Use of Gamified Social Media with Home Telemonitoring for Patient Self-Management in Poorly Controlled Medicaid Diabetics: A Pilot Study of Health Outcomes, Social Influences, and Habit Formation*

Poster Abstract

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1 MOTIVATION AND PROBLEM STATEMENT

Diabetes mellitus is a chronic disease characterized by persistent hyperglycemia. It is the seventh leading cause of death in the United States [1]. AHRQ [2] reports that patient compliance with medication and disease management protocols is, in fact, a major barrier to diabetes treatment goals. To motivate patients, enhance patient self-care of diabetes and improve health outcomes, we propose to conduct a study to evaluate the effectiveness of a gamified social media app with a competitive game element in conjunction with home remote patient monitoring (the proposed technology intervention) in a sample of Medicaid diabetic patients with poorly controlled diabetes.

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2 BACKGROUND LITERATURE

We reviewed literature on patient motivation, diabetes self-management and gamification in health. Health belief Model posits that cue to action and an informed, activated patient yield positive health outcomes [3]. Studies in self-management of diabetes with home telemonitoring have yielded mixed effect sizes of health outcomes [4]. Use of gamification in social media is being used with good outcomes in the fitness industry, and has demonstrated good initial promise in self-management of diabetes in adolescent patients [5].

3 METHODS

Our strategy is to conduct an eight-month pilot study in which the proposed technology intervention will be used by a sample of 60 qualifying patients who will be randomized equally to control and intervention groups. During the first two months, remote telemonitoring will establish baseline compliance with daily blood glucose testing and fasting blood glucose levels for individual patients in both groups. During the next three-month intervention period, an app will be introduced to both groups. The gamified app introduced to the intervention patients will display daily information anonymously comparing the individual patient's compliance and fasting blood glucose level from the previous day to all other intervention group patients. The app for the control group will display daily information only for the individual patient's compliance and fasting blood glucose level from the previous day. The apps will then be withdrawn from

both groups while remote telemonitoring continues during the last three-month period to explore whether anticipated improved health behaviors continue to impact self-management of diabetes and blood glucose control.

3.1 Design

Our app sends two daily notifications to the patients to check their previous day's compliance and fasting blood glucose level. Once opened, the control group app shows a screen with two tabs with the information from the first tab appearing first - showing the individual patient's compliance i.e. whether or not they checked their blood glucose the previous day. After a ten second delay the app automatically shows the second tab - showing whether the patient's blood glucose level the previous day was high, low or normal or it says that the patient did not their check their glucose. While using the app the patient can toggle between the two tabs. Similarly, the game app also shows two tabs with the first tab being shown first and the second one after a delay of 10 seconds. The first tab shows the percentage of patients who checked and percentage of patients who did not check their blood glucose the previous day. This information is presented graphically in two zones with the percentage converted to stick figures. This screen also indicates the zone the patient belongs to. Similarly, the second tab shows four zones with stick figures indicating the percentage of patients who had high, low and normal blood sugar levels, and the percentage of patients who did not check their blood glucose yesterday. This screen also indicates the zone the patient belongs to with the percentage converted to stick figures. Every Monday the game app announces as weekly winners those patients who complied the maximum number days the previous week and those patients who had normal glucose the most number of days. Other patients get a message encouraging them to play better and win the next week. Our app sends daily reports to the study team listing the patients with dangerously high\low glucose levels. A clinical research coordinator will immediately inform the patient and the primary care practitioner of the patient's condition. The daily report will also include the list of patients who did not comply and/or use the app for two days in order to monitor potential study withdrawal. The user interface of the app was designed in consultation with our study team consisting of experts in information systems, human factors, computer science, public health, and physicians who treat diabetics. Visual cues like color and language of the presentation of results and notification, aural cues like game sounds, and glucose ranges for results, notification and daily reports were built into the app based on literature and the inputs from this interdisciplinary team.

3.2 Development

The app was developed using Android version Lollipop (5.x). The app is targeted for the Samsung SM-T377P tablet in terms of display, size and resolution. Our frontend is an android application written in Java and the backend is a Django based web framework written in Python. The app is hosted on a backed server - an Amazon EC2 Instance. Our web server follows the HTTPS protocol – the widely used protocol for secure communication over a computer network.

3.3 Testing

The App underwent rigorous alpha and beta testing with an eight-member testing team. The control and intervention groups were assigned four members each. The test subjects received a glucometer kit and a tablet with the glucometry app and the game app. Test subjects were asked to randomly adhere in order simulate actual patient behavior. Subjects were asked to log their adherence and the performance of app features such as daily notifications to study team, daily notifications to patients, daily results to control and intervention group, and weekly results. Using this data, we resolved issues in app design during the testing phase. We did another round of testing by reversing the control and intervention group assignment in order to verify that the issues were resolved.

4 EXPECTED RESULTS

One, the proposed technology intervention should improve three specific patient outcomes: a) compliance with disease self-management tasks (behavioral outcome); b) diabetes control in terms of reduced HgbA1C levels (health outcome); and c) diabetes self-efficacy (psychological outcome). Two, positive social influence from patients' social networks around their diabetes would act as an antecedent of usage of the proposed technology intervention, and act as a moderator of the relationship between the proposed technology intervention and patient outcomes. Three, disease self-management habits (measured after removing the intervention) are formed as a result of usage of the proposed technology during the three-month intervention period.

5 IMPLICATIONS

If positive results are subsequently validated, then the proposed technology intervention focused on promoting good health behaviors and motivation for self- management of diabetes through cue-for-action, fun, and competition could significantly enhance the standard of care for diabetes particularly with respect to self-care. This change in clinical practice may also have broader implications for the self-management of other chronic diseases as well.

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