Effectiveness of a Group Educational Intervention in Patients with T2DM using TEL Methodologies

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Abstract

Diabetes mellitus (DM) is an important problem for public health. This is because it affects a large portion of our society and the prevention, control and treatment of the disease and its complications have a significant impact on socioeconomics. Chronic care is one of the current challenges that the National Health System is faced with; eighty percent of primary care patients and sixty percent of those admitted to the hospital suffer from a chronic disease. In our study, we performed a quasi-experiment in a simple random sample of 30 patients with type 2 diabetes mellitus (T2DM), in order to test the effectiveness of using ICT in an educational intervention group of patients with T2DM, developed over 7 participatory sessions. A literary search has been conducted using important databases: PubMed, Embase Elsevier, CINAHL, in the specialized registers of the Cochrane Group Practice and Organization of Effective Care (Cochrane Effective Practice and Organization of Group Care), as well as various scientific search engines, such as Dialnet.

Keywords: Diabetes Mellitus; Chronic Diseases; Telemedicine; Primary Care; mHealth; Self-Care; Glucose Monitoring

Introduction

Technological development has enabled us to apply Information and Communication Technologies (ICT) in the area of Health, providing tools that are necessary for adherence to the treatment of diseases [1]. Technological advances can be used in prevention, with their application we can significantly reduce the demand for health care and improve the health of citizens [2].

ICT are “technical tools that are used to create, store, retrieve and transmit information quickly and in large quantities”, strengthening, helping and improving the current health care model; health professionals use ICT to ensure support, coverage and continuity of care, improving communication processes and adapting available health resources to existing demands [3].

Diabetes mellitus is a chronic metabolic disease, with high morbidity and mortality. Its prevalence is 10 - 15% in Spain, being one of the most important cardiovascular risk factors. The incidence of T2DM is 3 - 4%, reaching 16% in people over 65 years of age. Prevalence rates have increased alarmingly in young people, during the last 10 to 20 years, overweight and obesity being one of the main causes [4].

Health professionals have opted for ICT due to the benefits they can bring to the health system and the patients, providing us with instruments such as digital clinical history, teleservice and telecare, also used to improve communication processes and knowledge management and research. All this convinces them that ICT will contribute to generating higher levels of health, well-being and economic improvement [5].

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The treatment of T2DM is based on diet, exercise, diabetes education and pharmacological treatment [6]. Teaching a person with diabetes about their disease is fundamental, in this way they will be able to take responsibility for their illness and enjoy greater independence [4]. Therefore, the educational intervention group has been conducted using ICT for its advantages of improving glycemic control, weight and exercise. In addition, it delays the need of insulin treatments [5], less personnel is required and more time is saved. Interactive games favor social experiences [6] and at the same time they teach about diabetes and self-care processes [7].

Objective: To maintain maximum autonomy and improve the quality of life using ICT and online tools during the different sessions of the group educational intervention. Aiming to lower the levels of glycosylated hemoglobin (Hba1c) in patients within 3 months by increasing their knowledge about T2DM, so that it results in a drop of (Hba1c) below 7% in 80% of participants.

Hypothesis: The use of ICT in a group educational intervention is effective in patients with T2DM, improves their knowledge of the disease and maintains HbA1c below 7%.

Material and Method

Quasi-experimental pre-post test in a simple random sample of 30 patients with T2DM, which uses a pre-post test to evaluate the effectiveness of ICT before and after the group educational intervention. A group educational intervention has been developed over 7 participatory sessions, each one lasting 60 minutes. It was carried out after a bibliographic search in relevant databases.

Study population/Inclusion criteria: Diabetic patients aged 12 to 16 years old who meet diagnostic criteria T2DM in the Health Area of Salamanca:

- Glucose random at or above 200 mg/dl, usual signs and symptoms of diabetes (polydipsia, polyuria, polyphagia and weight loss).
- Basal plasma glycemia equal to or greater than 126 mg/dl on two or more occasions.
- Glycemia at two hours of oral overload with 75 g of glucose equal to or greater than 200 mg/dl on two or more occasions.
- Diagnosis of previous diabetes: there is some reference to the diagnosis, control or treatment of diabetes in the Clinical History.
- Have a computer or mobile with an Internet connection to participate in the educational sessions.

Exclusion criteria

- Patients with a sensory, psychological or physical deficit that prevents them from following the dynamics of the sessions, the use of ICT and marked controls.
- Patients who have received Group Health Education in previous 2 years.
- Patients monitored at another level of care.
- Do not have a computer or mobile with an Internet connection.

Withdrawal criteria: Patients who are admitted to hospital or have deceased, as well as those that move out to a place outside of the area of intervention.

Variables of study:

- Socio-demographic variables (age, sex, academic studies)
- Time of evolution of T2DM
- Type of treatment
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- Complications related to DM
- Anthropometric measurements (BMI = Weight (Kg)/Size m²)
- HbA1c
- Degree of knowledge of the disease using a questionnaire developed by Hess and Davis of the University of Michigan (USA) [8].

The questionnaire consists of 38 questions covering five areas of theoretical knowledge about T2DM: basic questions (1 - 6 and 35 - 38), blood glucose (7 - 16), insulin administration (17 - 21), hydrates (22 - 26 and 28) and food exchange (27 and 29 - 34). Patients should indicate the correct answer to each question with (X). The overall reliability of the questionnaire is 0.89, with questions of equal difficulty.

To determine the degree of association between the study variables, considering that they are nominal, the chosen statistical method is the Chi-Square test for two independent groups, with a statistical significance level of $p < 0.05$ and 95% reliability using the statistical software SPSS version 2.3.

Basal records are compared before and three months after the educational intervention to investigate the degree of knowledge. To determine the effectiveness of metabolic control in patients, dichotomous classification was used according to the Professional Practice Committee 2016 of the American Diabetes Association and trichotomy to find out about the patients’ knowledge of T2DM [8], being as follows:

- **Hb A1c**: $< 7\%$: good control; $\geq 7\%$: poor control.
- **A systolic**: $< 130$ mmHg: good control; $\geq 130$ mmHg: poor control.
- **HDL-cholesterol**: $> 35$ mg/dl mmHg: good control; $\leq 35$mg/dl mmHg: poor control.
- **IMC**: decreases 1 point: good control; decreases below 1 point or does not decrease: poor control.
- **Knowledge about Type 2 DM**: $\geq 30$ points: high knowledge; 20-29 points: moderate knowledge; $< 20$ points: low knowledge.

Phases of the group educational intervention using ICT

**Recruitment of participants**

Participants were recruited through the Medora software that is used in the Health Centers of Castile and León, and permission was requested from the Ethical Committee of Primary Care of the Health Area of Salamanca. Once the commitment of confidentiality was signed, the register of patients between 12 - 16 years old who have T2DM was searched and the patient’s telephone number was obtained through their digital clinical history and they were invited to participate in the study.

**Individual basal visit**

Duration of 10 - 15 minutes, at the Health Center. At the visit the patient was informed about what group educational intervention consists of. Patients were asked to provide their e-mail address in order to send them the schedule of the sessions, interactive infographics and digital brochures. The T2DM Knowledge Test was done at the visit, in Google Drive query. To notify the patients of each of the sessions, their email address was added to a group created in the Remind APP (Figure 2), containing the name of the project. In this way the patient received a reminder on their phone before each session.

**Development of group sessions**

Seven sessions were conducted, each guaranteed a systematized, programmed and valuable educational approach that would help these patients self-control their disease, improving the quality of their lives and reducing the use of health resources that are often required by this pathology.

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**Post-intervention individual visit**

Patients were individually appointed for a visit at the Health Center through the Remind APP, 3 months after completing the intervention in order to obtain analytical information and check Hba1c, HDL-cholesterol, blood pressure and calculate the patient’s BMI.

**Evaluation of the intervention**

The results of the test on theoretical knowledge of T2DM pre and post intervention were analyzed, in order to see if there is a significant difference in its results. Also, find out the patients’ degree of satisfaction through a questionnaire that was given in the last session. The information collected in the different sessions and the values for hba1c, BMI, systolic BP and HDL, were also analyzed 3 months after the intervention, in order to evaluate the effectiveness of the intervention.

**Development of the sessions using ICT**


**Session 5: Self-analysis and pharmacological treatment:** Visualization of videos and learning about glycemic control applications [http://bit.ly/2kwFqJW](http://bit.ly/2kwFqJW) such as Sanofi diabetes Manager IOS Itunes (Figure 1). A blood glucose monitoring device connects to iPhone and iPod Touch and works in conjunction with a diabetes management App. After blood glucose testing with the device, results will automatically be uploaded on the App. People with diabetes can then manage, analyze and send test results by email to their healthcare professional -including blood glucose, carbohydrate intake and insulin dosage.


![Figure 1: Sanofi Diabetes Manager APP.](BitlyLink)
Results

During the evaluation period for the use of ICT in patients with T2DM, a total of 30 patients were studied, 60% (n = 18) men and 40% (n = 12) women. The mean age was 15 ± 1 years old. The mean progress of DM was 3 ± 1 years. 75% had no complications, 10% macrovascular, 10% microvascular and 5% both. The mean value of glycosylated hemoglobin (HbA1c) at the start of the study was 8.2 ± 1.3 and at the end was 6.3 ± 1.2.

At the beginning of the intervention using ICT, 10% of the patients had normal weight, 30% overweight and 60% obesity. At the end, a BMI decrease of 3% was observed. The mean abdominal circumference at the beginning of the educational intervention using ICT was 115 ± 11.9 cm in men and 100 ± 10.1 in women and at the end of the intervention 97 ± 12.2 cm in men and 87 ± 8, with a decrease between 12 and 15.6%.

Regarding T2DM knowledge, the mean number of correct answers in the Pre-test questionnaire, completed on Google Drive before the group intervention, was 18.36 ± 4.7 and after the educational intervention with ICT, the mean was of 90 ± 1.8 successes, acquiring in 90% of the participants a high level of knowledge (score ≥ 30). Mobile applications enabled 98% of patients to have a better track of their diabetes, making control easier for them and their medical professionals, both doctors and nurses.

Using ICT and online tools, we obtained that 93% of the participants after the group educational intervention had a glycosylated hemoglobin (HbA1c) below 7%, 90% maintained a systolic BP < 130 mmHg after 3 months and 92% had HDL > 35 mg/dl, decreasing by a point in their BMI by 78% in these 3 months.

There were no significant differences in the variable gender (p = 0.01), nevertheless, there are significant differences in the variables age (p = 0.001) and time of disease evolution (p = 0.03) in the effectiveness of educational intervention using ICT.

Discussion

Our quasi-experimental study TEL methodologies in Health Education was performed in a simple random sample of 20 patients with type 2 diabetes mellitus (T2DM) and developed on 7 participatory sessions, to know the effectiveness of using ICT in an educational intervention group.

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This intervention improved the level of knowledge of the disease, allowed the maintenance of maximum autonomy and improved quality of life, favored changes in the patient's attitude in 98%, allowing 93% of participants to have glycosylated hemoglobin (HbA1c) below 7%. For example, mobile applications allowed better registration of diabetes control, making it easy for 98% of patients to record the data, disappearing the notebooks that are often forgotten at home when taking measurements on the street or when going to the doctor. The participation of the patient by sending the recorded data to the digital clinical history helped to control the disease [10].

In the same way, financed under the 7th Framework Programme for Research and Technological Development (FP7), the REACTION project has in fact provided a tangible result for people suffering from diabetes: A platform for better diabetes management. The project started in early 2010 under the coordination of Lydia Montandon from Atos Research and Innovation, who in this endeavour has been backed by 14 other partners, representing 9 different countries, all with a strong expertise in the medical field and information technology. The platform has been field tested in two healthcare settings (Chorleywood Health Centre and Medical University of Graz), and has proved successful in providing better care to diabetes patients.

The main goal of REACTION was to investigate how information and communication technologies can support both patients and healthcare professionals in managing diabetes, by providing efficient and scalable tools that can be used in different healthcare contexts across Europe. The result is an intelligent service platform for remote monitoring and therapy management, facilitating continuous and tight control of blood glucose levels and other vital signs, which are crucial for good diabetes management and insulin therapy [11].

The Medical University of Graz (Austria) has developed a project based on REACTION tools. In-hospital hyperglycaemia has been found to be an important marker of poor clinical outcome and mortality among diabetic patients. The in-hospital care application domain of the REACTION platform features a range of services aiming at safe glycaemic control of patients with diabetes using an individual target level, depending on the history and actual state of the patient [12].

Also, at Chorleywood Health Center (UK), this becomes reality for diabetes patients deciding to participate in the REACTION primary care pilot. As part of their usual diabetes care, they are offered a suite of services providing home monitoring of blood glucose, blood pressure, physical activity and diet. Whereas the patient can monitor own data through a patient portal, the primary care team manages the incoming patient data via a clinical portal which works as a tool for decision making [13].

The results of our study coincide with Diego Fernández—Diabetes 2.0 workgroup member of the Spanish Diabetes Society (SED)—who has conducted the survey Diabe+ in which people were asked about perception of quality of life and the use of ICT in healthcare. 86% said that the use of ICT improve their quality of life and 78% believe they would improve their self-control if they had smartphone apps to measure glucose levels.

The survey reflects the real need to raise knowledge of ICT for improving diabetes patients wellness, to improve communication between health professionals and patients and to provide them with tools that allow them to better understand their pathology [14].

In addition, Sanjay Arora led a research team in 2012 at the University of Southern California (USC). The goal of the study was to determine the impact of ICT designed specifically for resource-poor T2DM patients. Participants received three text messages daily for 3 weeks in English or Spanish in the following domains: educational/motivational, medication reminders, healthy living challenges, diabetes trivia, and links to free diabetes management tools. This program demonstrated increased healthy behaviors, improved diabetes self-efficacy and medication adherence, and received excellent satisfaction scores in resource-poor, inner city patients with diabetes [15].

Finally, Sofía Prado Cucho said in 2013 that the use of Information and Communication Technology (ICT) to improve adherence to treatment in patients with chronic diseases could be a useful health system development tool for patient’s involvement in their health care. Also, it is important to follow up participants regularly, and verify its effectiveness at long-term [16].

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Conclusions

ICT are becoming instruments that act as a source of information, a means of interpersonal communication and collaborative work in the exchange of information and ideas, a medium for expression and creation, a cognitive tool and information processor; an interactive resource for learning, simulates and motivates through multimedia didactic materials. All this shows that ICT are an instrument that can change our lifestyle, creating new training settings and improving our health.

The group educational intervention using ICT improves the level of knowledge of the disease, diet, exercise, adherence to treatment and better metabolic control, representing a 90% higher level of knowledge in all areas. ICT allow the maintenance of maximum autonomy and improve the quality of life, increasing knowledge about T2DM, and helping 93% of participants to achieve glycosylated hemoglobin (Hba1c) levels below 7%.

Group dynamics and ICT favor changes in the patient’s attitude in 98%. Mobile applications allow better registration of diabetes control, making it easy for 98% of patients to record data, eliminating the need for notebooks that are often forgotten at home when taking measurements on the street or when going to the doctor [17]. The patient’s participation in sending the recorded data to their digital clinical history helps control their disease.

Future Research

Use of ICT to improve adherence to treatment in patients with chronic diseases.

Bibliography


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