlight the parts of this note that are important to you for each of these scenarios if you were seeing your own patient with a cough a week or two after your partner saw them." Sections are sorted by how they appear in a visit note. S2 indicates Scenario 2.

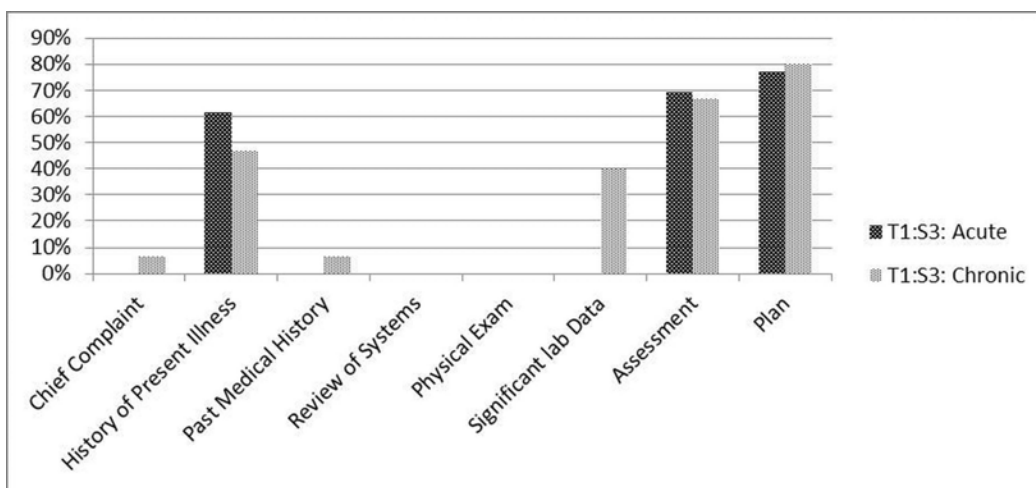


Fig. 5 Comparison between percentage of physicians highlighting of important sections of an acute clinic visit note and a chronic care visit note in Task 1: Scenario 3: "Please highlight the parts of this note that are important to you for each of these scenarios if you were seeing your patient for a follow-up visit, and you are reviewing your last note." Sections are sorted by how they appear in a visit note. S3 indicates Scenario 3.

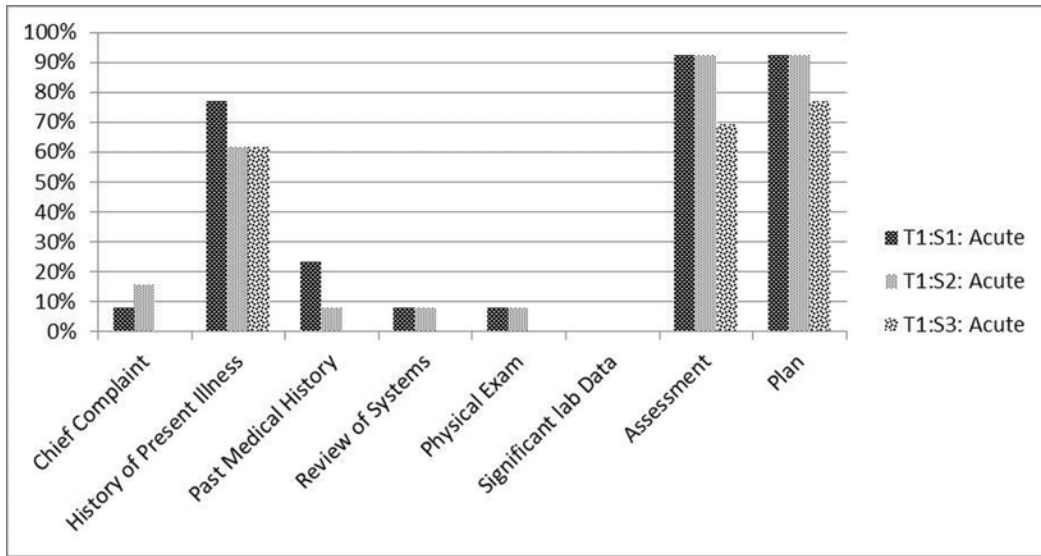


Fig. 6 Comparison of physicians highlighting of sections of an acute clinic visit note across all three scenarios in Task 1. Sections are sorted by how they appear in a visit note. S1 indicates Scenario 1; S2 indicates Scenario 2; S3 indicates Scenario 3.

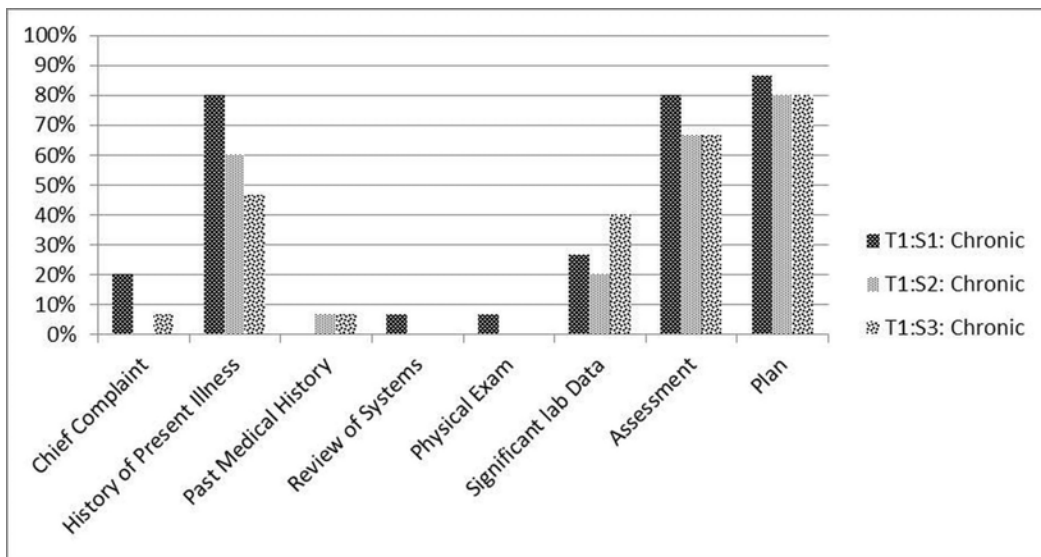


Fig. 7 Comparison of physician highlighting of sections of a chronic care visit note across all three scenarios in Task 1. Sections are sorted by how they appear in a visit note. S1 indicates Scenario 1; S2 indicates Scenario 2; S3 indicates Scenario 3.

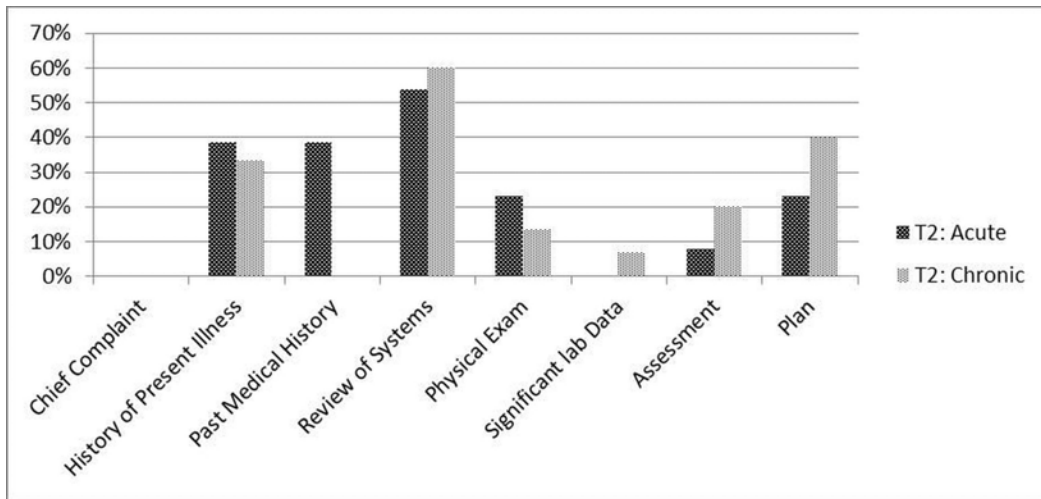


Fig. 8 Comparison between percentage of physicians highlighting of sections of an acute clinic visit note and a chronic care visit note that is generally not needed. Sections are sorted by how they appear in a visit note.

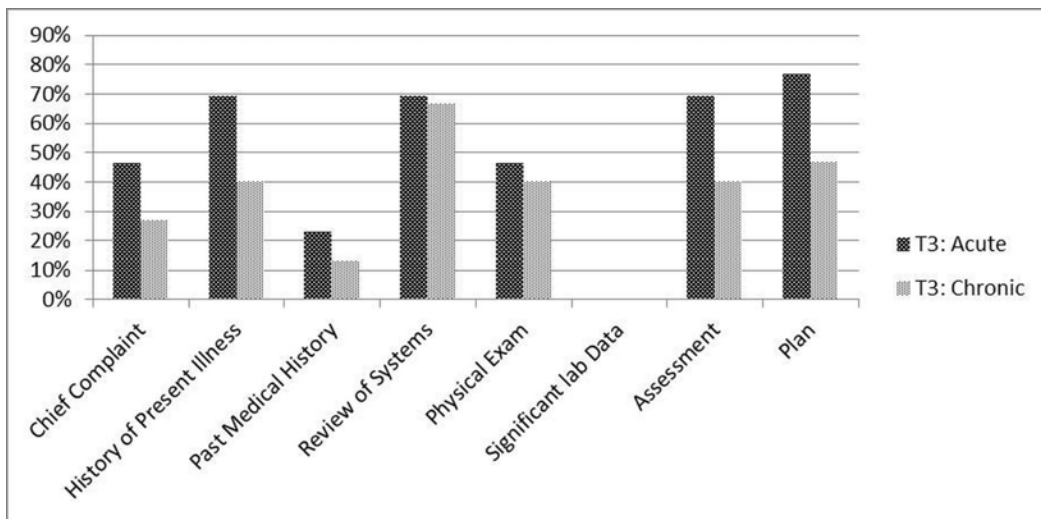


Fig. 9 Comparison between percentage of physicians highlighting of important sections of an acute clinic visit note and a chronic care visit note in Scenario 3: Please highlight the parts of the note that you would include because you are adhering to health system or regulatory guidelines. Sections are sorted by how they appear in a visit note.

Table 1 Information need analysis tasks to assist in assessing the information needs of physicians. The three interview tasks were asked while a physician was presented an acute clinic visit note and then a chronic care visit note. Task 1 contained three scenarios; Task 2 was used to identify sections physicians thought were NOT needed information, and Task 3 was asked to understand if information needs of physicians were dependent on regulatory guidelines.

Task 1	Imagine you are preparing for a patient visit before you enter the room. Please highlight the parts of this note that are important to you for each of these scenarios:
Task 1: Scenario 1	If you were seeing your partner’s patient with a cough a week or two after your partner saw them.
Task 1: Scenario 2	[If you were seeing your own patient with a cough a week or two after your partner saw them.
Task 1: Scenario 3	If you were seeing your patient for a follow-up visit, and you are reviewing your last note .
Task 2	Please highlight information contained in this note that is generally not needed.
Task 3	Please highlight the parts of the note that you would include because you are adhering to health system or regulatory guidelines.

Demographics	Percentage	
Gender		
Male	11	73%
Female	4	27%
Age (mean = 44 years)		
Race/Ethnicity		
Black		0%
Asian		0%
White	15	100%
American Indian or Alaskan Native		0%
Pacific Islander		0%
Years in Practice		
Less than 5 years	5	33%
5 – 10 years	3	20%
11 – 15 years		0%
16 – 20 years	2	13%
Over 20 years	5	33%
Use of EHR		
Less than 6 months		0%
7 months – 1 year		0%
2 years – 3 years	1	7%
4 years – 5 years	5	33%
Over 6 years	9	60%

Table 2 Demographics of 15 primary care physicians that participated in the semi-structured information needs analysis interview presented as percentages. Examined demographics include gender, age, race, years in practice, and use of EHR.

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