Towards Design Principles for the Three Phases of Physicians' Information Seeking Activities

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Abstract. Healthcare settings involve complex sociotechnical challenges, accentuated by rapidly expanding medical knowledge and technological developments. This entails a need for the professionals to continually seek information to update their skills and knowledge to solve problems in daily clinical practice while at the same time facing an increasingly fragmented health information environment. This research in progress paper addresses the real-life problem of physicians' information seeking activities before, during and after a patient visit. The anticipated contribution is a set of design principles that a system for information seeking through these three phases should support.

Keywords: Design science research · Information seeking · Learning · Healthcare

1 Introduction

Physicians belong to a highly specialized profession, with demands to keep their knowledge current and keep learning throughout their working life. Recent developments in medicine and technology enable fast and easy access to online clinical evidence. Various digital tools have been designed to bring together medical and patient information for supporting decision making at the point of care [1]. At the same time, it is hard to get an overview due to rapidly expanding medical knowledge, along with its overall increased complexity and fragmentation [2]. Furthermore, established role relationships within healthcare are challenged by digitally engaged patients who find other paths to knowledge than through traditional healthcare institutions and increasingly generate and track their own data on health apps and smartphones [3]. Recent research shows that while technology and sources of information retrieval have changed and improved, barriers for information seeking and retrieval still fail to satisfy the needs of physicians [4]. This calls for a design of health information systems that takes into consideration this complexity of on-the-fly decision making.

Therefore, we argue that there is a need for a more design-oriented approach [5, 6] when designing information seeking systems that take the dependency between the context and the IT system into consideration. The practical problem identified and addressed in this study concerns the need for physicians to continually seek new information to

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update or confirm their knowledge and find answers to clinical questions [7]. The aim of this research in progress paper is to identify and analyze how physicians learn through information-related activities in connection to patient work. The main contribution is a tentative design that supports the process of information seeking activities before, during and after a patient visit.

2 Theoretical Background

Research on information seeking behavior is spread across different disciplines concerned with the design, development, and evaluation of Information Technology (IT). Professional groups and occupations have provided a common structure for such investigations, with an increasing interest in health information systems resulting from the rapid growth of medical information and advances in digital technology [8]. Earlier studies focused on physicians' information needs and use, with emphasis on formal information sources related to either keeping up to date or clinical treatment and patient care [9]. While the technology keeps progressing, searching for information online broadly outlines the same pattern, and physicians still face problems related to information seeking and retrieval [4, 10]. Common barriers identified in the literature include time, accessibility, personal skills and attitudes, institutional characteristics as well as resource features [11]. In the Swedish context, prior research has highlighted the importance of relevance to clinical context for successful training in information seeking, and a recent national report shows that while physicians are positive to the use of digital tools, they face barriers in terms of lack of time, login procedures and technical problems as well as a lack of knowledge about available information sources [12, 13].

A common explanation for user resistance in healthcare is that the introduction of new technologies may change traditional practice and threaten the medical profession, which highlight the importance of adapting information systems to the workflow of clinicians. However, this is not without problems; as Zhou, Ackerman and Zheng [14] point out, medical records have what they describe as a dichotomized purpose of being both practice-centered, to facilitate real-time activities, and patient-centered, to support long-term information reuse. Due to the specific characteristics of the healthcare information environment and the complexity that comes with a design both supporting quick decisions and long-term competence development, a design-oriented approach, where the system will be informed by theories and rooted in practice, was chosen.

3 Method

The research is carried out within the Swedish healthcare system in response to a need for insights into the existing information practices of physicians, as well as practical recommendations for future design and integration of digital learning in clinical practice. The research approach is qualitative, and the study draws from interview data with Swedish physicians and prior work on digital learning and engagement in practice [3] to illustrate and gain more in-depth insights into the phases of information seeking at the point of care which is the focus of this paper. The research design is guided by the general design cycle by Vaishnavi and Kuechler [6], where interviews and workshops with participating physicians [3] were analyzed, and tentative design guidelines derived to be evaluated in the next phase. The overall aim of the research project is to arrive at design principles [15] that will guide future designs of information seeking systems for physicians and other groups with similar needs. The participating physicians were women and men, all resident physicians at the time of the data collection, i.e., practicing as physicians while also in training towards specialist competence. Most of them worked at outpatient clinics to obtain a specialty in general medicine (patient-based medical care provided across specialty boundaries). Other specialties, as well as physicians working in hospital settings, were also represented. Data collection activities are specified in Table 1.

Table 1. Data collection activities

Participants	Data collection	Year
Physicians	15 individual interviews	2015
Researcher, faculty, course participants	Engagement in 2-day workshops in evidence-based information seeking and case-based discussions	2015, 2021
Physicians	Respondent validation (planned)	2021

The analysis was done based on thematic analysis [16] to provide an overview of key events during the information seeking process, guided by theories on information seeking as outlined above, with the purpose to identify and analyze the types of information-related activities described in each phase.

4 Results: Three Phases of Information Seeking

In the analysis, we have focused primarily on how physicians seek information at the point of care, i.e., related to patient care in three phases: prior to meeting patients, during patient meetings and after patient meetings.

Phase 1: Prior to the Patient Meeting. Searching for information beforehand was mentioned as most common in cases where the patient has an unusual symptom or a known but rare disease: "*…then I can read up on that if it is something that I don't know or feel confident about"*. But the physicians also commented that it depends on other factors as well, such as time to prepare and having access to background information about the patient. They described that they often turn to the internet for an initial search: "*…to get an idea of, for example, a specific or unusual diagnosis or treatment, or to check for new updates"*. The importance of trustworthy information was highlighted, especially related to online health information, but they also trust their own judgement: "*…a quick Google search is usually enough to get confirmation*". Other types of information seeking that was mentioned prior to meeting the patient was to look for updates or specific recommendations: *"I can also search for drugs and possible side effects to prepare myself"*.

Phase 2: During the Patient Meeting. In this phase, the physicians likewise described information seeking activities when the patient has a new symptom, or something comes up during the consultation: "*Then, when the patient comes, and I examine, and it's something I do not know what it is, well then I have to check it out of course.*" They also described that it has become more common to include the patients in the information seeking process: "*to find out what information the patient has read*" and how they, when searching for information together with patients, deliberately turn to reliable information sources targeted towards patients that can be printed or shared: "*because there it is well explained [...] which is often appreciated.*" A typical case when the physicians themselves search for information during patient visits is for dermatology: "*then you can search for pictures or symptoms, and it is quite easy to get it down to a probable diagnosis.*" It was more common in this phase to mention consulting a peer or an expert as the first source of information. But online information seeking was also considered a second step, done after self-consultation: "[for the] *more difficult or unusual things; then you have to go in and search."*

Phase 3: After the Patient Meeting. Finally, the physicians described the need to search for information after having met with the patient, either for a specific question: "*I can also go in afterwards...to look it up before prescribing*" or for a more general update: *"...to see that my knowledge is still correct"*. The physicians, in general, did not find it hard to search for information if they knew what they were looking for: "[then] *it is not so difficult to find, and it's usually easiest to ask the patient, so you get a little more explanation, and then you can usually find the information.*" As one of the participants noted, this can make it hard to search in preparation: "*because it can seem to be about one thing, and so when you talk to the patient, it turns out to be something completely different.*" Colleagues were also mentioned in this phase, but more seldom for consultation, but rather to discuss cases and new recommendations or treatments brought up by patients: "*...if there is new information on [mentions a Swedish medical site], or if you have had a patient, then you bring this to discuss in the group.*"

5 Discussion and Conclusion

This study has described physicians' information seeking in three phases, and how they in this process face barriers but also engage in various types of learning. *The first phase*, prior to the patient meeting, can be characterized as mainly fact-checking to find updates on specific, known information, often through online digital tools provided by the hospital or quick internet searches using freely accessible, yet trustworthy sources. In this phase, the learning is typically for updating or re-learning something that is already known. In *phase two*, during patient meetings, physicians commonly search for information to guide the patient towards more validated sources tailored for laymen. Most often, the questions that arise during this phase are common questions that they already know the answer to from experience or basic medical knowledge. But when there is a need for gaining new knowledge relatively fast, they often use digital tools provided by the hospital. The information seeking done in *the third phase*, after patient meetings, most often regards follow-ups on specific questions, where the physicians need to check that they are updated on clinical guidelines, but also for more in-depth knowledge and reflection when discussing cases with colleagues.

Our findings confirm common barriers to information seeking such as difficulties to remember passwords and websites, and technical issues especially as they sometimes need to log-in at multiple levels while having a lack of time [11, 12]. Barriers were identified in all phases but considered most critical in phase two due to the presence of the patient. This highlights the importance to incorporate and align the technology with the work processes in healthcare, and that information seeking needs to be regarded as a sequential process rather than as separate entities [4, 17]. However, and equally important, findings from this study also illustrate that there are risks involved if too much focus is placed on "fast and easy access", as this may inhibit critical thinking and introduce new errors instead. Thus, stressing the importance of not viewing information seeking as an isolated activity out of context, but rather an activity that is integrated with work. Therefore, we suggest a holistic approach for developing a better understanding of the various strategies undertaken by physicians to overcome barriers to information seeking as they navigate and interact with both people and technologies in the information environment [3, 14].

For this initial step we have chosen to primarily zoom in on the information seeking done in the three phases, which is directed towards patient care, to develop a tentative design that supports the process of information seeking activities before, during and after the patient visit. Viewing the empirical data through the lens of previous research on information seeking among physicians, we arrive at four tentative design principles. The tentative design principles for the three phases of physicians' information seeking activities are as follows:

1. The system should support the validation of sources on the internet so the physicians can confirm what is already known or learn what is not known.
2. The system should provide seamless information so the physicians can access the information with low cognitive effort.
3. The system should enable physicians to consult peers or experts as a readily accessible sounding board during consultations.
4. The system should facilitate reflective peer discussions that leave digital footprints so it can be retrieved and spread throughout the organization.

The next step is to validate these design principles with the physicians through workshops and a survey. The final design principles should then be instantiated in a system that can be evaluated against the final design principles. Future research could follow changes or similarities in the three phases over time to capture continuing learning. It would also be interesting to explore patients' perspective or compare and contrast identified barriers within and across specific medical specialties and diseases.

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