

A Personalized Patient Education Framework to Support Diabetes Patients Self-management

Marut BURANARACH^{a*}, Thepchai SUPNITHI^a, Nattanun THATPHITHAKKUL^a.
Suwaree WONGROCHANANAN^b, & Wiroj JIAMJARASRANGSI^b

^a*National Electronics and Computer Technology Center (NECTEC), Thailand*

^b*Faculty of Medicine, Chulalongkorn University, Thailand*

*marut.bur@nectec.or.th

Abstract: Patient self-management support focuses on encouraging patients to be knowledgeable about their illness and to be able to sufficiently look after themselves. Some key elements to this achievement include knowledge, motivation, self-efficacy, goal-setting, action planning and problem-solving. In this paper, we describe a personalized patient education framework aimed to provide personalized learning resource recommendations for patients. Specifically, resources are recommended based on patients' goals and barriers. We built a patient's self-management portal that allows a patient to define his or her goals and barriers in the patient profile. Learning resources help to support patient education that can promote a patient to achieve the specified goals. In this framework, an ontology-based approach will be used for modeling patient's goals and barriers as well as learning subjects. Ontology allows patient conditions and learning resource metadata to be linked. Finally, we discuss evaluation plan for assessing the framework effectiveness in terms of improvement of patient's efficacy, i.e., knowledge test score, confidence levels and satisfaction.

Keywords: Personalization, Ontology Engineering, Patient Education Technology

Introduction

Diabetes is a chronic disease which requires special attention both from healthcare providers and patients. Its treatment procedure is typically complicated and requires a lot of interactions between medical personnel and patients. However, due to the limited number of medical personnel and the increasing number of patients, the time and attention that the medical personnel can spend with each patient becomes less and less. In alleviating the problems, we proposed uses of specialized technology to support self-management activities for diabetes patients. Supplement to conventional healthcare, they offer added services that are important for the patients especially while they are waiting for next visits to their doctors.

In this paper, we focus on patient education, which encourages patients to be knowledgeable about their illness and to be able to sufficiently look after themselves. Specifically, learning resources are provided to support patient education. In this framework, learning resources will be recommended for a patient based on the patient's selected goals and barriers. An ontology-based approach will be used for modeling patient's goals and barriers as well as learning subjects. Ontology allows patient conditions and learning resource metadata to be mapped, which will enable personalized resource recommendation.

1. Background

1.1 Self-management Support for Diabetes Patients

Self-management support is a component of the Chronic Care Model (CCM) [1] which focuses on encouraging patients to be knowledgeable about their illness and to be able to sufficiently look after themselves. Some key elements to this achievement include knowledge, motivation, self-efficacy, goal-setting, action planning and problem-solving. 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, increase in exercise, intake of medications, and monitoring of blood sugar levels, blood pressure, blood lipids, feet, and eyes.

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 should take into account each patient's distinctive life circumstances.

1.2 Patient Education

Patient education is the process of influencing patient behavior and producing the changes in knowledge, attitudes and skills necessary to maintain or improve health [3]. However, a number of research studies have found that much of the medical information provided for patients cannot be understood by most of the patient population [4, 5]. It was suggested that patient education materials should be short and simple, contain graphics and encourage desired behavior [5]. Patient education can help to improve patient's health literacy, which is the capacity to seek, understand and act on health information that is important for patient's self-management [6].

2. A Personalized Patient Education Framework for Patient Self-management Portal

2.1 Learning Resource Metadata

In our project, we have developed a diabetes patient self-management knowledge portal [7] that adopted a personalized service framework. The portal consists of a learning resource repository to support patient education. Articles and video clips are provided in the repository in four subject categories: food, exercises, emotions and healthiness. Each article contains metadata information that will be used in searching. Specifically, keywords that are best described each article are included in a metadata field of the article.

2.2 Patient Profile

In addition to the patient's personal and health information, the patient can set his or her targets and plans. The patient can set up goals such as food control, weight control, exercises, medication intakes, etc. After setting the goals, the patient can choose from a list of possible barriers that may prevent the patient to achieve each goal. After the patient specifies his or her barriers, the system shows recommended strategies that the patient can adopt to overcome the barriers. The patient can then create daily action plan on his or her calendar that is linked with a reminder service.

2.3 Personalized Learning Resource Recommendation

The personalized recommender framework focuses on providing each patient with the learning resources related with his or her selected goals, and barriers. Ontology model is used for mapping between patient profiles and learning resources. Figure 1 shows instance to concept mapping between patients' conditions, i.e. goals and barriers, and patient profile

ontology. In associating the learning resource metadata with ontology, keywords are linked with concepts in the learning subject ontology. Thus, each resource can be mapped to concepts in the subject ontology. The learning subject ontology is designed such that it can represent concepts associated with patient's goals and barriers. In order to create learning resource recommendation for each patient, rules are created to associate different patient conditions with different learning resource subjects.

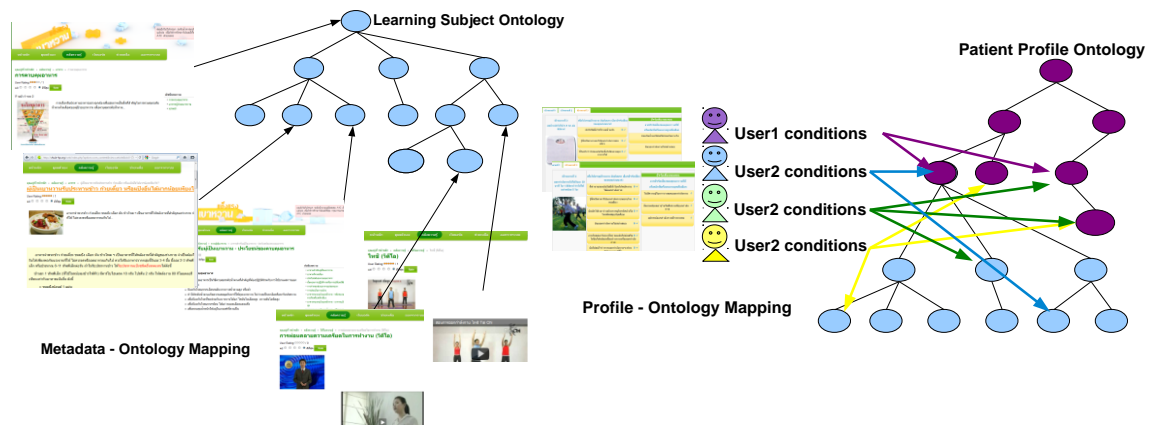


Figure 1 An ontology-based framework for personalized resource recommendations

3. Discussion

In this paper, we describe a personalized patient education framework designed for a diabetes patient self-management portal. The framework allows automatic recommendations of learning resources based on each patient's selected goals and barriers. Ontology is used as a means for associating patient profiles with learning resource metadata. Evaluation of the framework is planned in terms of patient efficacy improvement at every three-month interval. Questionnaires and pre-test and post-test score comparisons will be used to assess patient knowledge, patient confidence in self-care and patient satisfaction.

Acknowledgements

This work is partially supported by Faculty of Medicine, Chulalongkorn University, King Chulalongkorn Memorial Hospital, Thailand.

References

- [1] Bodenheimer, T., Wagner, E. H., & Grumbach, K. (2002). Improving primary care for patients with chronic illness. *The Journal of the American Medical Association (JAMA)*, 288(14), 1775-1779.
- [2] Holman, H., & Lorig, K. (2004). Patient self-management: a key to effectiveness and efficiency in care of chronic disease. *Public Health Reports*, 119 (3), 239-243.
- [3] Rankin, S. H., Stallings, K. D., & London, F. (2005). *Patient Education in Health and Illness* (5th ed.). Philadelphia, PA: Lippincott Williams & Wilkins.
- [4] Graber, M. A., Roller, C. M., Kaebler, B. (1999). Readability levels of patient education material on the World Wide Web. *Journal of Family Practice*, 48(1), 58-61.
- [5] Mayeaux, E. J. Jr. et al. (1996). Improving patient education for patients with low literacy skills. *American Family Physician*, 53(1), 205-211.
- [6] Adams, R. J. (2010). Improving health outcomes with better patient understanding and education. *Risk Management and Healthcare Policy*, 3(1), 61-72.
- [7] Buranarach, M. et al. (2010). Development of a personalized knowledge portal to support diabetes patient self-management. *Proceedings of the International ACM Conference on Management of Emergent Digital EcoSystems (MEDES'10)*.