Development of a Personalized Knowledge Portal to Support Diabetes Patient Self-management

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ABSTRACT
Patient self-management is an important component in improving quality of chronic disease healthcare. The promising benefits of the Interactive Behavior Change Technology (IBCT) on diabetes patient self-management are increasingly recognized. In this paper, we describe development of a knowledge portal prototype designed for enhancing self-management support among patients with type-2 diabetes. The portal focuses on personalization of the provided services: self-regulation, self-monitoring and evaluation, social support, virtual home visit and reminder. One of the development challenges is in designing a core framework that coordinates the related data, knowledge, interactions and personalized services in facilitating patients’ self-care.

Categories and Subject Descriptors
H.3.4 [Information Systems]: Systems and Software - User profiles and alert services; H.3.5 [Information Systems]: Online Information Services – Web-based services; J.3 [Computer Applications]: Life and Medical Sciences – health

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General Terms
Design, Human Factors

Keywords
Interactive Behavior Change Technology, Personalization

1. INTRODUCTION
Diabetes is a worldwide burden; its prevalence is expected to rise to 366 million by 2030 [1]. Diabetes patients’ daily lives are generally known to have a great impact on the patients’ health. It is advocated that diabetes must be principally managed by the patient on a day-to-day basis such as dietary habits (e.g., size and timing of meals, carbohydrate and saturated fat intake), increase in exercise (e.g. walking), intake of medications (correct dosage and timing as well as consistency over time), and monitoring of blood sugar levels, blood pressure, blood lipids, feet, and eyes. Unfortunately, self-management support occurs inconsistently during outpatient visits [2].

Effective diabetes self-management support requires a complex series of assessments and instructions. As a result, patients often require additional support and communication outside of the traditional clinician visit [2]. Further, the information provided for patients received should take into account each patient’s distinctive life circumstances. Thus, providing services aimed at achieving health-related behavior change is challenging and often requires the time, knowledge and skills.
The Interactive Behavior Change Technology (IBCT) can be used to address and support diabetes self-management [3]. Some support technologies include the Internet, CD-ROMs and DVDs, and telephone-based systems such as interactive voice responder (IVR), also known as automated telephone disease management, personal digital assistants (PDAs) or other handheld devices. In general, IBCT assists both patients and health care providers in monitoring changes in self-care needs. It also supports patients’ efforts to make behavior changes by promoting health and effective self-care. In addition, it can enhance communication between patients and potential supporters for their disease management.

In our project, we develop an IBCT-based knowledge portal prototype to provide supports for type-2 diabetes patient’s self-management. It integrates some common IBCTs including IVR, Web-based access, e-mails, mobile devices and sensors as well as less common IBCTs such as knowledge and personalization tools. The conceptual framework and implementation of the diabetes self-management portal prototype are briefly described.

2. CONCEPTUAL FRAMEWORK

There are few diabetes self-management websites that offered interactive assessments, social support or problem-solving assistance [4]. One example of interactive diabetes patient portal was developed that linked to an existing electronic medical record system [5]. In our project, we adopt the knowledge portal approach that focused on providing personalized knowledge and services. A conceptual framework is shown in Figure 1 using layered architecture diagram. The layered architecture composes of data, knowledge, interaction and personalization models. The data model layer focuses on storing the patient profile, clinical and activity data. The knowledge model layer focuses on acquiring and modeling knowledge required for patient’s self-management. Dialogue management must take into account the patient profile, clinical and activity data, and medical knowledge.

Figure 1. Layered architecture of the conceptual framework.

3. SUPPORTED SERVICES

The portal functions grouped by supported services are shown in Figure 2. Self-regulation is used as a dynamic motivational system of setting goals and developing strategies to achieve these goals. Personal log, graph and calculator are provided to estimate the patient’s diabetes control. The social support function gives the patients opportunities to talk with other patients with similar interests. Virtual home visits and reminders are system-initiated contact sessions, e.g. phone-based questionnaires and SMS alerts.

4. DISCUSSIONS

In this paper, we describe development of a knowledge portal prototype designed for enhancing self-management support among patients with type-2 diabetes. Our future works will focus on evaluation and added-value services, e.g. automatically alerting the doctors if the patient data falls into some abnormal status, recommending patient activities based on the patient’s past activities and preference, etc. In addition, we plan to incorporate automated acquisition of user data from mobile sensors and devices in preventing user’s errors from manual recording.

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6. REFERENCES