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Work system factors influencing physicians' screen sharing behaviors in primary care encounters

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Abstract

Objective: While the use of electronic health records (EHRs) in primary care has increased dramatically, its potential benefits need to be considered in light of potential negative impacts on physician-patient interactions and the increase in physician cognitive workload. This study aims to understand work system factors contributing to physicians' use of the EHR as a communication tool during primary-care encounters.

Methods: We interviewed 14 primary care physicians on their use of EHRs as a communication tool in patient visits. A qualitative content analysis guided by the work system model identified factors influencing physicians' decisions to share or not share the computer screen with their patients.

Results: The analysis revealed twenty-six factors that influenced physicians' decisions to share the screen, most related to the "task" (reviewing lab records), "tools and technology" (using algorithm calculators for risk prediction), or "individual" (patient interest) elements of the work system. The analysis revealed fifteen factors that influenced physicians' decisions not to share the screen, most related to the "individual" (patient's acute pain), "organization" (insufficient time), or "task" (documenting embarrassing information) elements of the work system.

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AUTHOR CONTRIBUTIONS

All authors contributed to the analysis and interpretations of the data. OA had principal responsibility for drafting the manuscript. All authors critically edited the manuscript and approved the final version.

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Conclusion: Eleven physicians made individual decisions to share or not to share the screen in a particular visit based on work-system related factors. Three doctors always shared the screen, based on the idea that it is polite and builds trust. However, several physicians also reported that it was time consuming and caused unnecessary distractions. Understanding these factors is essential to effective EHR redesign and training for improving physician-patient communication.

Keywords

EHRs; Works system model; physician-patient communication; physician-EHR interaction; primary care

1. INTRODUCTION

The use of electronic health records (EHRs) in primary care has increased dramatically in the last decade. [1, 2]. Studies have reported promising benefits of EHR use, such as improving healthcare quality, safety, effectiveness, and patient outcomes [3–5]. Despite these potential benefits, the use of EHRs in primary care has also been accompanied by negative consequences [6, 7], such as changes in the patient-physician dynamic [8–10], adverse impacts on physician-patient communication and patient-centered care, reduced physician attention to patient needs, and disengagement on the part of patients [10–15].

Increasingly, research in primary care focuses on how to use EHRs in a patient-centered way [11, 16, 17] in order to enhance patient-clinician communication and patient engagement during the visit [10, 18]. Research is needed to understand how EHRs may be used to their full potential to improve patient-doctor communication [19]. Several studies suggest that the potential pitfalls of EHRs can be avoided if physicians use EHRs as a communication and patient education tool during the visit, including sharing the screen with patients [10, 20, 21]. Screen sharing during the visit might help to improve real-time patient-clinician communication [10, 22, 23]; facilitate more accurate documentation [20], shared decision making [24], shared understanding [23], and patient involvement [21, 25]; and also reduce patient alienation that results when physicians focus on the computer screen [10, 20].

Some experts support using EHRs to facilitate communication and understanding by sharing the screen with patients during the visit [10, 20, 21], but the factors that influence physicians' screen sharing behaviors have not been explored. We know little about the system factors that facilitate or hinder physician screen sharing. Different physicians take very different approaches to using EHRs as a communication tool during patient visits, but a single physician may also have different screen sharing behaviors from visit to visit [26, 27]. Therefore, it is important to understand the work system factors that contribute to how physicians use EHRs during primary care visits; this information can be used to identify effective redesign, implementation, and training suggestions for EHRs. Previous studies have used the work system model to analyze work system factors in several clinical contexts, such as ICU nurses' interactions with technology [28, 29] and outpatient surgery [30]. However, research has not yet explored work system factors influencing physician screen sharing behavior in primary care encounters. In this study, we interviewed physicians to understand factors influencing their decision to share or not to share the computer screen

with their patients. We use the work system model [31, 32] as a guide to identify factors contributing to screen sharing. This model focuses on system design, the elements of the work system, interactions among the elements, and the impact of system design on the care process and outcomes [33]. We also gathered information on physician perceptions of advantages and disadvantages of screen sharing during patient visits.

2. METHODS

2.1. Design and Setting

This qualitative interview study was conducted in three University of Wisconsin Family Medicine clinics between March and May 2013. We recruited physicians from targeted sites using a purposive convenience sampling approach. An information sheet explaining the purpose of the interview was distributed to all physicians in these three clinics. The number of the interviews (14 interviews) was determined by reaching data saturation (recurring themes) [34]. Data saturation is a qualitative analysis technique where data collection iterates until no new recurring themes are found. In this study, we started to get similar responses by physician number 10. We continued to recruit and interview additional physicians looking for new themes, and we stopped at physician 14 because we were still not seeing any new themes. Similar studies have reached data saturation with sample sizes of 10 to 20 interviews [35–37]. Inclusion criteria for potential participants were: the participant is a faculty primary care physician who uses EHRs during care provision. We interviewed a total of fourteen primary care physicians from three different clinics, 6 male and 8 female. The average number of years the physicians had used the EHR was 6.7 (3-13 years) including their use in training years, and the physicians had been practicing on average 11.2 years (2-31 years). All of the exam rooms in these three clinics had similar settings regarding the location of the EHR, the physician's seat, and the patient's seat. All of the EHR screens are located on the wall on a swivel between the patient and the physician, so the screens can be moved around by the physicians. The study protocol was approved by university and clinic Institutional Review Boards..

2.2. Procedures

Semi-structured interviews were used to gain an in-depth understanding of the factors influencing physicians' decisions regarding screen sharing during patient visits. An interview guide ensured that the interview stayed focused on the topic of screen sharing. The interview guide and questions were developed based on the work system model [32, 38]. The work system model helps to identify factors that influence physicians' decisions to share or not to share the screen with patients. Several studies have used the work system model [31, 32, 38] to describe work in various settings and explore factors influencing providers' use of technologies in health care settings [28–30]. The work system components are: (1) the individual, (2) the tasks, (3) the tools and technologies, (4) the physical environment, and (5) the organizational conditions [31, 32]. In other words, the person is performing different tasks with various tools and technologies in a specific physical environment under certain organizational conditions [31]. The semi-structured interview guide included open-ended questions related to each work system element in case respondents discussed only one or two elements. The descriptive questions were designed to

elicit understanding of factors related to elements of the work system model, while avoiding directive questions. The questions aimed to capture the work system factors that influence physicians' screen sharing behaviors during patient visits. Descriptive open-ended questions and follow-up probes allowed flexibility for the interviewer to ask about information provided by respondents. The interview guide was tested with one faculty physician to evaluate the terminology, and to ensure that the questions were easy for physicians to understand. The interview guide was also reviewed by two Human Factors experts to ensure that the questions adequately addressed all work system elements. Based on their feedback, the interview guide was revised and finalized. Each of the fourteen interviews took between 30 and 50 minutes (mean = 38 minutes) and was conducted face to face at the clinics.

2.3. Analysis

Interviews were recorded with the permission of the physicians. Audio recorded interviews were transcribed verbatim before undergoing a descriptive coding process [39]. Qualitative content analysis of the interview data identified factors influencing physicians' screen sharing styles during primary care encounters. We used a combination of inductive and deductive analysis to allow for a more complete understanding of the data [40]. Inductive coding (derived from the data itself) was used to identify and capture detailed factors and broad categories, which were then linked to work system elements in a deductive process [41]. The deductive part of the analysis was guided by the five elements of the work system model: people, tasks, environment, organization, and technology and tools [31, 32, 38]. Two researchers independently reviewed and analyzed the data, and discrepancies were discussed, with the goal of reaching consensus. A third researcher provided additional perspective and feedback for the final interpretation of the data.

The steps followed to analyze the data were as follows. First, the sentence was set as the unit of meaning, which determines the level of detail for the textual analysis [42]. Second, each transcript was reviewed several times to make sense of the data. Third, a systematic inductive coding process was begun, with multiple systematic readings and interpretation of the raw data. This was followed by systematic coding of each transcript, which allowed major categories/factors to emerge. This inductive coding process was used to assign codes to each unit of meaning, which reflected emerging factors influencing screen sharing behaviors. Finally, categories or groups were generated that combined similar codes [43]; this completed the inductive stage of the analysis. Next, a deductive coding process was used to group the codes under predetermined themes based on the work system model (the individual, the tasks, the tools and technologies, the physical environment, and the organizational conditions).

3. RESULTS

Qualitative content analysis of the interview data identified the work system factors that influenced physicians' decisions to share the screen or not to share the screen, as well as the physicians' perceptions of advantages and disadvantages of screen sharing during patient visits. The factors identified for screen sharing and non-screen sharing are different in nature, and are not necessarily opposite of each other.

3.1. Factors influencing physicians' decision to share the screen

The content analysis of interview data revealed twenty-six factors that influenced physicians' decisions to share the screen. These factors are grouped in broad categories (educating patients, reviewing results/records, patient interest, physician-patient relationship, demographics, visit, time, and training) and linked to work system elements. See Table 1 for a complete list of factors and their associated work system elements. It should be noted that three physicians stated that they always keep the screen turned towards the patient during the entire visit.

Most of the factors reported by physicians are related to the “task,” “tools and technology,” or “individual” elements of the work system model. Some factors are classified under more than one work system element. Task factors include reviewing results/records with patients, such as reviewing and sharing lab results, medication and patient history, or verifying information with patients. For example, one physician stated a commonly shared sentiment in this way: *“If there is any kind of lab value that we’re talking about I will pull it up on the screen so that they can see it,”* while another physician said: *“So consciously I share the lab values, radiology or imaging values. I will show the vital signs. I will show – including the weight – those are things I consciously show.”* Educating the patient was also important, including preparing an after-visit summary and instructions: *“I’ll often summarize the plan from the visit and then turn the screen so the patient can see it and go through it with them and make sure that – that we have the same understanding about what we’re doing.”* Physicians also discussed using decision and risk assessment tools: *“I also share the screen with them if we are using one of those algorithm calculators to come up with a risk prediction, because I want them to see that as well rather than just hear it.”*

Individual factors are mostly related to patient interest, demographics, and the patient-physician relationship. Physicians often shared thoughts such as the following: *“There’s some patients who ask to look, some patients who are really into it and who I think are very literate or computer savvy, and they want to see it. And that’s fine if they request it, sure. I’ll show it to them.”* Depending on a patient’s request or behavior, the physician might determine that the patient would like to see the screen. For example, one physician stated: *“If I sense from them that they’re interested in what I’m doing, I’ll move the screen so that they can look at it even if it isn’t really an attempt to share useful information.”* Other individual factors influencing screen sharing are related to the patient-physician relationship, such as physicians’ belief that sharing the screen might improve patient trust and prevent the patient from thinking the physician is hiding something from her/him: *“And I do think it goes back to this question of trust where I think my new patients obviously don’t know who I am, and I want them to see what I am putting in there.”* There are also a few factors related to organization, such as physicians having sufficient time in the visit or receiving training regarding screen sharing. These factors encourage some physicians to share the screen with patients during the visit.

3.2. Factors influencing physicians' decision not to share the screen

We identified fifteen factors that influenced physicians' decisions not to share the screen with patients (Table 2). These factors are grouped in broad categories such as physical/mental health, time, sensitive information, confidentiality, and patient interest.

Individual characteristics of patients, such as having acute pain, visual impairment, being mentally ill, or being in a negative mood are the main factors influencing physicians' decisions not to share the screen. For example, one physician stated: "*So if they 're in acute pain, and they really aren't feeling good, typically I'm not going to sit there and, you know, turn the screen to them to share.*" Another category is time-related factors, which are classified in various work system elements, such as the physician is running behind schedule, feels rushed, or feels time pressure. In the words of one physician: "*I also tend to avoid screen sharing if the visit is becoming especially long or complicated, and I'm starting to feel the time crunch and wanting to just kind of keep moving, fearing somewhat that sharing may further delay or further prolong, I should say, the visit.*" Having many complicated patients on the schedule, which will most likely take more than the scheduled visit time, also influences physicians to avoid screen sharing: "*So if I look at my schedule ahead of time and say, 'We've got lots of complicated patients. I need to keep on schedule,' then I may choose not to do, you know, sort of any use of the screen because of that time crunch.*" Some physicians stated that they do not share the screen if the information on the screen is too dense and hard to understand for the patient. Another category relates to sensitive information, such as reading a psychiatrist's note or documenting embarrassing information or legal issues, such as fake pain, obesity, child abuse, or drug seeking. Several physicians shared sentiments similar to this one: "*You know, if I'm concerned about child abuse, elder abuse, you know, suicidal behavior, homicidal behavior, I generally would not -- share the screen in those circumstances.*"

3.3. Perceived advantages and disadvantages of screen sharing

The interview data also provided information on physicians' perceptions of the advantages and disadvantages of screen sharing. Some of the potential advantages of screen sharing mentioned by physicians included: a good way to educate the patient, potential to improve new patient trust in the physician, help in shared decision making, and help for patients to visualize certain things that are hard to conceptualize. Physicians stated that screen sharing has the potential to foster collaboration between physician and patient, leading to better outcomes, improved patient engagement and empowerment, better relationships with the patient, better team work between the patient and physician to improve patient health, improved patient understanding of care plans and entered records, and making data entry more transparent so patients have more trust in the physician. Interestingly, eight physicians stated that screen sharing might help to improve patient trust. For example, one physician stated: "*So I am articulately describing what they're saying they can see how I'm putting it in there. So particularly for a new patient it may foster trust that they know, wow, this doctor has really been thorough and is really updating my chart accurately as I believe it should be.*"

Physicians also reported several disadvantages of screen sharing, saying it was time consuming, a potential source of distractions because of patient misinterpretation of the information on the screen, that it increased the chances of disclosing of sensitive and embarrassing information that physicians do not wish the patient to see, or that it could provoke additional and unnecessary questions not related to the main discussion topic. One physician summarized the potential downside of screen sharing, saying: *“It can be distracting. I think that if, showing the EHR, for a lab value that is abnormal but not significant at the time, then, you know, the patient may get hung up on that even though it’s not important. So, I’ve had cases where in sharing the screen and the EHR the patient will ask a lot of questions about lab values.”*

4. DISCUSSION

This qualitative study identified several system factors that influence physicians’ decisions regarding whether to share or not to share the computer screen with patients during office visits. The analysis helped us describe common work system factors influencing physician screen-sharing behavior during patient encounters in primary care. Our findings emphasize the need to understand perceptions of physicians related to work system elements and differences in physicians’ EHR use, so this can be used in future EHR design and training efforts.

The results indicated that most of the physicians had a combination of screen sharing and screen avoiding behaviors based on factors described in Tables 1 and 2. On the other hand, three physicians stated that they always share the screen with the patient, regardless of whether it is useful or not, or whether the patient is looking or not. Research shows that patients are generally interested in what the physician is typing or looking at on the screen [12, 21]. In keeping with this patient interest, several physicians in our study stated that if the patient expresses direct interest, if they receive cues that the patient is interested, or if they know that the patient is interested in seeing the screen based on their experience in previous visits, they generally share the screen with the patient. It is interesting to note that some physicians just share the screen as a form of courtesy to the patient, even though the information is not useful for the patient. Finally, some doctors think that screen sharing is a way to establish trust with new patients in the first encounter; this is an interesting hypothesis to test in future research.

Although most of the physicians acknowledged that the information in the EHR belongs to the patient, and that patients always have the right to see their records, physicians reported avoiding sharing the screen at times for several reasons. Two major situations caused physicians to avoid screen sharing: (1) when records contained sensitive information and (2) when physicians felt time pressure (lack of time). Some physicians would avoid sharing the screen when they documented or read sensitive information, or when they had concerns about patient misinterpretation or embarrassment. For instance, the word “tumor” means “mass” in medical language, and most tumors are not cancerous, but patients might understand the word to mean “cancer” and become unnecessarily concerned; or a physician’s documentation of obesity or psychogenic pain might be embarrassing for the patient. Research on “open notes” in which patients have access to physicians’ notes has

also reported similar concerns on the part of physicians [44, 45]. Time pressure was also significant for many physicians since screen sharing or teaching the patient might be seen as prolonging the visit. This may be a legitimate concern, as one previous study showed that visit time is significantly longer with screen sharing than without screen sharing [27]. Our results also suggest that screen sharing might be minimized when the patient is very sick, emotionally down, or does not have any interest or trust in the EHR. In these cases, the physician focusing on the patient with minimal use of technology might be a better approach.

Physicians reported several advantages of screen sharing related to educating patients, fostering patient understanding, and improving relationships with patients. These results support the results of previous research, such as the finding that screen sharing improves communication and collaboration between doctor and patient [46, 47], as well as patient involvement and education [48]. This focus on gaining patient trust underlines how thoughtful EHR use might minimize the potential negative perceptions of patients regarding physicians' computer use [21], and might enhance patient-centered care [49]. Our study contributes to the idea that sharing EHR screens might have benefits for physicians in addition to benefits for patients. Previous studies mostly reported benefits of screen sharing for patients. Our study adds to this literature by identifying perceived benefits of EHR screen sharing for physicians, such as improving patient trust in the physician, and improving the physician's collaboration and relationship with patient. Our study also suggests that physicians may be more willing to screen share when they have been trained to approach even sensitive information in more patient-friendly ways. For example, it is not necessarily best practice for a physician to avoid discussing stigmatizing or embarrassing conditions (e.g. obesity). Although it is beyond the scope of this study, physicians may avoid such topics because of their own embarrassment, because they are less engaged with a patient due to the perceived stigma, or because they are concerned about protecting patients' feelings, among other reasons. Future studies might explore whether training in how to record and present sensitive information may improve patient-centered practice.

Finally, our results show that physicians consider screen-sharing activity based on two main intentions. The first one is to use the EHR as an effective documentation tool. Physicians need to input data and retrieve data from EHRs. However, previous studies indicated that when physicians focus only on the EHR or do not share the screen while inputting data, this may create disengagement in doctor-patient communication, cause loss of eye contact, and make physicians less attentive. When the physicians pay undue attention to the EHR, this can also increase patient interest about what the physician is looking at on the screen [21]. Therefore, if the screen is shared while the physician uses the EHR as a documentation tool (even if the physician does not make an active attempt to share information with the patient), the patient will have a chance to see the screen, potentially minimizing any negative effects of technology on patient perception or communication. The second intention of physicians for screen sharing is to use the EHR as an education tool. This might contribute to patient-centered care by educating the patient about their care, sharing useful information with them, and helping the patient better understand medical information with visual data displays.

4.1. Implications

Future EHR systems may increasingly incorporate information that can be shared with patients. However, the features and factors that contribute to information (screen) sharing are not well known. Understanding these factors can inform health care work system designs, as well as EHR design. It is essential to identify effective strategies for integrating EHR use into clinician-patient interactions [50]. It is also necessary to identify EHR designs that support positive exam-room dynamics by enhancing information transparency during clinician-patient interactions [49]. EHR design should also address optimal interactions between the clinician, patient, and computer. For instance, future EHR designs might include functions to help clinicians educate patients and share information easily with visual tools. Encouraging dictation in the presence of the patient, limiting the role of physicians in Computerized Physician Order Entry (CPOE) [51], and employing voice recognition, handwriting recognition, and touch screens might be data entry alternatives that can minimize physician disengagement from the patient [50]. These functions could enhance interactions and patient-centered communication by allowing the clinician to continue facing the patient even when entering information in the EHR. These functions also might increase mutually perceived personal connections during EHR use. Two potential implications from the findings are that, in some cases, physicians and patients would benefit from a more interactive system in which patients are more involved, as well as from using staff (such as medical scribes) to do data and order entry so physicians can spend minimal time typing during the visit and more time for patient education. Both of these design changes would allow the physician to focus on the patient during medical visits, therefore promoting patient-centered care. Another design suggestion would be a more simplified, patient-friendly separate screen for patients in the exam room, so clinicians can share only the content which is useful for the patients and minimize the potential distractions from the main screen. Future research should examine patient perceptions about different types of screen sharing, such as how they feel about engagement with the overall visit, communication with the physician, and the EHR technology. Finally, future research could track outcomes such as patient satisfaction, patient decisions to return to this same doctor or switch doctors, and patients' long-term health outcomes related to physicians' information (screen) sharing styles.

4.2. Limitations

This study has some limitations. This study was conducted in three clinics that belong to a single healthcare system, and all doctors used the same commercial EHR system. Thus it is unclear how these findings might apply to other healthcare settings and different EHR technologies. Another limitation is the potential biases of physicians we interviewed, since we only obtained their perceptions, experiences and opinions regarding factors influencing screen sharing. We also do not have any data regarding the characteristics of physicians who did not volunteer to participate in the study.

5. CONCLUSION

This study contributes to our understanding of factors influencing the use of EHRs as a communication tool by physicians. The work system model provided a systematic approach

to understanding all factors that influence physicians' decisions to share or not to share the screen. These findings have implications for future EHR research, design, organizational implementation, and training. This study also has implications for EHR-based communication skills research and provides useful information about how EHRs can be used to improve patient communication and patient education in the exam room, ultimately contributing to patient-centered care.

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REFERENCES

- [1]. Blumenthal D, Implementation of the Federal Health Information Technology Initiative, *New England Journal of Medicine* 365 (2011) 2426–2431. [PubMed: 22187990]
- [2]. Waterson P, Hoonakker PL, Carayon P, Special issue on human factors and the implementation of health information technology (HIT): comparing approaches across nations, *International Journal of Medical Informatics* 82 (2013), 277–280. [PubMed: 23375708]
- [3]. Rao SR, DesRoches CM, Donelan K, Campbell EG, Miralles PD, Jha AK, Electronic health records in small physician practices: availability, use, and perceived benefits, *Journal of the American Medical Informatics Association* 18 (2011) 271–275. [PubMed: 21486885]
- [4]. Rippen HE, Pan EC, Russell C, Byrne CM, Swift EK, Organizational framework for health information technology, *International Journal of Medical Informatics* 82 (2013) e1–13. [PubMed: 22377094]
- [5]. Hayrinen K, Saranto K, Nykanen P, Definition, structure, content, use and impacts of electronic health records: a review of the research literature, *International Journal of Medical Informatics* 77 (2008) 291–304. [PubMed: 17951106]
- [6]. Harrison MI, Koppel R, Bar-Lev S, Unintended consequences of information technologies in health care--an interactive sociotechnical analysis, *JAMIA* 14(2007) 542–549. [PubMed: 17600093]
- [7]. LeBlanc TW, Back AL, Danis M, Abernethy AP, Electronic Health Records (EHRs) in the Oncology Clinic: How Clinician Interaction With EHRs Can Improve Communication With the Patient, *Journal of Oncology Practice* 10(2014), 317–321. [PubMed: 25027025]
- [8]. Saleem JJ, Flanagan EM, Russ AL, Carmit K, Elli L, Russell SA, Bennett KJ, You and me and the computer makes three: variations in exam room use of the electronic health record, *JAMIA* 21 (2013) e147–e151. [PubMed: 24001517]
- [9]. Kumarapeli P, de Lusignan S, Using the computer in the clinical consultation; setting the stage, reviewing, recording, and taking actions: multi-channel video study, *JAMIA* 20 (2013) e67–e75. [PubMed: 23242763]
- [10]. White A, Danis M, Enhancing Patient-Centered Communication and Collaboration by Using the Electronic Health Record in the Examination Room Enhancing Patient-Centered Communication With the EHR, *JAMA* 309(2013) 2327–2328. [PubMed: 23757080]
- [11]. Duke P, Frankel RM, Reis S, How to integrate the electronic health record and patient-centered communication into the medical visit: a skills-based approach, *Teachology Learning and Medicine* 25(2013) 358–65.
- [12]. Asan O, Montague E, Physician interactions with electronic health records in primary care, *Health Systems*, 1 (2012) 96–103. [PubMed: 24009982]
- [13]. Makoul G, Curry RH, Tang PC, The use of electronic medical records communication patterns in outpatient encounters, *JAMIA* 8(2001) 610–615. [PubMed: 11687567]

- [14]. Pearce C, Dwan K, Arnold M, Phillips C, Trumble S, Doctor, patient and computer--a framework for the new consultation. *International Journal of Medical Informatics*, 78(2009) 32–38. [PubMed: 18752989]
- [15]. Gibson M, Jenkins KN, Wilson R, Purves I, Multi-tasking in practice: coordinated activities in the computer supported doctor-patient consultation, *International Journal of Medical Informatics* 74(2005) 425–36. [PubMed: 15914080]
- [16]. Ventres WB, Frankel RM, Patient-centered care and electronic health records: it's still about the relationship, *Family Medicine* 42(2010) 364–366. [PubMed: 20455111]
- [17]. Street RL Jr, Liud L, Farbere NJ, Chenf Y, Calvittig A, Zuesth D, Gabuzdae MT, Belli K, Gray B, Rickg S, Ashfaqg S, Aghae Z, Provider interaction with the electronic health record: The effects on patient-centered communication in medical encounters. *Patient Education and Counseling* 96 (2014) 315–319 . [PubMed: 24882086]
- [18]. Lown BA, Rodriguez D, Commentary: lost in translation? how electronic health records structure communication, relationships, and meaning. *Academic Medicine* 87(2012) 392–394. [PubMed: 22452913]
- [19]. Wilcox L, Patel R, Back A, Czerwinski M, Gorman P, Horvitz E, Pratt W, Patient-clinician communication: the roadmap for HCI in CHI'13 Extended Abstracts on Human Factors in Computing Systems. 2013 ACM.
- [20]. O'Malley AS, Cohen GR, Grossman JM, Electronic medical records and communication with patients and other clinicians: are we talking less? Issue brief (Center for Studying Health System Change), 131(2010).
- [21]. Frankel R, Altschuler A, George S, Kinsman J, Jimison H, Robertson NR, Hsu J, Effects of Exam-Room Computing on Clinician-Patient Communication: A Longitudinal Qualitative Study. *Journal of General Internal Medicine* 20(2005) 677–682. [PubMed: 16050873]
- [22]. Piper AM, Hollan JD, Supporting medical communication for older patients with a shared touchscreen computer. *International Journal of Medical Informatics* 82(2013) e242–e250. [PubMed: 21497130]
- [23]. Unruh KT, Skeels M, Civan-Hartzler A, Pratt W, Transforming clinic environments into information workspaces for patients. 2010 ACM.
- [24]. Almquist JR, Kelly C, Bromberg J, Bryant SC, Christianson TH, Montori VM, Consultation Room Design and the Clinical Encounter: The Space and Interaction Randomized Trial, *Health Environments Research and Design* 3(2009) 41–78.
- [25]. Bates DW, Bitton A, The future of health information technology in the patient-centered medical home. *Health Affairs (Millwood)* 29(2010) 614–621.
- [26]. Ventres W, Kooienga S, Marlin R, Vuckovic N, Stewart V, Clinician style and examination room computers: a video ethnography. *Family Medicine* 37(2005) 276–281. [PubMed: 15812698]
- [27]. Asan O, Montague E, Technology-mediated information sharing between patients and clinicians in primary care encounters. *Behaviour & Information Technology* 33(2013) 259–270. [PubMed: 26451062]
- [28]. Gurses AP, Carayon P, Performance obstacles of intensive care nurses. *Nursing Research* 56(2007) 185–194. [PubMed: 17495574]
- [29]. Gurses AP, Carayon P, Identifying performance obstacles among intensive care nurses. *Proceedings of the Human Factors and Ergonomics Society*, 2005: p. 1019–1023.
- [30]. Carayon P, Hundt AS, Alvarado CJ, Springman SR, Ayoub P, Patient safety in outpatient surgery: the viewpoint of the healthcare providers. *Ergonomics* 49(2006) 470–485. [PubMed: 16717005]
- [31]. Carayon P, Smith MJ, Work organization and ergonomics. *Applied Ergonomics* 31(2000) 649–662. [PubMed: 11132049]
- [32]. Smith MJ, Sainfort PC, A balance theory of job design for stress reduction. *International Journal of Industrial Ergonomics*, 4(1989) 67–79.
- [33]. Gurses AP, Carayon P, Exploring performance obstacles of intensive care nurses. *Applied Ergonomics* 40(2009) 509–518. [PubMed: 18951120]
- [34]. Robson C, *Real word research*. 2002: Oxford: Blackwell.
- [35]. Gurses AP, Seidl KL, Vaidya V, Bochicchio G, Harris AD, Hebden J, Xiao Y Systems ambiguity and guideline compliance: A qualitative study of how intensive care units follow evidence-based

- guidelines to reduce healthcare-Associated infections. *Quality and Safety in Health Care*, 17(2008) 351–359. [PubMed: 18842974]
- [36]. Holden RJ, Cognitive performance-altering effects of electronic medical records: An application of the human factors paradigm for patient safety. *Cognitive Technology and Work* 13(2011) 11–29.
- [37]. Saleem JJ, Flanagan ME, Wilck NR, Demetriades J, Doebbeling BN, The next-generation electronic health record: perspectives of key leaders from the US Department of Veterans Affairs, *JAMIA* 20(2013) e175–177. [PubMed: 23599227]
- [38]. Carayon P, The balance theory and the work system model. Twenty years later. *Intl. Journal of Human–Computer Interaction*, 25(2009) 313–327.
- [39]. Miles MB, Huberman AM, *Qualitative data analysis: An expanded sourcebook*. 1994: Sage.
- [40]. Elo S, Kyngäs H, The qualitative content analysis process. *Journal of advanced nursing* 62(2008) 107–115. [PubMed: 18352969]
- [41]. Forman J, Damschroder L, Qualitative content analysis. *Advances in Bioethics* 11 (2007) 39–62.
- [42]. Graneheim UH, Lundman B, Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse education today* 24(2004) 105–112. [PubMed: 14769454]
- [43]. Hsieh HF, Shannon SE, Three approaches to qualitative content analysis. *Qualitative health research* 15(2005) 1277–1288. [PubMed: 16204405]
- [44]. Delbanco T, Walker J, Bell SK, Darer JD, Elmore JG, Farag N, Leveille SG, Inviting patients to read their doctors' notes: a quasi-experimental study and a look ahead. *Annals of Internal Medicine* 157(2012) 461–470. [PubMed: 23027317]
- [45]. Neeman N, Isaac T, Leveille S, Dimonda C, Shin JY, Aronson MD, Freedman SD, Improving doctor–patient communication in the outpatient setting using a facilitation tool: a preliminary study, *International Journal for Quality in Health Care* 24(2012) 357–364. [PubMed: 22190587]
- [46]. Mead N, Bower P, Patient-centred consultations and outcomes in primary care: a review of the literature, *Patient Education and Counseling* 48(2002) 51–61. [PubMed: 12220750]
- [47]. Ahern DK, Woods SS, Lightowler MC, Finley SW, Houston TK, Promise of and potential for patient-facing technologies to enable meaningful use. *American Journal of Preventive Medicine* 40(2011) S162–S172. [PubMed: 21521591]
- [48]. Ventres W, Kooienga S, Vuckovic N, Marlin R, Nygren V P. Stewart, Physicians, patients, and the electronic health record: an ethnographic analysis, *The Annals of Family Medicine* 4(2006) 124–131. [PubMed: 16569715]
- [49]. Chen Y, et al. Unpacking exam-room computing: negotiating computer-use in patient-physician interactions. 2011 ACM.
- [50]. Shachak A, Reis S, The impact of electronic medical records on patient–doctor communication during consultation: a narrative literature review, *Journal of Evaluation in Clinical Practice* 15(2009) 641–649. [PubMed: 19522722]
- [51]. Sutherland JE, Egbert N, Gjerde CL, Pint-Burke T, Franklin C, Walker D, Dictation in the presence of the patient, *Archives of Family Medicine* 7(1998) 281. [PubMed: 9596465]

- There are perceived advantages and disadvantages of screen sharing in the visit.
- Time pressure and sensitive information are main factors avoiding screen sharing.
- Screen sharing perceived as way to better educate patients in the visit.
- More user friendly EHRs might improve screen sharing behaviors in the visit.

Summary Points

What was already known on the topic?

- EHRs have the potential to improve doctor-patient communication.
- Screen sharing would be one way to use EHRs as a way to communicate with patients in an effective way.
- Physicians employ different types of screen sharing behaviors from visit to visit.

What has this study added to our knowledge?

- Multiple work-system related factors influence physicians' decisions to use the EHR as a communication tool during patient visits
- There are perceived advantages and disadvantages of screen sharing in the visit.
- There are many patient related factors that influence physicians' decisions not to share the screen.
- This study has implications which might contribute to redesign of more user friendly EHRs.

Table 1.

List of factors, categories, and work system elements contributing to physician screen sharing

Categories and Condensed Units	# of physicians	Work System Elements
Educating patients		
• Preparation of after visit summary and patient instruction	11	TT and Task
• Explaining trends and biomarkers over time in patient data	9	TT
• Using decision and risk assessment tools	5	TT
• Discussing growth curve, such as height and weight of a child	4	TT
• Looking up information from the web	3	TT, and Task
Physicians' motivation and beliefs		
• Physician's belief that visuals help patients learn better	8	Individual and TT
• Physician's belief that screen sharing helps patients understand information	7	Individual and TT
Reviewing results/records		
• Reviewing and sharing test results	12	Task
• Reviewing and updating patient and medication history	7	Task
• Verifying information with the patient	4	Task
• Sharing other providers' notes, such as those of a specialist	4	Task
• Order entry, e.g. lab, x-ray, medication	3	Task
Physician-patient relationship		
• Physicians do not want patient to feel they are hiding anything	4	Individual
• Physicians perceive screen sharing as a way to improve relationships with patients	4	Individual
• Physicians wish to involve patients in shared decision making	4	Task
• Physicians believe it will improve new patient trust	3	Individual
• Physicians believe it is polite to share the screen	2	Individual
Patient interest		
• Patients request to see the screen	8	Individual
• Subtle cues from patients show their interest in looking at the screen	4	Individual
• Physicians know the patient likes screen sharing from past visits	3	Individual
Demographics		
• Physicians have good computer skills	7	Individual
• Patients have a high level of education	3	Individual
Visit		
• Visit type and content	7	Task
Time		
• Having sufficient visit time	8	Organization
Training		
• Receiving training regarding screen sharing	5	Organization

Note: TT corresponds as "Tools and Technology"

Table 2.

List of factors, categories, and work system elements contributing to physician not sharing screen

Categories and Condensed Units	# of physicians	Work System Elements
Physical/mental health		
• Patients being in acute pain/not feeling well	10	Individual
• Patients being in negative mood (depressed, down, upset, anxious)	6	Individual
• Patients having significant visual impairment	5	Individual
• Patients being mentally ill	4	Individual
Time		
• Physician running behind schedule	7	Individual, Task
• Physician feeling rushed and time pressured	6	Individual and Organization
• Physician having many complicated patients scheduled for the same day	4	Organization
• Physician knowing the patient's issues will take more than the scheduled visit time	4	Individual and Organization
Sensitive information		
• Physician looking at psychiatrist's note	7	Individual, Task
• Physician documenting embarrassing information, such as malingering, obesity	6	Individual, Task
• Physician documenting legal issues, such as child abuse, drug seeking	6	Individual, Task
Confidentiality		
• Checking arrival of next patient on the screen	4	Task, TT
Patient demographics		
• Physician believing information on the screen is too hard for patient to understand	4	Individual
Patient interest		
• Physician knowing from past visits that patient does not like looking at screen	4	Individual
Physician computer skills		
• Physician does not want patient to notice his/her poor computer skills	3	Individual