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Introduction and Use of an Education-notification Application for Patients Undergoing Heart Valve Replacement

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Abstract

Proper education and notification of patients undergoing heart valve replacement is of paramount importance. The past decade has witnessed a growing interest in the use of modern, advanced technologies in medicine and patient education. This study aimed to introduce an education-notification application for patients undergoing heart valve replacement. Research was carried out in two phases of software design and performance evaluation. The first phase consisted of two stages: development of educational materials and notifications befitting to the application and algorithm design. The second phase of the study involved the assessment of the viewpoints of 30 patients undergoing heart valve replacement using a researcher-made questionnaire. Validity and reliability of the questionnaire were confirmed using descriptive statistics and Mann-Whitney U test. According to the results, the designed education-notification software was described as “good” or “very good” by 81.3% (n=24) of the participants.

Keywords: Design, Assessment, Education-notification software, Patients undergoing heart valve replacement

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Introduction

As with all medical procedures, heart valve replacement is associated with several complications (1). As such, patients undergoing this medical procedure require long-term care (2). Nevertheless, in many cases, patients are forced to spend the post-operative convalescence at home due to the shortage of facilities in healthcare centers (3).

Previous studies in this regard have surveyed patient self-management of anticoagulation (4) and positive effects of individual and group training on diminishing the side-effects of warfarin (5). However, most of these studies have emphasized on the prevention of warfarin side-effects, without sufficient attention to the other educational and healthcare needs that affect the quality of life of these patients (6, 7).

Despite the pivotal role of education in improving the quality of life of the patients undergoing heart valve replacement, patient education is commonly considered a time-consuming and repetitive aspect of healthcare services.

Considering the rising number of chronic patients and shortage of nursing workforce for direct patient education, novel techniques to meet the educational needs of patients and save time, energy and human resources are of significant utility (5). As such, researchers have been concerned with developing effectual strategies for patient education, which could be applied through face-to-face training and various other methods, such as the use of pamphlets, booklets, and videos (8).

Today, advancement of information and communication technologies and the growing use of communication instruments have facilitated access to distance education (9). Virtual education is a new field of communication technology, which provides lifelong learning regardless of time and location. In Iran, this type of education has been widely developed; however, it has limited applications in health care and patient education (10).

Virtual learning is available in various forms, including web-based education and educational software packages, which are easily installed on personal computers or mobile phones. Some of the prominent advantages of virtual education are the ability to create and store masses of information, continuity of the provided information, lack of anxiety during education, ability to use a variety of colors and images, and ability to add new data to previous contents (11).

In this regard, a clinical trial was conducted by Ghaforri et al. (2013) on the implementation of virtual education methods, entitled the "Effects of follow-up care by telephone and short message services (SMS) on the quality of life of patients after cardiac valve replacement surgery in Tehran, Iran". According to the results, mean scores of different dimensions of quality of life decreased after the intervention in all the patients who were followed-up via phone call and SMS, as well as the control group (indicating higher quality of life). However, no significant differences were reported in the effects of follow-up via phone call and SMS on the quality of life of the patients undergoing heart valve replacement (12).

Moreover, findings of other clinical trials have suggested that quality of life could be considered a key element in the assessment of healthcare quality, as well as a part of the treatment procedure. Correspondingly, measurement of quality of life in patients with chronic diseases yields further information regarding the status of health and disease and could be a useful guide to improve the quality of care (13).

One of the main strengths of the study by Ghaforri et al. was the continuity of education since the educational needs of patients undergoing heart valve replacement might change over time, and a single educational session after hospital discharge cannot meet their needs thoroughly. On the other hand, educational materials (e.g., booklets) may be lost or destroyed. Moreover, patients may not be able to carry the educational booklets at all times and places.

Another limitation in the mentioned research was the follow-up of patients via phone call and SMS, which only reiterates the previous educational materials and cannot provide timely notifications for taking medications, receiving laboratory tests and visiting the physician, which are important events in the life of chronic patients (14).

Today, advancement of communication technologies and instruments has facilitated access to distance education (15). Virtual education has opened new horizons for the connection between technology and education, presenting lifelong learning opportunities for learners at any time and place. In Iran, although virtual training has been widely developed, it is rarely used in medicine and patient

education (10). Virtual learning is available in various forms, such as web-based training and educational software packages installable on personal computers and mobile phones.

Cell phone technology has been applied in interventions regarding health beliefs, many of which involve unilateral approaches (i.e., providing or extracting information), while interactive and adaptive methods are used less frequently (17). In a study, Raili et al. stated that the majority of studies on cell-phone interventions focus on weight loss and smoking habits, and only a few experiments concern the treatment compliance and disease control in patients.

Currently, no published clinical trials are available in developing countries regarding the improvement of patient-centered outcomes using mobile technology-based healthcare (18).

Since patients undergoing heart valve replacement experience several chronic problems, provision of direct, effective educational interventions befitting to the needs of these patients is a major challenge in hospitals and clinics (19). Meanwhile, with the advancement of modern technology, patients have access to smart phones, which are able to run sophisticated applications and meet the needs of patients in terms of education and notification for test schedules, regular physician visits, and timely medication use (14).

With this background in mind, it seems necessary to develop education-notification applications that could be installed on cell phones and perform the mentioned tasks properly for patients undergoing heart valve replacement.

Methods

This study was conducted to design and evaluate an education-notification application during 2015-2016. Software design was carried out in two stages. The first stage involved the development of educational materials and notifications suited to the application. To do so, reliable sources of patient education and scientific literature regarding valvular heart disease were explored in a library study (20-26).

Furthermore, with consideration of ethical codes, a list was prepared based on the reviewed sources, containing information such as the disease and its significance, warning signs, importance of adherence to treatment, importance of medical tests, all issues related to warfarin (31 cases), dietary patterns, physical activity and rest, diseases, sexual activity, outdoor and indoor health care, and schedules of medications, laboratory tests and physician visits. Afterwards, the software was designed based on this list. Validity of the educational content was assessed through consultation with 10 faculty members of Mashhad University of Medical Sciences, Iran.

The second stage of software design involved the development of an algorithm using the common tools available for this purpose. The Enterprise Architect, which is a well-known software for system modeling, was applied to create the diagrams required for a system, including a use case diagram (actions required for each user in the system), sequence diagram (succession of activities at the time), activity diagram (general execution process of system activities), and class diagram, which is close to the implementation level and represents system capabilities and their correlations.

The education-notification application designed in this study contains four main menus, including “educational materials”, “notification system”, “search system”, and “contact researcher”. Additionally, educational materials consist of three subgroups, including information on the side-effects of warfarin and their control, heart valve disease and its complications, and warning signs of the disease.

The notification system is configured by the researcher in accordance with the time of surgery. In addition, this component of the application could remind the schedule of medications, laboratory tests, and physician visits, as well as the warning signs of the disease. During the installation of the application, it records the date of surgery and prepares automatic notifications about the time of taking medications, visiting the physician, and receiving the required tests 10 hours prior to the events. In the search menu, the patient has access to the desired contents by using specific key words. In the menu of contact researcher, the patient is able to contact the researcher via phone call, SMS, email, and other social networks.

In the second phase of the study, the designed application was tested in order to ensure correct functioning. To assess the application, we initially identified the patients undergoing their first heart valve replacement at Ghaem and Imam Reza hospitals of Mashhad (Iran). Patients who had smart

phones (Android and IOS) and basic literacy were enrolled in this study, and written informed consent was obtained from all the selected patients prior to participation.

The designed application was installed on the cell phones of the patients and one immediate family member after transfer from the intensive care unit to the surgery ward and before discharge from the hospital.

Method of using the application was explained to the participants. After three months, utilization of the software was evaluated using a researcher-made questionnaire, the content validity of which had been confirmed by 10 experts. Moreover, reliability of this questionnaire was determined based on the test-retest method (0.81).

The researcher-made questionnaire consisted of two sections. The first section included the demographic characteristics of participants, and the second part contained 20 items regarding the quality of the designed application. Items in this questionnaire were graded based on a Likert scale (Very good=3, Good=2, Average=1, Poor=zero). In addition, frequency of responses to each option was measured and analyzed.

In the initial interview with the patients, the researcher completed the first section of the questionnaire (i.e., demographic data) through verbal questions. Meanwhile, the education-notification software was installed on the mobile phones of the participants, who were briefed on the method of using the application. The second part of the questionnaire was completed two months later through the follow-up of patients over the phone.

Data analysis was performed in SPSS version 22 using descriptive statistics and Mann-Whitney U test.

Results

In total, 30 patients undergoing heart valve replacement were enrolled in this study, including 14 women (46%) and 16 men (54%). In terms of education level, 13 patients (50.5%) were below high school diploma, 10 cases (30.3%) had high school diploma, and others had academic education. Moreover, 21 participants (70%) were employed, and 9 cases (30%) were unemployed or housewives. Analysis of the obtained data from the second section of the questionnaire, which were related to the quality of application from the perspective of the patients, indicated that the application was easy to use for 22 participants (75%), while 28 patients (93%) were completely satisfied with the application. Furthermore, 18 patients (60%) were completely satisfied with the efficacy of the education-notification software in terms of physical activity, 20 participants (68%) described the effects of the application on dietary patterns as “good”, while 14 patients (49%) described the application as “average” with regard to psychological conditions.

According to the results of this study, 26 participants (87%) believed that the designed application was quite effective in the timely consumption of medications, 23 patients (76%) described the application as quite effective in reminding the laboratory tests, and 20 cases (68%) described the application as “good” in reminding the schedule of physician visits.

Implications for Practice

From the viewpoint of the studied patients, the designed education-notification application was beneficial in the management of their diet, physical activities, physician visits, laboratory tests, medication schedules, and disease complications. In this study, we evaluated the perspectives of the patients undergoing heart valve replacement toward a newly developed application. Therefore, it is recommended that future clinical trials be conducted regarding the effectiveness of the patient education-notification software in reducing complications, notifying medical events, and controlling the adherence of patients to the treatment regimen.

Conflict of interest

The authors declare that there is no conflict of interest.

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