

HealthTWITTER Initiative: Design of a Social Networking Service Based Tailored Application for Diabetes Self-Management

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Objectives: Diabetes is a chronic disease of continuously increasing prevalence. It is a disease with risks of serious complications, thus warranting its long-term management. However, current health management and education programs for diabetes mainly consist of one-way communication, and systematic social support backup to solve diabetics' emotional problems is insufficient. **Methods:** According to individual behavioral changes based on the Transtheoretical Model, we designed a non-drug intervention, including exercise, and applied it to a mobile based application. For effective data sharing between patients and physicians, we adopted an SNS function for our application in order to offer a social support environment. **Results:** To induce continual and comprehensive care for diabetes, rigorous self-management is essential during the diabetic's life; this is possible through a collaborative patient-physician healthcare model. We designed and developed an SNS-based diabetes self-management mobile application that supports the use of social groups, which are present in three social GYM types. With simple testing of patients in their 20s and 30s, we were able to validate the usefulness of our application. **Conclusions:** Mobile gadget-based chronic disease symptom management and intervention has the merit that health management can be conducted anywhere and anytime in order to cope with increases in the demand for health and medical services that are occurring due to the aging of the population and to cope with the surge of national medical service costs. This patient-driven and SNS-based intervention program is expected to contribute to promoting the health management habits of diabetics, who need to constantly receive health guidance.

Keywords: Mobile Health, Social Support, Intervention Studies, Diabetes Mellitus, Self Care

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I. Introduction

The aging of the global population has played a key role in the rise of chronic diseases. In an analysis of the statistics of death causes by Statistics Korea in 2012, it was found that the most widely occurring chronic diseases were cancer, cardiovascular disease, cerebrovascular disease, intentional self-harm (suicide), diabetes, and pneumonia, in that order [1]. Of those, diabetes is on the rise globally. According to the World Health Organization (WHO), about 20 million people have currently been diagnosed as diabetics. About 11 million people died of diabetes in 2005, and the WHO forecast that

death from diabetes would increase to twice this number by 2030 [2].

Like most chronic disease patients, diabetics, with effective disease control achieved through systematic and continuous treatment and management, can live the same healthy lives as those of normal people. However, the conventional diabetes treatment and management process, which is centered on hospitals, has several limitations, as shown in the following, in its attempts to satisfy the above requirements. First, diabetes health management and education programs are mainly operated in a form of one-way communication. One-way communication means physician-centered and physician-led communication. Second, there is inadequate systematic assistance via social support to solve the problem of emotional support for diabetics, who need to receive lifelong treatment. Third, adopting advanced health information technology is required for effective healthcare. Beyond the conventional method, social networking service (SNS) communication-based treatment and mobile application based treatment [3-7] have emerged recently. This study proposes an SNS-based mobile application for diabetes self-management; the system offers tailored information that can induce changes in patient behavior through relevant and helpful messages, exchanges, and information.

II. Case Description

1. Health and Treatment Behavior Prediction Tools

As a patient's active participation and own responsibility are required in chronic disease management, the paradigm of diabetes self-management interventions has shifted to an approach that is focused on patient-centered behavioral change techniques that consider training in problem solving, self-

efficacy enhancement, attitudes on behavioral change, and individual awareness change, including conversion from one-sided, information-oriented education. In this context, we adopted a Transtheoretical Model (TTM) to health behavior intervention, focusing on such factors as diabetics' exercise and diet [8].

This model is based on the premise that a certain process of stages can be followed when patients change their behavior. The model explains health behavior in terms of cognitive motivation factors that affect an individual's behavior instead of focusing on behavioral results [9]. The TTM model has proven effective in stopping smoking and in attempts to implement diabetes intervention programs after varying a program's intensity based on a patient intention [10,11].

The TTM model consists of five stages: the precontemplation stage, contemplation stage, preparation stage, action stage, and maintenance stage. Using such a stage paradigm, we designed an intervention program for each stage based on the most influential variables in each individual's behavioral change stage [12,13].

2. User Interface of HealthTWITTER

HealthTWITTER is composed of three major functions: 1) messaging and SNS function, 2) health profile, and 3) group management (Figure 1B). The messaging and SNS function pertains to posting messages on the board of HealthTWITTER by registered users when they upload their messages in their groups or in public. The health profile function refers to the logging and monitoring of patient medication, symptoms, laboratory results, and demographic information, such as body weight and blood sugar level. It also contains exercise and dietary logging data, with compliance information from the treatment intervention program, which works



Figure 1. The HealthTWITTER user interface: (A) login screen where only authorized (registered) users can use the application, (B) the main menu bar representing three major functions (it pops up from the left side), (C) the intervention function menu composed of 'Intervention Status,' 'My Mission,' 'Today's Mission,' and 'Social Group Status.'

based on our developed TTM model-based intervention algorithm. Figure 1C is one example of intervention, in which the exercise intervention program has four functional

buttons. ‘Intervention Status’ shows how the user is ready to exercise using an exercise status by conducting the auto-run process of intervention algorithm. ‘My Mission’ announces

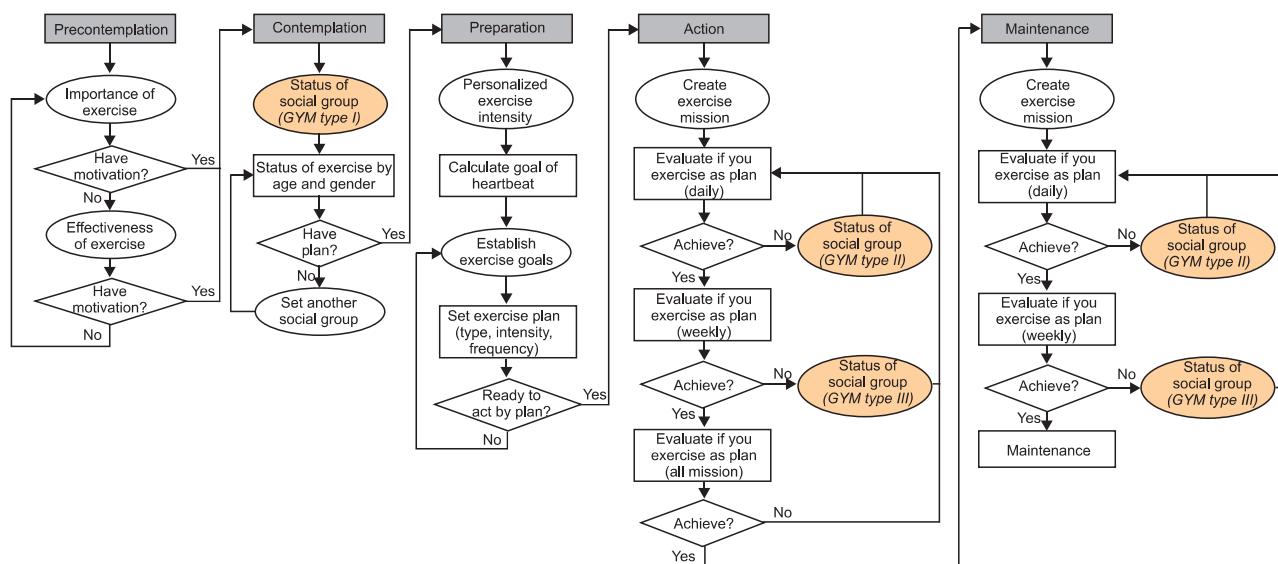


Figure 2. Algorithm for exercise assessment.

Table 1. Self-assessment model by health behavior change stages

Change stage	Details
Pre-contemplation	Recognizing the effect of exercise on health (recognizing the need for exercise) Inducing interest in exercise Recognizing the effect of exercise Recognizing environmental obstacles hampering exercise
Contemplation	Checking one’s own exercise Thinking of exercise one prefers Imagining one’s own image becoming healthier through exercise Recognizing obstacles disturbing an exercise plan Offering clues to motivate the commencement of exercise (providing information on patients with a status to the patient)
Preparation	Making specific and individualized exercise plans based on the recommended exercise program (frequency, intensity, duration, and type of exercise) Signing a contract with oneself on the plans mentioned above Recognizing caution upon starting exercise Making an exercise schedule and exercise journal Recognizing the effect of regular exercise on health Having confidence that one can exercise regularly
Action/maintenance	Praising oneself on the satisfied aspects by inspecting the exercise journal Remembering the advantages that regular exercise gives to a person Making it possible to continue exercise by forming a support group or workout friends Providing clues to motivate continuous exercising if one does not like to exercise or if an exercise mission fails (providing other patients’ status on continuing exercise and mission achievement) Removing obstacles hindering exercise

the exercise goal set by the user. ‘Today’s Mission’ shows an individual’s daily exercise goal and reminds the user of this goal through the Push Alarm function. ‘Social group status (Social GYM)’ shows how much classified group members exercise, as represented by their exercise patterns.

To build the initial classified social group with a sufficient number of patients, we utilized data from the Incheon Chronic Disease Management System (iCDMS), which is a chronic disease management system that contains data from chronic disease patients (high blood pressure patients, diabetics, and child obesity patients). The data cover the period from their initial registration to their follow-up management [14].

3. Self-Management Algorithm Based on TTM Model

HealthTWITTER has three intervention programs focusing on diet, exercise, and blood sugar level information necessary for diabetes management. Each intervention program is conducted according to a self-management algorithm based on serial stages. As an example, we show how the TTM model and SNS-based exercise intervention work (Figure 2).

We also adopted the contents of the self-assessment model (Table 1), which was built by Prochaska and Diclemente [15] and which refers to the TTM in order to operate HealthTWITTER with consistency.

III. DISCUSSION

HealthTWITTER is a social network-based intervention program created for the prevention of diabetes and the disease’s continuous management. It has been designed using an algorithm that offers tailored health management service for individuals. Unlike original diabetes management apps [16-18], which only represent input information, HealthTWITTER may be supported through SNS and is designed based on the reliable TTM model for effective health behavior intervention. As a result of these developments, it is thought that HealthTWITTER will have high application rates for patients in their 20s and 30s, who receive less intensive health management since attentive supervision is focused on the age brackets of 65 and older. To test our application for the targeted group, we gathered preliminary outcomes from the participants of the ‘2030 Camp’ operated by the Korean Diabetes Association in July 2012 [19]. More than 80% of the participants said they had the intention to use HealthTWITTER. Although this study can play a pivotal role in promoting the SNS-based health care industry’s development, the following limitations exist:

First, there is limitation in the study target. This study lim-

ited the research target to diabetics in their 30s and 40s, who have low awareness rates and treatment rates, with the intention of increasing attention paid to them. The development of an algorithm that can be applied to all age brackets will be necessary in the future.

Second, there is difficulty in securing reference group data. To create a reference group, exercise-related data from the initial stage of contracting diabetes is necessary. Although clustering was conducted based on the iCDMS data, which targeted elderly people aged 65 or older, there was a limitation in that the data were different in direction from the data used in this study. Further studies will need to present a reference group through the acquisition of reliable cumulative data by linking with the Seoul City Metabolic Syndrome Management Service, which manages chronic disease patients with minimum ages of at least in the 30s [20].

In October 2013, the Ministry of Health and Welfare issued an announcement of legislation on the revision of the Medical Service Act to allow u-health care between patients and doctors; this idea was focused on neighborhood medical centers, with the hope of enhancing treatment effects by offering chronic disease management anytime. Through the HealthTWITTER app, a collaborative patient-physician health care model will be developed with two advantages; namely, the reduction of poor adherence to chronic disease treatment and the decline in increasing health and medical service costs.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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