The role of information and communication technology in self-management of type 2 diabetes

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Abstract

Introduction: Type 2 diabetes is a chronic disease which represents a substantial burden on healthcare across the world. The use of information and communication technology (ICT) in self-management of diabetes is becoming more common, as it enables effective self-management and control over your health. Technology such as computers, smart phones, tablets and mobile apps can overcome time and location barriers by monitoring data such as blood glucose levels from home and can establish communication between patients and healthcare personnel. Previous studies have shown that despite numerous benefits, prevalence of ICT use in self-management of type 2 diabetes is low. *Methods:* The descriptive research method with a systematic literature review was used in the following databases: Google Schoolar, PubMed, CINAHL and Medline. The search proceeded with the help of Boolean logical operator AND, together with the key words: »Patient«, »Type 2 Diabetes«, »Self-management«, »Information and communication technology«. A systematic literature review was conducted in the first half of March 2020. PRISMA methodology was used to display decisions about usefulness of reviewed sources and seven of those sources were selected for further analysis. *Results*: Patients with type 2 diabetes are willing to use ICT and are aware of its benefits, but the prevalence remains low. Ignorance about computers, smart phones or more specifically mobile apps and the possibility of personal information breaches are the most common barriers to ICT use. Results show that the use of ICT contributes to a statistically significant reduction of glycated hemoglobin (HbA1c), however studies are divided about the reduction of body weight and body mass index (BMI). Patients want ICT to include different communication channels, enable possibilities for exchanging experiences and connection with different healthcare systems and to offer written and visual individualized information about their disease.

Discussion and conclusions: Because the use of ICT enables simpler monitoring of diabetes and reduces the possibilities of complications, its use is becoming ever more necessary, due to the fast ageing population and an increasing rate of chronic disease. This way of self-managing disease will simplify medical treatment for patients living in the countryside because of faster and easier access to medical assistance. In addition, healthcare personnel will be relieved of unnecessary treatment and will be able to take preventative measures faster and more easily through continuous patient monitoring. Developing new ICT for the management of chronic diseases such as type 2 diabetes requires collaboration between healthcare personnel and ICT experts; in addition, we must consider the patient's wishes and needs.

Keywords: patient, type 2 diabetes, self-management, information and communication technology

Introduction

Type 2 diabetes mellitus (T2DM) is a chronic disease that represents a major cause of morbidity and mortality and has a substantial burden on healthcare across the world (WHO – World Health Organization, 2018). In 2019 the prevalence of diabetes was estimated to be 9,3 % worldwide (463 million of people) and by 2030 they expect an increase to 10.9 % (700 million of people) (Saeedi et al., 2019). Improperly managed diabetes leads to serious damage to the heart, blood vessels, eyes, kidneys, nerves, and limb amputation (WHO, 2018). Active and efficient management of diabetes, which can be exceedingly difficult (Nyenwe et al., 2011), is key to prevent or minimize these complications (CDC – Centers for Disease Control and Prevention, 2019). Information and communication technology (ICT) is generally defined as technology used to communicate, manipulate, and store data by electronic means (Perron et al., 2010). The use of ICT is becoming more common, as it enables effective self-management of diabetes, patient empowerment, and control over your health (Yamaguchi et al., 2019). ICT such as computers, smart phones, tablets, and mobile apps can overcome time and location barriers by monitoring data such as blood glucose levels from home (Arnhold et al., 2014), establish communication between patients and healthcare personnel and help patients learn more about their ongoing self-care (Cui et al., 2016).

Methods

We conducted a systematic literature review with a descriptive analysis of the sources. The literature was searched in the following databases: Google Scholar, PubMed, CINAHL, and Medline. Keywords used to search for relevant articles included: "Patient", "Type 2 Diabetes", "Self-management", and "Information and Communication Technology". The search proceeded with the help of Boolean logical operator AND for connecting the search terms. English-language articles, published between 2015 and 2020 that were available in full,
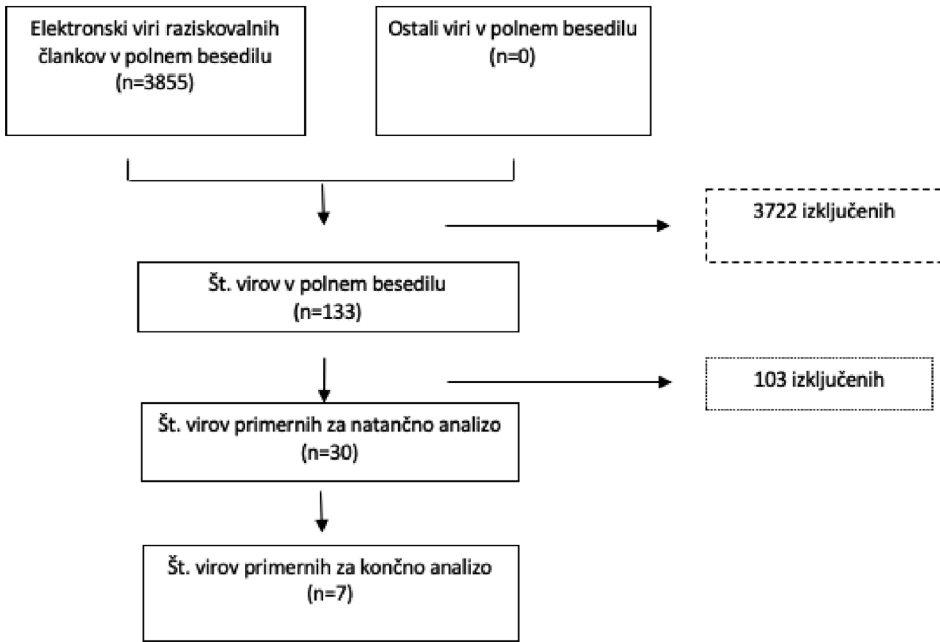
Figure 1: PRIZMA diagram

were identified and reviewed. PRISMA methodology (Figure 1) was used to display decisions about the usefulness of reviewed sources.

Results

Results of a descriptive analysis of the studies are presented in Table 1.

Table 1: Overview of studies

Author	Purpose of research	Methodology	Results
Aminuddin et al., 2019	To determine the effectiveness of smartphone-based interventions.	A systematic review and meta-analysis.	Participants who received smartphone-based self-management intervention had better self-efficacy, self-care activities, health related quality of life and lower glycated haemoglobin compared to the control group. The effects on body mass index and blood pressure were not statistically significant.

Author	Purpose of research	Methodology	Results
Ayanlade et al., 2019	To identify the ICT tools used for diabetes management and assesses the level of adoption of the tools.	Questionnaire, observation, and structured interviews.	ICT reduce health care personnel's workload and enable faster and easier completion of their daily tasks. Patients acknowledge the usefulness of ICT because it helps with their disease management plans.
Gardsten et al., 2017	To identify patients' wishes and needs for an ICT self-management service.	Participatory design: Future workshop method.	ICT self-management service needs to offer different communication channels, possibilities for exchanging experiences and written and visualized individualized information.
Georgsson and Staggers, 2017	To understand patients' perceptions of using ICT for diabetes self-management.	Descriptive study using a questionnaire and semi-structured interview.	Patients had positive perceptions toward ICT tool. After 6 months of using the ICT tool they saw clear benefits in using the technology and had favourable behavioural disease outcomes.
Lehocki et al., 2015	To evaluate impact of ICT on clinical outcomes (glycated haemoglobin (HbA1c) and metabolic parameters).	Prospective, non-interventional, observational, multi-centre study.	Clinical evaluation after 3 months of intervention showed statistically significant change of HbA1c in both patient groups. Results also showed statistically significant tendency to decrease in weight and BMI.
Petersen et al., 2018	To identify the challenges and barriers for the adoption of ICT tools for diabetes self-management.	Qualitative study with semi structured interviews.	Barriers to ICT adoption for diabetes self-management are: expensive ICTs, lack of technological literacy, participants' perceptions that mobile technologies are useless, the mistrust of technology and the preference for face-to-face interaction with medical staff.
Shibuta et al., 2017	To examine the prevalence and patient characteristics associated with willingness to use ICT in self-management of diabetes.	A cross-sectional interview survey.	Only 16 % patients with diabetes currently use ICT and a total of 50 % expressed the willingness to use ICT in future. Factors associated with the willingness are not having nephropathy, outpatient visits once a month or more, current use of personal computers and/or smartphones and having greater diabetes related emotional distress.

Discussion

Prevalence of patients using ICT-based self-management tools is low (16 %) (Shibuta et al., 2016). The most common tools they used were applications,

spreadsheet software and pedometer functions in mobile phones. On the other hand, most of the patients with type 2 diabetes were willing to use ICT-based tools in future and thought it is useful (Shibuta et al., 2016). In the study from Georgsson and Stagegers (2017) patients saw clear benefits in using the technology and had favourable behavioural disease outcomes after 6 months using ICT-based self-management tool. These types of tools were also accepted by the health care personnel, who claimed it helped them with continuous monitoring of the patient's health status, especially for patients that live in the countryside. It also helps take preventive measures sooner, relieve them unnecessary work and enables faster and easier accomplishment of their daily tasks (Ayanlade et al., 2019). Psychosocial factors which influence patients' willingness to use ICT are the patients' attitude toward ICT, the effectiveness and level of expected success of such technology, and the strive imported by the patients (Shibuta et al., 2016). Other factors associated with the willingness are not having nephropathy, frequent visits to diabetes physicians once a month or more and current use of personal computers and/or smartphones (Shibuta et al., 2016). Patients suggested that ICT should include different communication channels, enable possibilities for exchanging experiences and connection with different healthcare systems and to offer written and visual individualized information about their disease (Gardsten et al., 2017). Patients were unwilling to use an ICT based self-management tool because it seemed burdensome, difficult to use and too complex, especially for older patients. For some patients it seemed boring, ineffective, and too time consuming. Others thought that their current self-management activities were enough for them or their health condition did not allow them to use ICT based tools (Shibuta et al., 2016; Petersen et al., 2018). Other barriers included fear of data insecurity, mistrust of technology and the preference of face-to-face interaction with health care personnel (Petersen et al., 2018; Ayanlade et al., 2019). It was shown that patients found ICT based tools helpful in making diabetes self-managment plans (Ayanlade et al., 2019). They also used ICT to facilitate data logging and as an incentive for better adherence to disease management principles. Studies show that the use of ICT contributes to a statistically significant reduction of glycated haemoglobin (HbA1c) (Lehocki et al., 2015; Aminuddin et al., 2019). Patients that used ICT-based self-management tools also showed better self-efficacy, self-care activities and health related quality of life (Aminuddin et al., 2019). Studies are however divided about the reduction of body weight and BMI (Lehocki et al., 2015; Aminuddin et al., 2019).

Conclusion

Patients with diabetes are aware of ICT's benefits, importance, and usefulness in self-management, yet its usage remains low. ICT has a positive effect on both patients and health care personnel. It is a matter of fact that ICT is becoming more necessary, due to the fast ageing population and an increasing rate of chronic diseases. Therefore, it is important to know and understand the res-

ervations patients with diabetes have toward ICT, so they can be successfully eliminated. When developing new and improved ICT we must consider the patients' needs and wishes.

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