Improving Usability, Safety and Patient Outcomes with Health Information Technology
F. Lau et al. (Eds.)

doi:10.3233/978-1-61499-951-5-59

Embedding Health Literacy Tools in Patient EHR Portals to Facilitate Productive Patient Engagement

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Abstract. Many health care providers have opened their EHR systems to patients in order to increase information sharing and patient participation. Accessing to EHR has offered the promises of improving patient understanding, engagement, and outcomes. Although patients generally appreciate the access to their health records, currently, most EHR systems are used as data storage and communication tools and their potential for promoting productive patient engagement have not fully developed. There is a need to develop and incorporate effective health literacy tools into EHR patient portals, helping patients interpret their health data, understand their medical conditions and treatment plans, make informed decisions, and take proper actions. We will examine the challenges that patients face in using EHR portals, then provide two innovative health literacy solutions for facilitating productive patient engagement: (a) an embedded semantic medical search engine that provides reliable and contextualized health information support, and (b) an integrated AI voice chatbot that answers patients' questions and provides on-demand self-care advice. Other approaches that can add benefits to patients in the context of using EHR will also be described.

Keywords. Electronic health records (EHR), patient EHR portal; health literacy, health information, embedded health information tools, contextualized medical search, AI voice chatbot, patient education, patient engagement, clinical outcomes

1. Introduction

Health information technologies, particularly Electronic Health Records (EHR) is seen as a key driver of value-based and patient-centered care. At present, the majority of EHR systems available in North America hospitals are mostly used as data storage and communication tools typically consisting of patient health histories, lab test results, diagnostic images and reports, as well as physician's notes. The benefits of EHR for physicians seem clear: improving productivity, coordinated care, patient safety, physician-patient communication, and patient education.

In recent years, many health care providers have opened their EHR systems to patients in order to increase information sharing and patient participation. Although patients generally appreciate the access to their health records, current EHR systems have not yet shown substantial evidence for improving patient understanding, engagement, and outcomes. As all EHR platforms were developed for physicians and as it takes years of professional training to understand the kinds of clinical information contained, patients face many challenges in using such systems. Some studies even reported

negative impact on patients, especially on people with limited health literacy. There is a need to develop and incorporate effective health literacy tools into EHR patient portals in order to facilitate productive patient engagement, bringing EHR to its full potential.

In this paper, we define EHR patient portals as Electronic Health Records (EHR) systems that provide access for patients to view their health histories, lab test results, diagnostic images and reports, as well as physician's notes. We will examine the challenges that patients face in using such EHR portals, then provide two innovative health literacy approaches for facilitating productive patient engagement: (a) an embedded semantic medical search engine that provides reliable and contextualized health information support, and (b) a AI voice chatbot that answers patients' questions and gives them advice on their health conditions. Other approaches that can add benefits to patients in the context of using EHR will also be described.

2. Problems in Implementing and Using EHR Patient Portals

Productive patient engagement through EHR portals requires patients to have the basic health literacy, which is the capacity to obtain, understand, and use health information in their healthcare. Patients with limited health literacy often have difficulty in understanding medical terminology used in lab reports, doctor's notes and other content (Chen, Zheng, et al., 2016). In addition, patients with limited health literacy and limited English proficiency often experience suboptimal communication and health outcomes (Ratanawongsa et al., 2017). In particular, such patients often felt overwhelmed by the complexity of health data, which often cause confusion and anxiety, especially when they receive abnormal test results via the EHR patient portals (Giardina, Modi et al., 2015). The adoption and utilization of EHR patient portals has been relatively low. According to a recent report (Heath, 2018), even 52% Americans have access to their EHR, only 28% Americans viewed their medical records. The top reasons for not viewing patient health records are (a) wanting to speak with providers in person (76%), and (b) limited perceived need to view medical records (59%). In order to increase patient use of their EHR, the patient portals need to offer additional content that is perceived useful by patients. Adding health information content that is actionable, educational, and interactive may better inform, educate, and engage patients, increasing the likelihood for them to use the EHR. Furthermore, given the prevalence of low health literacy in the population and the challenges that patients face in using EHR portals, tools that improve patients' understanding of EHR data and treatment plans, as well as their basic health literacy may prove valuable.

3. Two Health Literacy Tools for Facilitating Productive Patient Engagement

Several approaches have been taken to improve physician-patient communication and patient education in the context of patient EHR use. Using secure text messaging and email communications between doctors and patients are among the most popular ones. Such physician-patient communication can be carried out either inside or outside the EHR platforms, and both work very well. However, such an approach requires significant amount of work by the physicians, adding workloads on physicians who are already at risk of burnout. In addition, it is difficult to implement this method as a general

approach to meeting all health information needs of patients at all time, the EHR systems need to have a built-in mechanism to satisfy patients' information needs in timely fashion.

Basic health literacy education for the general public is often achieved through self-directed learning. Contextualized instruction and on-demand learning are two important strategies for developing understanding and supporting problem solving in this form of learning (Pari, 2003). To address challenges indicated above, we provide two innovative health literacy solutions for facilitating productive patient engagement: (a) an embedded semantic medical search engine that provides reliable and contextualized health information support, and (b) an integrated AI voice chatbot that answers patients' questions and provides on-demand self-care advice. Other approaches that can add benefits to patients in the context of using EHR will also be described.

3.1. An Embedded Semantic Medical Search Engine that Provides Contextualized Health Information Support

Incorporating a semantic medical search engine in patient EHR platforms provides a way for patient to access contextualized health information needed for them to make sense of test reports, treatment plans, and other EHR content. We are recommending semantic search engine because such search engines have built-in rules to identify, prioritize, and select health information for facilitating patients understanding, informed medical decisions, and proper self-care. These rules can also address questions that patients often have, such as why, when, and to whom a given medical intervention is effective or ineffective. This may help patients better understand their health data, treatment plans, and self-care tasks. We have developed such a semantic search engine which can be used in EHR via API and the details of this search engine were described elsewhere (Chen, Decary, 2017, 2018).

Beside conducting health information search in the context of viewing their health records, patients can access contextualized information through hyperlinks. The hyperlinks can provide explanations on test reports, physician notes, or the relationship between an abnormal test result (e.g., high glucose level) and the way to change it (e.g., diet, exercises, or drug). Depending on the needs and preference of patients, such a contextualized search tool can be used to help patients learn things they perceive as useful.

3.2. An Integrated AI Voice Chatbot that Answers Patients' Questions and Provides On-demand Self-care Advice

We are now at a unique time in human history where AI-powered voice technology has matured enough to make a difference in people's lives and that AI voice medical chatbots can be developed to provide on-demand and personalized self-care advice to patients. Such voice chatbots can make it easier for patients to obtain, understand, and use health information, improving their self-care as well as their treatment outcomes.

We are working on several specialized AI voice medical chatbots to provide self-care advice for various chronic conditions and surgical procedures. Such chatbots can engage in human-like natural conversations with patients via both voice and text, answering open-ended questions and providing personalized self-care advice. They can be deployed to all computer platforms, AI Assistant devices, smartphones, and many popular messaging and social media platforms. They can also be expanded into other

languages than English. Two video snippets of our AI voice chatbot prototypes can be viewed online (Chen & Decary, 2018).

Although these chatbots are developed as stand-alone applications, they can be integrated into patient EHR platforms to help patients understand their health data, treatment plans, as well as lifestyle modifications needed for successfully managing their health conditions. As many health organizations are seeking effective digital health tools to promote productive patient engagement, improve treatment outcomes, and reduce health care costs, we believe AI voice-activated medical chatbots will become an important and integral part of patient EHR platforms.

3.3. Other Approaches

No matter how smart technology may have become, there are always situations in which patients need additional support and resources beyond what is offered by the technology. In such cases, patients should be able to engage in secured communication with their primary care providers; they should also have access to immediate telehealth consultation when they fail to understand medical information that is crucial for their treatment plan. At present, some health providers have offered such services as integral parts of their patient digital health care ecosystem, ensuring the continuous support and care to their patients.

4. Future Directions

The advances in AI and digital health technology have offered the real potential to transform global health care. However, currently, in Canada, the EHR adoption rate is very low. Although 85% Canadian primary care physicians are using EHR, only 15% Canadians have access to their health records (Canada Health Infoway, 2018), which is much lower than the 52% access rate by Americans (Heath, 2018). Besides opening EHR portals to Canadians, we need to understand barriers that Canadians face in adopting EHR and take effective approaches to overcome such barriers. In particular, we need to consider the importance of health literacy when selecting, designing, and utilizing patient EHR platforms. In addition to medial search engines and AI voice chatbots, other features can be added to EHR to make EHR more useful and effective. For instance, providing diagnostic and predictive analysis using population EHR data, incorporating online health services (e.g., telemedicine, e-booking, and e-prescription) will enable us to develop a new type of EHR platforms, and eventually an intelligent, integrated, and connected consumer digital health care ecosystem.

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