



Review article

Mixed-methods research on diabetes patient health education using digital technologies

Ajda Cenčič^{1*}, Mirko Prosen² , Sabina Ličen²¹ Diabetes Outpatient Clinic, Primary Healthcare Center Koper, Koper, Slovenia² University of Primorska, Faculty of Health Sciences, Department of Nursing, Izola, Slovenia

Abstract

Introduction: Digital health interventions have the potential to improve access to educational programmes. In digital health research, mixed-methods approaches are effective as they illuminate problems from multiple perspectives.

Aim: The aim of this scoping review was to examine the extent of mixed-methods research on the use of digital technologies in diabetes education for patients with type 2 diabetes.

Methods: We identified 10 relevant articles through a search in the PubMed, EBSCO and ScienceDirect electronic databases using the following terms: “type 2 diabetes AND (internet OR web based) AND education AND mixed method”, and “type 2 diabetes AND diabetes self-management education AND (web-based OR internet OR technology assisted education) AND mixed method”, and “diabetes mellitus, type 2 [MeSH Terms] AND internet [MeSH Terms] AND education [MeSH Terms] AND mixed method”.

Results: The most frequently used qualitative method was an in-depth interview combined with a quantitative data survey. The most frequently used intervention was the use of websites.

Conclusions: Considering the high prevalence of diabetes and considerable increase in the use of new technologies, we identified only a small number of studies. Future studies should focus more on participants' experiences and on factors encouraging patients to participate in such educational programmes, as well as on identifying the most effective online educational tools. Studies should also use larger samples.

Keywords: Diabetes mellitus type 2; Diabetes self-management education; Qualitative and quantitative methods; Telenursing

Introduction

Diabetes is a chronic disease which requires the person affected to make a variety of daily decisions related to self-management and care (Powers et al., 2016). There are currently 451 million people with diabetes worldwide. By 2045, this number is expected to reach 693 million. Recent estimates of diabetes prevalence, diabetes-related deaths, and diabetes-related healthcare expenditures indicate a major burden on social, financial, and healthcare systems across the globe (Cho et al., 2018).

Diabetes self-management education (DSME) is important as it can reduce the risk of developing diabetes-related complications, improve glycaemic control (American Diabetes Association, 2018; Powers et al., 2016), and reduce costs (American Diabetes Association, 2018). In line with the National Standards for DSME and Support, all patients with diabetes should be involved in DSME to develop the skills, abilities, and knowledge they need to make day-to-day decisions about their condition, as well as to implement and maintain the skills and behaviours needed to self-manage the condition (American

Diabetes Association, 2018). Existing healthcare services and educational programmes may not meet all the needs of patients with type 2 diabetes (Pal et al., 2018). Only a proportion of people with diabetes receive such education (Attridge et al., 2014; Coonrod et al., 1994; Ruppert et al., 2010). According to Cauch-Dudek et al. (2013), only one in five newly diagnosed diabetes patients have participated in a DSME programme.

Barriers to DSME participation include lack of time, childcare, and transportation; male participants' shame about the disease, and lack of interest in health; and difficulty contacting participants by phone (Testerman and Chase, 2018), lack of health care resources, work commitments, language barriers, and financial costs (Attridge et al., 2014). The high dropout rates in DSME suggest that retention needs to become a priority for programme policies, planning and evaluation to improve programme effectiveness. DSME tailored to people with diabetes could reduce dropout rates. Addressing linguistic and cultural specificities and other individual characteristics such as age or employment status could improve programme accessibility (Gucciardi et al., 2007). Efforts should also be invested into the identification and addressing of the barriers to DSME which exist at the levels of the health system payers, providers,

* **Corresponding author:** Ajda Cenčič, Diabetes Outpatient Clinic, Primary Healthcare Center Koper, Dellavallejeva ulica 3, 6000 Koper, Slovenia; e-mail: ajda.cencic@zd-koper.si

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and patients (American Diabetes Association, 2021). The use of mixed-methods approaches in research can examine such problems from multiple perspectives. Moreover, combining quantitative and qualitative research methods may provide a more complete understanding of a certain problem (Plano Clark, 2010).

To improve the effectiveness of DSME programmes, healthcare providers should identify patient preferences to inform the design of DSME interventions and adapt their implementation to the preferences of patients of different clinical and sociodemographic profiles (Fan and Sidani, 2018). Some barriers to DSME access and support can be mitigated through telemedicine approaches (American Diabetes Association, 2021). The Internet offers abundant ways of sharing education, opinions, and experiences (da Silva, 2017). For example, one in three American adults has sought information about a medical condition online (Attridge et al., 2014). Digital health interventions could be used to expand the range of health education content and meet a broader range of patient needs to improve access to DSME services and behavioural support (Pal et al., 2018). E-learning is defined as instruction delivered through a digital device (such as a smartphone, laptop, desktop computer or tablet) to support learning (Clark and Mayer, 2016). Online information can be accessed anywhere, anytime by an unlimited number of users, and thus presents a potential solution for training and support for large numbers of people with undiagnosed and diagnosed type 2 diabetes worldwide, without overburdening the healthcare system (Zhang et al., 2019).

The aim of this scoping review was therefore to examine the extent of mixed-methods research on using digital technologies in diabetes nursing education in patients with type 2 diabetes. More specifically, we investigated the methodological approaches used to conduct the selected mixed-methods studies to highlight the implications for future research in the field of digital diabetes education of patients with type 2 diabetes.

Materials and methods

Methodology

We used a scoping review to address the mentioned objective of this literature review.

Identifying the research question

We defined the following research question: "What is the extent of mixed-method studies on using digital technologies in diabetes nursing education in patients with type 2 diabetes?"

The review did not aim to assess the outcomes of studies but the methodological approaches to the design of the studies and the ways in which they used mixed-methods approaches.

Identifying relevant studies

We conducted our search in the following electronic databases: PubMed, EBSCO and ScienceDirect. We conducted our search between 19 December 2020 and 9 January 2021 and included articles published up to 10 January 2021. We restricted our search to only include English-language full-text research articles. We used the following search terms: "type 2 diabetes AND (internet OR web based) AND education AND mixed method", and "type 2 diabetes AND diabetes self-management education AND (web-based OR internet OR technology assisted education) AND mixed method", and "diabetes mellitus, type 2 [MeSH Terms] AND internet [MeSH Terms] AND education

[MeSH Terms] AND mixed method". We restricted our search by including only research published between 2010 and 2021.

Study selection

Our database search with the mentioned search terms resulted in a total of 170 articles. We identified an additional 14 articles through lists of references of the articles retrieved. After removing duplicate records, a total of 116 articles remained. We applied several inclusion and exclusion criteria. Inclusion criteria comprised studies which focused on the use of digital technologies in diabetes education for adults with type 2 diabetes (any form of education supporting diabetes management via an electronic device) and a combination of quantitative and qualitative methods.

The exclusion criteria were studies which included traditional frontal (teacher-centred) nursing education interventions without the use of digital technology, diabetes nursing education with the use of digital technology for patients without diabetes or with prediabetes or type 1 diabetes or paediatric patients (age <18 years) or gestational diabetes, or studies which included patients with type 2 diabetes and patients with other chronic diseases.

We also excluded studies based on systematic reviews, meta-analyses, narrative reviews, and study protocols for trials. In addition, there were telemonitoring studies which did not meet the inclusion criteria. In addition, the quality assessment of these 10 studies was conducted using the Mixed Methods Appraisal Tool MMAT (Hong et al., 2018), which allows the methodological quality of studies to be assessed in five categories (Whittemore and Knafl, 2005). The aim of the quality assessment was to assess the quality of studies and the weight of evidence in an impartial and transparent manner. As it was difficult to compare the quality of studies with different methodological designs, disagreements were then resolved based on discussions between authors until a final consensus was reached. Our literature review thus included a total 10 studies which met the eligibility criteria. Figure 1 presents the outline of the review, identification, and decision on the usability of the reviewed studies through a PRISMA 2020 diagram (Page et al., 2021) – Fig. 1.

Data extraction and synthesis

Two independent reviewers extracted the relevant data from the studies included in the scoping review. Relevant text units from the studies were entered into a Microsoft Excel spreadsheet, using the developed framework as a guide. The extracted data included specific details on the year of publication, main purpose of the study, design, source of qualitative data, source of quantitative data, findings, interventions, e-education, and limitations determined by the specific aim of the scoping review. Reviewers resolved any disagreements through discussion.

Results

Frequency analysis

We included 10 studies for data abstraction (Table 1), and most ($n = 6$) were mixed-methods studies. The studies focused on website design, testing, and implementation ($n = 3$), usability of websites and technological solutions for e-education ($n = 3$) and experiences with technological solutions ($n = 3$). Only one study examined the impact on glycaemic control. Most studies were conducted in the United States of America ($n = 5$) and Europe ($n = 3$).

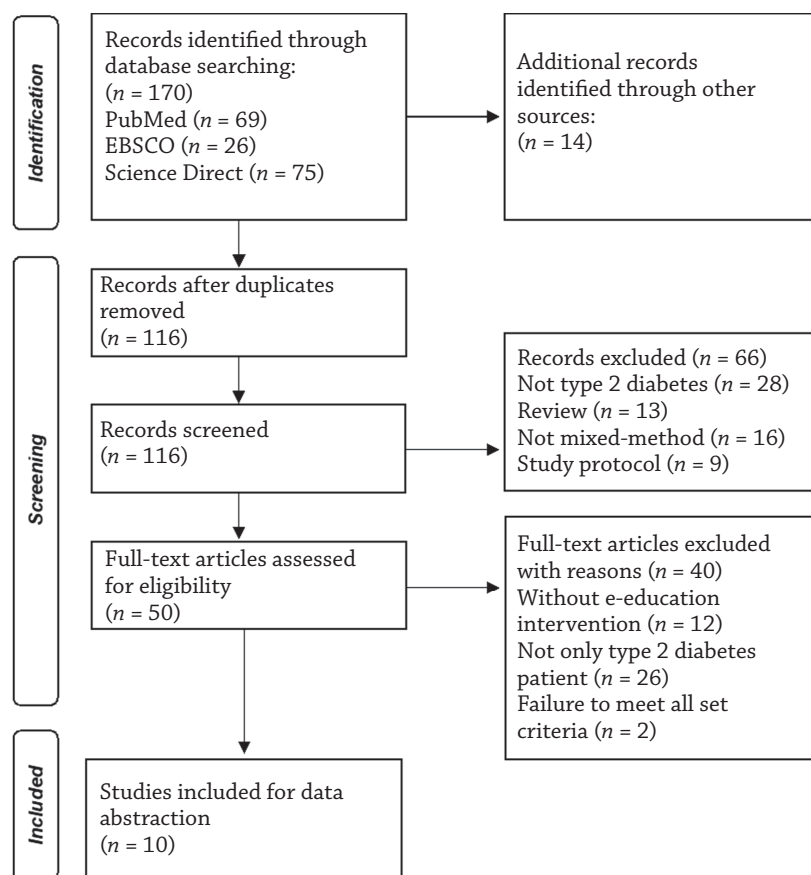


Fig. 1. PRISMA flow diagram

Data collection techniques

In terms of qualitative methods, most of the examined studies used in-depth interviews ($n = 8$). To obtain qualitative data, studies used the think-aloud protocol, content analysis and observation notes. For obtaining quantitative data, most studies ($n = 8$) used surveys such as demographic, usability, health, and knowledge questionnaires.

Content analysis

Content analysis of the studies (Table 2) revealed different educational interventions, with the most commonly used intervention involving the use of websites ($n = 8$), in which patients used e-educational materials on nutrition, physical activity, weight loss, lifestyle and behaviour changes, and skills development. Some websites included videos, nutrition games and quizzes. This was particularly the case in studies which included people of culturally diverse backgrounds such as Aborigines and African Americans.

Three of the studies under review used daily text messages to promote self-care. The studies which used the intervention of text messaging focused specifically on diabetes control and self-management. They analysed glycaemic control and medication adherence. Some studies included interactions with the nurse, lifestyle coach or other patients with diabetes as part of the intervention. They used video conferencing and social support through the use of forums. The studies which used interactions analysed psychological well-being and factors influencing the programme use. The studies included in this review also reported study limitations. Most of the limitations appertained to insufficient sample size and sampling bias.

Having analysed the studies included in our review, we hereby highlight the following characteristics: interventions, e-education, and limitations.

Discussion

With this review, we contribute to the identification of mixed-methods studies in the field of digital technologies in diabetes nursing education in patients with type 2 diabetes.

Nursing science research is primarily concerned with developing new methods to improve the quality and scientific validity of data, which has led to an extraordinary increase in methodological diversity (Meissner et al., 2011). Although mixed-methods research is becoming an increasingly popular methodology design (Hesse-Biber, 2010) and the Internet is an efficient way of information sharing (da Silva, 2017), our literature search resulted in only a small number of studies which met the inclusion criteria ($n = 10$). "Mixing" in mixed-methods approaches is more than just combining two independent components of quantitative and qualitative data analysis. The application of this approach in health and nursing research involves integrating, combining, and embedding these data components (Zhang and Creswell, 2013). There are many factors which can influence the impact of education, such as motivation, the influence of the environment, the influence of nursing educators, and others. Mixed-methods approaches allow and guide researchers to use a variety of approaches in addressing research questions which cannot be answered through a single method. Nursing researchers in particular can

Table 1. Study characteristics

Author, year	Main purpose of the study	Design	Sample	Qualitative data	Quantitative data	Findings
Adams et al., 2017	To report on the development and use of the "How's Your Sugar" website for Aboriginal people with diabetes	Mixed-methods study	T2D; $n = 11$	Content analysis of project documents (team meetings, reports and notes taken during interviews).	Website data collection, web-based survey ($n = 11$) and re-survey ($n = 6$).	Aboriginal people use web-based health promotion, which can increase their educational engagement, and which presents benefits for participants. Web-based technologies can potentially measure behaviour change. The inclusion of cultural diversity in terms of self-determination presents a challenge for the designers.
Bergner et al., 2017	To analyse the ways in which people with limited health literacy participated in the Rapid Education/Encouragement and Communications for Health (REACH) text-messaging intervention and to obtain user feedback	Mixed-methods study	T2D; $n = 55$	Semi-structured interviews about respondents' experiences conducted over the phone ($n = 31$).	Survey containing mobile phone use and health literacy measures ($n = 55$).	Text messaging interventions have potential benefits for participants, regardless of their health literacy status. Text messaging may have the potential to reduce type 2 diabetes health disparities related to limited health literacy.
Carter et al., 2011	To develop and test the use of an online intervention for African Americans with diabetes	Randomised controlled trial	T2D; $n = 47$	Qualitative in-depth interviews ($n = 13$) with participants from treatment group (random sample of half).	Demographic information, self-perceived physical and mental health status, HbA1c, BMI, blood pressure, attitudes and health knowledge survey, behaviours and practices related to diabetes.	Findings support the development of telehealth interventions to promote effective chronic disease management in medically underserved communities.
Georgsson and Staggers, 2016	To analyse the usefulness of a multimethod approach for patients experienced in the use of mHealth systems	Mixed-methods study	T2D; $n = 10$	Open-ended interviews (15–20 minutes) and a think-aloud protocol.	A short demographic questionnaire completed at the beginning, and a questionnaire on the usability of the SMS system at the end of the intervention (sample) ($n = 10$).	Multi-method, structured and standardised approaches are needed in mHealth usability research. A novel application of the Framework Analysis method and Usability Problem Taxonomy was used to structure, code and classify problems, proving the feasibility of the combined methods.
Heinrich et al., 2012	To analyse the usability of an educational programme	Randomised controlled trial	T2D; $n = 564$	Semi-structured one-on-one interviews with patients ($n = 5$) and healthcare providers ($n = 6$).	Online questionnaire ($n = 564$), pre-test and post-test design ($n = 99$), knowledge questionnaire.	The programme can improve knowledge, but it is not fully used. The use of mostly spoken texts was highly appreciated. Health care practitioners need support in implementing new educational programmes.
Hofman et al., 2016	To assess the effectiveness of the "HeLP-Diabetes" online intervention on the psychological well-being of people with diabetes	Longitudinal cohort study	T2D; $n = 19$	Semi-structured interviews ($n = 19$) about whether the intervention improved participants' well-being.	Pre-test, post-test via online questionnaires.	Internet-based self-management interventions may have the potential to decrease diabetes-related distress. The qualitative data also suggests that internet interventions can positively impact both psychological and behavioural outcomes.

Table 1. (continued)

Author, year	Main purpose of the study	Design	Sample	Qualitative data	Quantitative data	Findings
Nelson et al., 2017	To examine user experiences in using Messaging for Diabetes (MED)	Pilot study, mixed-methods study	T2D; <i>n</i> = 80	Feedback questions (open-ended items), semi-structured interviews lasting 30–45 minutes (<i>n</i> = 60).	Medical records (clinical data), HbA1c, feedback questions (<i>n</i> = 60).	Consideration of user experience is critical to developing engaging mHealth interventions. User feedback reveals what mHealth elements have the most value and why, which users to target, and how to optimise the efficacy and appeal of an intervention.
Nijland et al., 2011	To examine the factors influencing the use of an online application (DiabetesCoach)	Mixed-methods study	T2D; <i>n</i> = 50	Data from usability testing (<i>n</i> = 20), observation notes (problems experienced when using the web application), email interviews with open-ended questions (<i>n</i> = 6), and content analysis of email messages.	Interviews with nurses (<i>n</i> = 226, non-participants), log files, and surveys.	Innovations in health care will spread more rapidly through the use of technology that is simple to use and has components for interactivity. Factors which appear to influence increased use are: avoiding selective enrolment, making use of participatory design methods, and developing push factors for persistence.
Quinn et al., 2018	To analyse patient inclusion in the Mobile Diabetes Intervention Study (MDIS) and differences in HbA1c	Mixed-methods study	T2D; <i>n</i> = 163	Analysis of patient messages to assess patient engagement.	HbA1c.	The findings from this study help validate the efficacy of the mobile diabetes intervention. The next step is to determine differences between patients who engage in mobile interventions and those who do not engage, and to identify methods to enhance patient engagement.
Yu et al., 2014	To develop and test the use of an online educational application	Mixed-methods study	T2D; <i>n</i> = 23	Focus group interviews, videos of individual usability testing sessions and field notes.	While demographic characteristics and quantitative methods were used, the article focuses specifically on qualitative findings.	Participants identified a series of unmet health care needs: timely access to knowledge about diabetes, control and tracking of their disease, and opportunities to share experiences.

Legend: T2D – type 2 diabetes; *n* – sample size; HbA1c – Glycated Hemoglobin; BMI – Body Mass Index; SMS – short message service.

Table 2. Study interventions and limitations

Author, year	Interventions	E-education	Limitations
Adams et al., 2017	The use of the "How's Your Sugar" website for Aboriginal people	Yes; Videos on managing diabetes, nutrition game, quiz, and email reminders.	Small sample size was reported as a limitation for calculating statistical significance.
Bergner et al., 2017	REACH, a text messaging application to support patients with type 2 diabetes	Yes; REACH included daily text messages promoting self-care.	A possible sampling bias was indicated. A short intervention period and recruitment from qualified health centres was indicated as a limitation to the generalisability of the results.
Carter et al., 2011	Participants had to measure their weight, blood sugar, blood pressure, and access the portal and video-conference with a nurse	Yes; Health education videos, materials on nutrition, physical activity, and weight loss, videoconference with a nurse to develop the action plan.	Small sample size and sample selection were indicated as limitations to the generalisability of the results.
Georgsson and Staggers, 2016	Interactive, SMS intervention	Yes; The portal contained educational content.	The use of a convenient sample size and the novelty of the system were indicated as limitations to the generalisability of the results.
Heinrich et al., 2012	Use of a web-based education programme (Diabetes Interactive Education Programme; DIEP) for patients with type 2 diabetes	Yes, web-based educational programme.	Intervention duration and small sample size for user evaluation were indicated as insufficient for generalisation.
Hofman et al., 2016	The use of HeLP-Diabetes, an internet-based self-management intervention developed as part of a National Institute Health Research (NIHR) programme	Yes, online education, lifestyle changes, social support through forums and personal stories.	Sample characteristics, small sample size, characteristics related to the demand and duration of the intervention affect the transferability of the results.
Nelson et al., 2017	Use of MED, a medication adherence intervention delivered via text messaging and interactive voice response (IVR)	Yes; MED uses a mobile communication platform to promote and deliver medication adherence.	Not everyone who participated in the intervention provided feedback. The study was conducted at a single site, which limits the generalisability of the results.
Nijland et al., 2011	DiabetesCoach Web-based application (interactive, personalised profile, nurse/patient email)	Yes, online education, lifestyle coach.	Small and selected sample and unmeasured attrition were reported as limitations of the study.
Quinn et al., 2018	Access to patient portal	Yes; computer feedback messages, portal educational materials.	The role of diabetes educator messages in patient outcomes is unknown. It cannot be conclusively argued that patient outcomes are solely due to the content of the messages.
Yu et al., 2014	Use of the website	Yes, online education and support.	Small sample size was indicated as a limitation to the generalisability of the results.

Legend: SMS – short message service.

benefit from the opportunity to use such a dynamic approach so as to address complex and multifaceted research problems (Doyle et al., 2009), such as disparities across populations, age groups, ethnicities and cultures, poor adherence to treatments deemed effective, behavioural factors contributing to disability and health, and translational health research needs (Meissner et al., 2011). Three of the studies identified in this review addressed complex issues related to digital education, such as cultural diversity, disparities related to limited health literacy, and medically underserved communities. Digital interventions have been shown to have benefits for participants (Adams et al., 2017; Bergner et al., 2017; Carter et al., 2011). Adams et al. (2017) note that inclusivity of cultural diversity on the basis of self-determination represents a challenge for designers.

Mixed-methods research provides a powerful third paradigm choice which often yields the most informative, complete, balanced, and useful research results. Mixed-methods research is likely to generate better research results and outcomes

(Johnson et al., 2007). The rationale for using mixed-methods approaches in nursing research is to look at problems from multiple perspectives, add information about individuals and develop a more comprehensive understanding of a problem, as well as to compare, validate, or triangulate findings, contextualise trends, or examine processes/experiences along with the outcomes (Plano Clark, 2010). Georgsson and Staggers (2016) recommend the use of multiple methods in data collection for usability testing, as multiple data collection methods yield a more comprehensive set of usability issues. In their study, usability testing uncovered the largest set of usability issues, followed by interviewing and questionnaire surveying. The interview did not reveal any unique consolidated usability issues while the questionnaire revealed one.

This review confirms the important role of qualitative methods in mixed-methods research. The most commonly used combination of mixed-methods was the use of surveys and in-depth interviews. In most of the studies reviewed, qualitative data revealed additional findings, which allowed for an

understanding of user experiences, barriers and problems in using websites and other electronic solutions. Nelson et al. (2017) found that consideration of user experience is critical to developing engaging digital interventions. User feedback reveals which elements are most valuable and why, which users to target, and how to optimise the usability and appeal of an intervention. In a study conducted by Hofmann et al. (2016), qualitative data suggests that internet interventions can positively impact the psychological and behavioural outcomes of adults with type 2 diabetes.

In terms of the development of web-based educational content, Nijland et al. (2011) highlight the importance of innovations in health care, which will spread more rapidly through the use of technology that is simple to use and incorporates interactive components. They identify factors which appear to influence the increased use of technologies in digital diabetes education: avoiding selective enrolment, making use of participatory design methods, and developing push factors. In a study conducted by Heinrich et al. (2012), participants highly valued the use of mostly spoken text rather than written text. In another study (Yu et al., 2014), participants outlined a range of unmet health needs, and stated that they would like timely access to tailored knowledge related to their condition, mechanisms to control and track their disease, and opportunities to share their experiences with other patients.

DSME and support should be patient-centred; it can be provided in groups or individual settings and/or through the use of technology, and should be communicated with the entire diabetes care team (American Diabetes Association, 2021). Diabetes educators are actively involved in continuous improvement and seek to find new creative ways and methods to bring DSME closer to patients, as well as to reduce dropout rates. The number of people using the Internet for information about health is growing. Diabetes educators play an important role in this context and should therefore create and disseminate more educational content using online channels. However, as shown in a study included in this review, health care practitioners need support to implement new educational programmes (Heinrich et al., 2012). As DSME and support can improve outcomes and reduce costs, reimbursement by third-party payers is recommended (American Diabetes Association, 2021).

Limitations

This review presents a method for classifying, analysing, and evaluating studies using mixed-methods approaches. A major limitation to this review is that most of the identified articles focused only on website use, and online education was only part of the interventions. More mixed-methods studies focusing on e-education for patients with type 2 diabetes should be conducted. Other limitations of the studies reviewed were inadequate sample size and sampling bias. Participants in the studies were more motivated and interested in the interventions. They may have been more proficient in using new technologies. More studies should be conducted to test the knowledge and ability of patients with diabetes to self-manage their disease.

Conclusions

Considering the high prevalence of diabetes and the sharp increase in the use of new technologies, we identified only a small number of mixed-methods research papers in the field of e-education in patients with type 2 diabetes. One of the reasons for this could be the older population of patients with type 2 diabetes.

This review presents an analysis of the identified mixed-method research on e-education for patients with type 2 diabetes and highlights the importance of using qualitative methods to gain insight into user experience, barriers, and problems related to using websites and other digital solutions for e-education. It also presents the impact of the studies included in the analysis.

Future studies should focus more on experiences related to e-education, potential barriers, and factors which encourage patients to participate. They should also aim to identify the most effective educational tools in terms of behaviour change, glycaemic control, and knowledge through a comparison of e-educational materials, videos, games, quizzes, text messages, video conferences, lifestyle coaching, social support forums, and others. More studies should also include larger random sample sizes and a control group to achieve more reliable and valid results.

Ethical aspects and conflict of interests

The authors have no conflict of interests to declare.

Výzkum smíšených metod zdravotní edukace pacientů s diabetem pomocí digitálních technologií

Souhrn

Úvod: Digitální zdravotní intervence mají potenciál zlepšit přístup ke vzdělávacím programům. Ve výzkumu digitálního zdraví jsou přístupy založené na smíšených metodách účinné, protože osvětlují problémy z více úhlů pohledu.

Cíl: Cílem přehledové studie bylo prozkoumat rozsah smíšených metod výzkumu za využití digitálních technologií v edukaci diabetiků u pacientů s diabetem 2. typu.

Metodika: Pomocí vyhledávání v elektronických databázích PubMed, EBSCO a ScienceDirect jsme identifikovali 10 relevantních článků s použitím následujících termínů: „diabetes 2. typu A (internetový NEBO webový) A vzdělávání A smíšená metoda“ a „diabetes 2. typu A edukace v rámci samoléčby diabetu A (webové NEBO internetové NEBO technologiemi asistovaná edukace) A smíšená metoda“ a „diabetes mellitus 2. typu [MeSH Terms] A internet [MeSH Terms] A edukace [MeSH Terms] A smíšená metoda“. **Výsledky:** Nejčastěji využívanou kvalitativní metodou byl hloubkový rozhovor kombinovaný s kvantitativním datovým šetřením. Nejčastěji využívanou intervencí bylo používání webových stránek.

Závěr: Vzhledem k vysoké prevalenci diabetu a značnému nárůstu používání nových technologií jsme identifikovali pouze malý počet studií. Budoucí studie by se měly více zaměřit na zkušenosti účastníků a na faktory povzbuzující pacienty k účasti na takových vzdělávacích programech, jakož i na identifikaci nejúčinnějších online vzdělávacích nástrojů. Studie by také měly pracovat s větším počtem účastníků výzkumu.

Klíčová slova: diabetes mellitus 2. typu; edukace v oblasti self-managementu diabetu; kvalitativní a kvantitativní metody; teleošetřovatelská péče

References

- Adams K, Liebrecht A, Browne J, Atkinson P (2017). How's Your Sugar? Evaluation of a Website for Aboriginal People with Diabetes. *JMIR Diabetes* 2(1): e6. DOI: 10.2196/diabetes.6930.
- American Diabetes Association (2018). 4. Lifestyle Management: *Standards of Medical Care in Diabetes-2018*. *Diabetes Care* 41(Suppl. 1): S38–S50. DOI: 10.2337/dc18-S004.
- American Diabetes Association (2021). 5. Facilitating Behavior Change and Well-being to Improve Health Outcomes: *Standards of Medical Care in Diabetes-2021*. *Diabetes Care* 44(Suppl. 1): S53–S72. DOI: 10.2337/dc21-S005.
- Attridge M, Creamer J, Ramsden M, Cannings-John R, Hawthorne K (2014). Culturally appropriate health education for people in ethnic minority groups with type 2 diabetes mellitus. *Cochrane Database Syst Rev* 4(9): CD006424. DOI: 10.1002/14651858.CD006424.pub3.
- Bergner EM, Nelson LA, Rothman RL, Mayberry L (2017). Text Messaging May Engage and Benefit Adults with Type 2 Diabetes Regardless of Health Literacy Status. *Health Lit Res Pract* 1(4): e192–e202. DOI: 10.3928/24748307-20170906-01.
- Carter EL, Nunlee-Bland G, Callender C (2011). A Patient-Centric, Provider-Assisted Diabetes Telehealth Self-management Intervention for Urban Minorities. *Perspect Health Inf Manag* 8(Winter): 1b.
- Cauch-Dudek K, Victor JC, Sigmund M, Shah BR (2013). Disparities in attendance at diabetes self-management education programs after diagnosis in Ontario, Canada: a cohort study. *BMC Public Health* 13: 85. DOI: 10.1186/1471-2458-13-85.
- Cho NH, Shaw JE, Karuranga S, Huang Y, da Rocha Fernandes JD, Ohlrogge AW, Malanda B (2018). IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. *Diabetes Res Clin Pract* 138: 271–281. DOI: 10.1016/j.diabres.2018.02.023.
- Clark RC, Mayer RE (2016). *e-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning*. New Jersey: John Wiley & Sons, p. 7.
- Coonrod BA, Betschart J, Harris MI (1994). Frequency and determinants of diabetes patient education among adults in the U.S. population. *Diabetes Care* 17(8): 852–858. DOI: 10.2337/diacare.17.8.852.
- da Silva E (2017). Internet and information technology use in diabetes education. *Austin Diabetes Res* 2(1): 1012.
- Doyle L, Brady A-M, Byrne G (2009). An overview of mixed methods research. *J Res Nurs* 14: 175–185. DOI: 10.1177/1744987108093962.
- Fan L, Sidani S (2018). Factors Influencing Preferences of Adults with Type 2 Diabetes for Diabetes Self-Management Education Interventions. *Can J Diabetes* 42(6): 645–651. DOI: 10.1016/j.cjcd.2018.04.003.
- Georgsson M, Staggers N (2016). An evaluation of patients' experienced usability of a diabetes mHealth system using a multi-method approach. *J Biomed Inform* 59: 115–129. DOI: 10.1016/j.jbi.2015.11.008.
- Gucciardi E, DeMelo M, Offenheim A, Grace SL, Stewart DE (2007). Patient factors associated with attrition from a self-management education programme. *J Eval Clin Pract* 13(6): 913–919. DOI: 10.1111/j.1365-2753.2006.00773.x.
- Heinrich E, de Nooijer J, Schaper NC, Schoonus-Spit MHG, Janssen MAJ, de Vries NK (2012). Evaluation of the web-based Diabetes Interactive Education Programme (DIEP) for patients with type 2 diabetes. *Patient Educ Couns* 86(2): 172–178. DOI: 10.1016/j.pec.2011.04.032.
- Hesse-Biber SN (2010). *Mixed Methods Research: Merging Theory with Practice*. New York, NY: Guilford Press, pp. 3–9.
- Hofmann M, Dack C, Barker C, Murray E (2016). The Impact of an Internet-Based Self-Management Intervention (HeLP-Diabetes) on the Psychological Well-Being of Adults with Type 2 Diabetes: A Mixed-Method Cohort Study. *J Diabetes Res* 2016: 1476384. DOI: 10.1155/2016/1476384.
- Hong QN, Fàbregues S, Bartlett G, Boardman F, Cargo M, Dagenais P, et al. (2018). The Mixed Methods Appraisal Tool (MMAT) version 2018 for information professionals and researchers. *Educ Inf* 34(4): 285–291. DOI: 10.3233/EFI-180221.
- Johnson RB, Onwuegbuzie AJ, Turner LA (2007). Toward a Definition of Mixed Methods Research. *J Mix Methods Res* 1: 112–133. DOI: 10.1177/1558689806298224.
- Meissner H, Creswell J, Klassen AC, Plano Clark V, Smith KC (2011). Best practices for mixed methods research in the health sciences. *National Institutes of Health* 29: 4–10.
- Nelson LA, Mulvaney SA, Johnson KB, Osborn CY (2017). mHealth Intervention Elements and User Characteristics Determine Utility: A Mixed-Methods Analysis. *Diabetes Technol Ther* 19(1): 9–17. DOI: 10.1089/dia.2016.0294.
- Nijland N, van Gemert-Pijnen JE, Kelders SM, Brandenburg BJ, Seydel ER (2011). Factors influencing the use of a Web-based application for supporting the self-care of patients with type 2 diabetes: a longitudinal study. *J Med Internet Res* 13(3): e71. DOI: 10.2196/jmir.1603.
- Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 372: n71. DOI: 10.1136/bmj.n71.
- Pal K, Dack C, Ross J, Michie S, May C, Stevenson F, et al. (2018). Digital Health Interventions for Adults with Type 2 Diabetes: Qualitative Study of Patient Perspectives on Diabetes Self-Management Education and Support. *J Med Internet Res* 20(2): e40. DOI: 10.2196/jmir.8439.
- Plano Clark VL (2010). The Adoption and Practice of Mixed Methods: U.S. Trends in Federally Funded Health-Related Research. *Qual Inq* 16: 428–440. DOI: 10.1177/1077800410364609.
- Powers MA, Bardsley J, Cypress M, Duker P, Funnell MM, Fischl AH, et al. (2016). Diabetes Self-management Education and Support in Type 2 Diabetes: A Joint Position Statement of the American Diabetes Association, the American Association of Diabetes Educators, and the Academy of Nutrition and Dietetics. *Clin Diabetes* 34(2): 70–80. DOI: 10.2337/diaclin.34.2.70.
- Quinn CC, Butler EC, Swasey KK, Shardell MD, Terrin MD, Barr EA, Gruber-Baldini AI (2018). Mobile Diabetes Intervention Study of Patient Engagement and Impact on Blood Glucose: Mixed Methods Analysis. *JMIR MHealth and UHealth* 6(2): e9265. DOI: 10.2196/mhealth.9265.
- Ruppert K, Uhler A, Siminerio L (2010). Examining patient risk factors, comorbid conditions, participation, and physician referrals to a rural diabetes self-management education program. *Diabetes Educ* 36(4): 603–612. DOI: 10.1177/0145721710369705.
- Testerman J, Chase D (2018). Influences on Diabetes Self-Management Education Participation in a Low-Income, Spanish-Speaking, Latino Population. *Diabetes Spectr* 31(1): 47–57. DOI: 10.2337/ds16-0046.
- Whittemore R, Knafl K (2005). The integrative review: Updated methodology. *J Adv Nurs* 52(5): 546–553. DOI: 10.1111/j.1365-2648.2005.03621.x.
- Yu CH, Parsons JA, Hall S, Newton D, Jovicic A, Lottridge D, et al. (2014). User-centered design of a web-based self-management site for individuals with type 2 diabetes-providing a sense of control and community. *BMC Med Inform Decis Mak* 14: 60. DOI: 10.1186/1472-6947-14-60.
- Zhang W, Creswell J (2013). The use of "mixing" procedure of mixed methods in health services research. *Med Care* 51(8): e51–e57. DOI: 10.1097/MLR.0b013e31824642fd.
- Zhang Z, Monro J, Venn BJ (2019). Development and Evaluation of an Internet-Based Diabetes Nutrition Education Resource. *Nutrients* 11(6): 1217. DOI: 10.3390/nu11061217.