Saúde e Pesquisa
DOI: 10.17765/2176-9206.2024v17n1.e12422

Educational technologies for insulin therapy in adults with type 2 diabetes mellitus: a scoping review

Tecnologias educacionais para insulinoterapia em adultos com diabetes melitus tipo 2: revisão de escopo

***Ana Danúsia Izidório Rodrigues de Araújo*[1*], *Ana Roberta Vilarouca da Silva*[2]**

[1]PhD student in Nursing from the Postgraduate Program in Nursing, Federal University of Piauí, Master in Health and Community from the Postgraduate Program in Health and Community, Federal University of Piauí, Teresina (PI), Brazil; [2]PhD in Nursing, Professor of the Bachelor's Degree in Nursing. Federal University of Piaui. Picos (PI), Brazil.

*** Corresponding author**: Ana Danúsia Izidório Rodrigues de Araújo – *Email*: anadanusia_15@hotmail.com

ABSTRACT
The present study aimed to map educational technologies for administering insulin therapy in adults with type 2 diabetes mellitus treated by health services. This was a scoping review based on the methodological framework developed by JBI and the checklist of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews. A search was carried out in databases and gray literature. The articles were evaluated in a paired and independent manner by two reviewers. For the selection and screening of studies, the Rayyan® reference manager was used. Data were summarized with a table and discussion in thematic categories. Although different educational technologies address the topic of insulin therapy, further studies are needed to evaluate the effects and feasibility of using such technology within the scope of insulin therapy.

Keywords: Health services. Insulin therapy. Technologies. Type 2 diabetes mellitus.

RESUMO
O presente estudo objetiva mapear as tecnologias educacionais para administração da terapia insulínica em adultos com diabetes mellitus tipo 2 atendidos pelos serviços de saúde. Trata-se de uma revisão de escopo, baseada na estrutura metodológica desenvolvida pelo JBI e no checklist do *Preferred Reporting Items for Systematic reviews and* Meta *Analyses extension for Scoping Reviews*. Foi realizada busca em bases de dados e literatura cinza. Os artigos foram avaliados de forma pareada e independente por dois revisores. Para seleção e triagem dos estudos foi utilizado o gerenciador de referências Rayyan®. A síntese dos dados ocorreu por meio de tabela e discussão em categorias temáticas. Embora existam diferentes tipos de tecnologias educacionais que abordem a temática de insulinoterapia, faz-se necessário a realização de mais estudos no que tange a avaliação de efeitos e viabilidade do uso de tal tecnologia no âmbito da insulinoterapia.

Palavras-chave: Diabetes mellitus tipo 2. Insulinoterapia. Serviços de saúde. Tecnologias.

INTRODUCTION

Educational technologies (ET) emerge as a proposal for action to improve the health issues highlighted in this scenario from a reflective, creative, transformative, critical, and multidimensional perspective between those involved and the environment[1].

They are facilitating tools as they explore countless possibilities in the health education process, enhancing expanded care, whether in health promotion or disease prevention, optimizing patient performance, and increasing trust between the professional and the patient[2].

The development of an ET within the scope of insulin therapy is justified due to the growing number of people with diabetes and the existing fragility concerning knowledge about self-care, as well as application techniques, storage of inputs, insulin application rotations, and resulting changes, such as lipodystrophy, among others[3].

Considering statistics worldwide, in 2021, 537 million adults had diabetes mellitus (DM); estimates indicate that by 2045, the number of people with DM will be 738 million[4]. Type 2 diabetes mellitus (DM2) accounts for 90 to 95% of all cases of diabetes (DM). It has a complex and multifactorial etiology involving genetic and environmental components[5,6]. Unlike type 1 diabetes mellitus (DM1), in which 100% of patients require exogenous insulin for treatment, most patients with type 2 diabetes mellitus (DM2) do not use insulin initially after diagnosis[7]. Due to low adherence to oral therapy, insulin therapy has to be introduced as a last pharmacological resource to achieve clinical stability of the disease in the face of uncontrolled glycemic levels[8].

A series of precautions recommended by the Brazilian Diabetes Society has to be considered for effective insulin therapy planning[7], ranging from storage and conservation, preparation and administration of the injection, as well as reuse and/or disposal of syringes and needles. Knowing the appropriate technique for preparing and administering insulin according to the SBD[7] recommendations is essential for achieving glycemic goals and improving the quality of life of people who need injections daily.

The use of educational technologies enables the construction of knowledge, helping daily decision-making, and when these technologies are built effectively and aimed at promoting health, they can modify the reality of a population and must be built in the context of the target audience[9].

Therefore, there is a need to understand in more depth this subject, which is so important for health promotion. Even though there is significant scientific production on insulin therapy, research requires expansion regarding ET that addresses insulin administration in people with DM2, as well as all the management involving the practice. Therefore, a broad review of the literature on insulin management options and strategies in adult patients with DM2 is necessary.

Furthermore, the presentation of insulin therapy through ET and observing the technique in a context closer to the patient's reality, with the inputs and in the usual place of application, can contribute to the knowledge of a real panorama of the phenomenon[10].

In order to gather information on the subject and given the importance of the insulin administration technique, the present study aimed to map the ET for administering insulin therapy in adults with type 2 diabetes mellitus treated by health services.

METHODS

This was a scoping review based on the methodological structure developed by JBI[11] and the checklist of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)[12]. Five steps

were followed[11,13]: 1) identification of the research question; 2) identification of relevant studies; 3) study selection; 4) data categorization; 5) collection, summary, and mapping of results. The protocol was registered on the Open Science Framework (OSF) platform through number 10.17605/OSF.IO/5CZHM to ensure the quality and transparency of the writing of its findings.

The acronym PCC (Population: Adults with DM2; Concept: Educational technologies for insulin administration; Context: health services) was used to structure the research question. From this, the question is: What are the educational technologies for administering insulin therapy in adults with type 2 diabetes mellitus treated by health services?

As inclusion criteria, the following were established: studies with adults with DM2 treated by primary health care and/or secondary health care, use of educational technologies in the practice of insulin therapy, without year and language restrictions. Letters to the editor, abstracts in event annals, book chapters, incomplete articles, and ongoing studies were excluded.

As sources of information to obtain the desired answers, searches were carried out in the databases *Medical Literature Analysis and Retrieval System Online* (MEDLINE) via PubMed, MEDLINE via Elton B. Stephens Company (EBSCO), MEDLINE via MEDLINE via Virtual Health Library, Scopus, *Web of Science*, EMBASE, *Cumulative Index to Nursing and Allied Health Literature* (CINAHL), and Latin American and Caribbean Literature in Health Sciences (LILACS).

Gray literature was also investigated, with the following sources of information: Google Scholar, Brazilian Digital Library of Theses and Dissertations (BDTD), Catalog of Theses and Dissertations (CTD) of the Coordination for the Improvement of Higher Education Personnel (CAPES), OpenGrey, New York Academy of Medicine (NYAM) Library, ProQuest Dissertations and Theses (PQDT) and Open Access Theses and Dissertations (OATD).

To construct the high-sensitivity search strategy, three controlled health vocabularies were used, Health Science Descriptors (DeCS), Medical Subject Headings (MeSH), EMTREE, and keywords, together with Boolean operators AND and OR[14]. Advanced search was carried out in the databases according to the strategy structured in Box 1.

Box 1. Search strategy for document retrieval. Teresina, state of Piauí, Brazil, 2023.

	P	C	C
Extraction	Adults with DM2	Educational Technologies for Insulin Administration	Health Services
Conversion	Adult/ Type 2 Diabetes	Educational Technology / Insulin	Health Services
Construction	*(Adult OR Adults) AND ("Type 2 Diabetes" OR "Type 2 Diabetes Mellitus")*	*OR "on-line education" OR "online education" OR "on-line learning" OR "software application" OR "software app" OR game OR games OR simulator OR podcast OR "audio book" OR "e-book" OR "electronic book" OR primer OR chat OR chatbot OR "virtual learning" OR "distance education" OR "audio recording" OR audiorecording OR "sound recording" OR "instant messenger" OR website OR video OR "video game" OR videogame OR videoconferencing OR movie) AND (insulin OR "insulin treatment" OR "insulin therapy")*	*("Health Services" OR "health service" OR "health care service" OR "Primary Health Care" OR "first line care" OR "primary care nursing" OR "primary healthcare" OR "primary nursing care" OR "Secondary Care" OR "secondary health care" OR "secondary healthcare" OR "public health service" OR "public health care" OR "public health center")*
Utilization	*(Adult OR Adults) AND ("Type 2 Diabetes" OR "Type 2 Diabetes Mellitus") AND ("Educational Technology" OR "serial album" OR "digital technology" OR "e-learning" OR "on-line education" OR "online education" OR "online learning" OR "software application" OR "software app" OR game OR games OR simulator OR podcast OR "audio book" OR "e-book" OR "electronic book" OR primer OR chat OR chatbot OR "virtual learning" OR "distance education" OR "audio recording" OR audiorecording OR "sound recording" OR "instant messenger" OR website OR video OR "video game" OR videogame OR videoconferencing OR movie) AND (insulin OR "insulin treatment" OR "insulin therapy") AND ("Health Services" OR "health service" OR "health care service" OR "Primary Health Care" OR "first line care" OR "primary care nursing" OR "primary healthcare" OR "primary nursing care" OR "Secondary Care" OR "secondary health care" OR "secondary healthcare" OR "public health service" OR "public health care" OR "public health center")*		

The search results were exported to the Rayyan® reference manager developed by the Qatar Computing Research Institute (QCRI)[15] to remove duplicates and select and screen studies by two researchers, independently, with differences resolved with the participation of a third examiner. In the first phase, titles and abstracts were read. Studies that met the inclusion criteria were analyzed in full in the second phase. Furthermore, manual searches were carried out in the references of the included studies to identify potentially eligible studies to compose

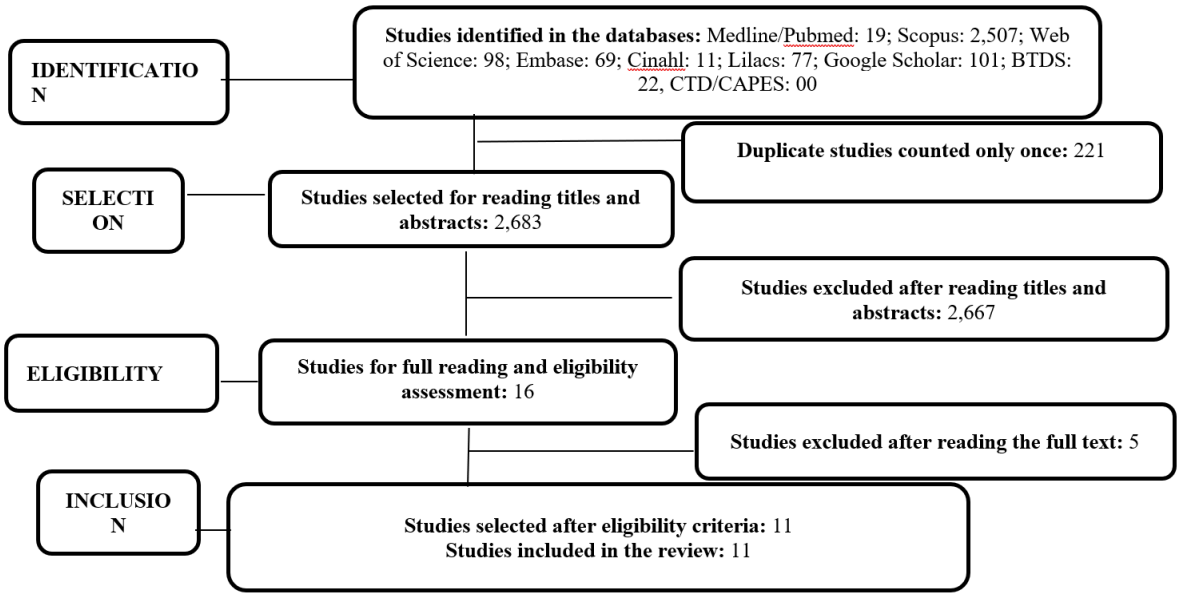
the sample. The entire screening and inclusion process was documented using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart[16].

Then, two reviewers extracted the data into a Microsoft Excel® spreadsheet. Information mapping was based on the JBI instrument for characterizing productions[11]. The following variables were extracted: authors, country, year, objective of the study, type of educational technology, type of insulin, health institution, health professionals who provide guidance and care to the target audience, and main results. Any doubts or disagreements were resolved with the participation of a third reviewer.

Finally, the results were discussed using thematic categories, descriptive tables, and/or graphs.

RESULTS

According to the application of the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)[16], which includes the search, exclusion, selection, and eligibility process of articles, as illustrated in figure 1, 2,904 studies were identified, of which 221 duplicates, in which the inclusion and exclusion criteria were applied, selecting 11 articles as a sample.



*PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses

Figure 1: Flowchart of search and selection of articles.

Regarding the characterization of the studies, the majority (n=4) were developed in Brazil, China (n=2), and Australia (n=2), followed by Italy, Spain, and the United States. The English language predominated in the studies (n=8), Spanish (n=1) and Portuguese (n=2) were also verified, and concerning the year of publication, the year 2022 stood out (n=3), also highlighting the years 2023 (n=1), 2020 (n=1), 2019 (n=2), 2018 (n=1), 2017 (n=1), 2015 (n=1) and 2013 (n =1).

As for journals, those in the area of Diabetes (n=3), as well as Nursing (n=4) and Medicine (n=4) were not exclusive. And about the study design, the randomized clinical trial stood out (n=4) (Box 2).

Below, the objectives, main outcomes, and educational technologies on insulin therapy of the selected studies are presented (Box 3).

Box 2. Characterization of articles included in the review. Teresina, state of Piauí, Brazil, 2023.

Number	Authors	Year	Country	Journal	Design/sample
01	Miranda et al.[17]	2022	Brazil	Primary Care Diabetes	Randomized Clinical Trial
02	Huang et al.[18]	2022	China	Journal of Clinical Nursing	Quasi-experimental trial
03	Bassi et al.[19]	2022	Italy	JMIR Human Factors	Proof-of-Concept Study
04	Bramwell et al.[20] 2020 Australia			European Journal of Cardiovascular Nursing	Pilot study
05	Menon et al.[21]	2019	Australia	Therapeutic Advances in Endocrinology and Metabolism	Study Protocol for a Randomized Clinical Trial
06	Song et al.[22]	2018	China	Diabetes Ther	Comparative study
07	Inoriza et al.[23]	2017	Spain	Atención Primaria	Prospective study
08	Levy et al.[24]	2015	United States	J Med Internet Res	Randomized Clinical Trial
09	Diehl et al.[25]	2013	Brazil	JMIR Research protocols	Randomized Clinical Trial
10	Cunha et al.[26]	2019	Brazil	Rev Esc Enfermagem USP	Cross-sectional, descriptive, and quantitative study
11	Ribeiro et al. [27]	2023	Brazil	Cogitare Enferm	Methodological study

Box 3. Objectives, main outcomes, and educational technologies identified in the studies according to mapping. Teresina, state of Piauí, Brazil, 2023.

(Continued)

Number	Objective	Main outcomes	Educational technology
01[17]	To investigate the effects of problematizing intervention in the treatment of individuals with type 2 diabetes mellitus.	The use of a problem-solving intervention provided an improvement in specific behavioral and clinical parameters compared to routine diabetes care. However, a longer follow-up period for these patients could bring benefits in terms of glycemic control.	Problem-solving educational intervention
02[18]	To evaluate the effectiveness of a nurse-led online education program in patients with diabetes mellitus treated with initial basal insulin therapy.	In total, 339 patients were included in the intervention group and 333 patients in the control group. According to the analysis, 3 months after the intervention, the fasting blood glucose (FBG) compliance rate (rate difference: 0.078, 95% CI: 0.006–1.150, $p < 0.05$), and HbA1c (%) (rate difference: 0.070, 95% CI: 0.001–0.137, $p < 0.05$) between the intervention and control groups were statistically significant; after 6 months of intervention, rates remained significant.	Online education program
03[19]	To evaluate the preliminary effectiveness of a visual coach intervention for psychosocial support before and after the intervention and at follow-up.	The results showed that over the 12 sessions, there were no significant changes before and after the intervention and during follow-up regarding psychosocial factors. However, most users showed a downward trend across the three time periods in symptoms of depression and anxiety, showing thus good psychological well-being and no emotional distress related to diabetes. Furthermore, users felt motivated, involved, encouraged, emotionally understood, and stimulated by Motibot during the interaction.	Motibot – virtual trainer

(Continued)

Number	Objective	Main outcomes	Educational technology
04[20]	To compare convenience, efficiency, and ease of use.	"We demonstrated high acceptance and clinical utility of the Health2Sync(H2S) application. Physicians were happy to use H2S and I found it easy and convenient for most patients". Importantly, this reduced frequency of contacts with patients, time per interaction and average time for titration ($p<0.01$). Patient selection for this communication intervention is important.	mHealth intervention – mobile app
05[21]	To examine the effects of REMODEL-IDA on glycemic control at 3 months in patients with DM2.	Given the potential benefits of mHealth in assisting patient self-management, this should lead to improved clinical outcomes as measured by Glycated Hemoglobin (HbA1c). Other potential benefits of this new model of care include improved efficiency in the delivery of healthcare services and patient and healthcare professional satisfaction.	Mobile application
06[22]	Entender a técnica de injeção de insulina na China por meio de exame direto e pesquisa detalhada	As canetas de insulina são usadas por 92% dos injetores de insulina chineses, com 3/4 usando agulhas de caneta de 4 ou 5 mm. Isso é consistente com os valores do IMC chinês (e, portanto, da espessura da gordura subcutânea) sendo mais baixos do que no resto do mundo (ROW), aumentando o risco de injeções intramusculares com agulhas mais longas. A dose diária total de insulina é 33 UI na China versus 45 UI em outros lugares. As taxas de lipohipertrofia (LH) são menores do que no ROW, mas ainda encontradas em pelo menos 25% dos pacientes chineses. Os pacientes aparentemente não percebem que têm LH ou desconhecem os perigos de injetar no LH, pois muitos deles o fazem, e aqueles que o fazem usam uma média de 11 UI a mais de insulina do que os pacientes sem LH.	Questionário de Técnica de Injeção (ITQ)
07[23]	To evaluate whether type 2 diabetic patients with insulin and self-control (DIA) included in an integrated diabetes mellitus (DM) management program with telematic monitoring achieve a better degree of metabolic control at 12 months than those not included.	Reduction of 0.38% in HbA1c in cases (95% CI: -0.89% to 0.12%). No significant differences in any of the recorded activities, nor significant changes in quality of life. The results obtained are similar to other equivalent studies. The patient's profile is elderly, with multiple morbidities, who still present technological limitations. To overcome these barriers, it would be necessary to dedicate more time to training and solving possible technological problems©.	Emminens and Conecta® Platform - Integrated care program with telemedicine support
08[24]	To evaluate whether our Mobile Insulin Titration Intervention (MITI) using text messaging and phone calls was effective in helping patients achieve their optimal insulin glargine dose at 12 weeks; evaluate the feasibility of the intervention in our clinical setting and patient population, collect data on cost savings associated with the intervention and measure patient satisfaction with the intervention.	A total of 61 patients consented and were randomized into the study. A significantly higher proportion of patients in the intervention group achieved their optimal insulin glargine dose than patients in the usual care group (88%, 29/33 vs 37%, 10/27; $P<0.001$). Patients responded to 84.3% (420/498) of SMS text messages requesting their blood glucose values. The nurse saw patients in 2 attempts or by voicemail 91% of the time (90/99 assigned calls). When patients traveled to the clinic, they spent an average of 45 minutes (IQR 30-60) traveling and 39 minutes (IQR 30-64) waiting before appointments. A total of 61% (37/61) of patients had visit co-payments. After participating in the study, patients in the intervention group reported higher satisfaction with treatment than those in the usual care group.	Mobile Insulin Titration Intervention (MITI)

(Conclusion)

Number	Objective	Main outcomes	Educational technology
09[25]	To evaluate the educational effectiveness of InsuOnline, a game for educating primary care physicians (PCPs).	The design and development of a game to educate PCPs about insulin is possible with a multidisciplinary team. InsuOnline may be an attractive option for large-scale continuing medical education to help improve PCPs' knowledge of insulin therapy and potentially improve care for patients with Diabetes Mellitus.	*InsuOnline* – game for education
10[26]	To analyze insulin therapy carried out by people with diabetes in Primary Health Care.	The sample consisted of 150 patients. The majority were female (66.7%), aged 50-85 years (79.3%), and there were illiterates (16.7%). Patients with type 2 diabetes (62.0%) with complications (42.7%) on oral hypoglycemic drugs and insulin were highlighted. Syringes/needles (83.1%), lancets (85.5%), reagent strips (91.0%), and insulin vials (93.8%) were stored incorrectly by the majority. In preparation, application, and transportation, the correct form predominated. Waste was incorrectly disposed of. In the general analysis of the stages of insulin therapy, the majority performed it inappropriately (93.3%). Sociodemographic and clinical variables did not influence insulin therapy, but in the intragroup analysis, there was a significant difference in incorrect performance in some groups.	Interview
11[27]	To build and validate education technology on insulin therapy for educational practices of health professionals.	Educational technology had a Content Validity Index of 0.91 and an Appearance Validity Index of 1.00. It was validated and can be used by primary care health professionals in health educational practices to promote teaching-learning about the use of insulin, benefiting the process of care and communication in health care.	Serial album

DISCUSSION

This review presented educational technologies addressing information about insulin therapy and highlighted the significance of improving glycemic control through the usability of these methods. In this approach, digital technologies have mostly stood out in the area of information dissemination, and this also applies to the aforementioned subject.

In most studies, the approach to this issue, when considering people with DM2 using insulin, highlights only adherence or non-adherence to treatment, aiming exclusively at glycemic control[17,18,21,23], compromising the importance of the insulin injection technique and its probable complications due to errors in the insulin therapy process.

Corroborating these findings, the results of a study show that, in the studied municipality, the performance of a significant portion of people with DM and/or family members responsible for insulin therapy at home is flawed concerning knowledge and practice of the storage process, preparation, administration, and disposal of waste. More than half of the participants got at least half of the knowledge questions wrong, and more than half made mistakes in at least a third of the aspects assessed in the simulation[28].

Another very important aspect that needs to be considered in the treatment of patients with DM2 is the psychological aspect[19], as according to a scientific study, the effectiveness of this mechanism varies according to the quality of adherence to it, considering that it results in a decrease in a considerable number of chronic or acute complications related to this condition, that is, psychosocial, cultural and economic aspects directly influence the quality of adherence[29].

Furthermore, through the search for studies, applications aimed at professionals, in this case, physicians[20,25], were selected to improve interaction with their respective patients when sending information pertinent to their insulin therapy treatment. Still, in this communication criterion to facilitate the follow-up of treatment for people with DM2, another study highlights how text messages[24] collaborate and add instant and personalized information with their functionality. In this context, another study points out that the use of language consistent with the recommendations for written communication is not enough; it states that knowledge alone is not capable of producing changes, especially in behavioral attitudes. It emphasizes that it is essential that the healthcare team encourages independence for the development of individual self-care[30].

Using technology as an ally in carrying out daily activities can be an important tool to improve this population's quality of life of this population[31].

Only one of the studies that address the insulin injection technique contains this content covering the steps for the safe use of insulin[27] through a demonstration with images related to the text. The others explain some errors that arise in the context of insulin therapy, such as lipodystrophies[22] and the incorrect storage of inputs and their disposal[26], which consequently harms the successful process of such procedures. Given this, a study with people with DM being followed up in PHC to analyze the stages of insulin therapy practice detected that the majority performed the stages inappropriately[32].

In view of the findings, the diversity of ET developed not only in Brazil but in other countries is notable; however, it is highlighted that more studies must be developed to improve the management of insulin therapy and guarantee the target audience alternatives when choosing their technology. The scarcity of studies is a limitation of this study.

CONCLUSION

Considering that educational technologies tend to be beneficial in people's health treatment since they are accessible and guarantee scientifically based knowledge in a clear and safe way, and highlighting that different types of educational technologies address the topic of insulin therapy, it is concluded that it is necessary to carry out more studies regarding the evaluation of effects and feasibility of using such technology in the context of insulin therapy.

The development of these technologies ensures that the user chooses the one that fits their profile, in addition to combining this care with consultation with the physician, nurse, and other professionals who will add to their health care strategies, in this case, insulin therapy.

The complexity of the insulin therapy process requires a cautious approach to educational technologies due to the need for changes in the lifestyle of people with type 2 Diabetes mellitus, including healthy eating, physical exercise, intake of hypoglycemic medications, if necessary, in addition to insulin injection.

REFERENCES

1. Salbego C, Nietsche EA, Teixeira E, Girardon-Perlini NMO, Wild CF, Ilha S. Care-educational technologies: an emerging concept of the praxis of nurses in a hospital context. Rev. Bras. Enferm. 2018; 71(Suppl 6): 2666-2674. Doi: http://dx.doi.org/10.1590/0034-7167-2017-0753.

2. Araújo KB, Ribeiro MNS, Diniz CX, Espírito Santo FH, Teixeira E. Tecnologias educacionais e sociais de prevenção à violência contra a pessoa idosa: revisão integrativa da literatura. Revista Kairós-Gerontologia 2020; 23(4):103-121. Doi: https://doi.org/10.23925/2176-901X.2020v23i4p103-121

3. Marques CR. Percepção dos usuários insulino dependentes não controlados quanto ao tratamento para o diabetes mellitus tipo 2. Rev. APS. 2017 jan/mar; 20 (1): 69- 80. Doi: https://doi.org/10.34019/1809-8363.2017.v20.15702.

4. International Diabetes Federation, Atlas de la Diabetes de la FID. [Internet] 2024 [cited 2024 fev. 27]. Available from: https://diabetesatlas.org/atlas/tenth-edition/.

5. American Diabetes Association. Standards of medical care in diabetes. Diabetes Care, v. 42(Suppl 1):S1-193, 2022.

6. Skyler JS, Bakris GL, Bonifacio E, Darsow T, Eckel RH, Groop L et al. Differentiation of Diabetes by Pathophysiology, Natural History, and Prognosis. Diabetes 2017;66:241–255
7. DOI: https://doi.org/10.2337/db16-0806

7. Brasil. Sociedade Brasileira de Diabetes. Diretrizes SBD 2019-2020. Oliveira JEP, Montenegro Junior RM, Vencio S. São Paulo: Editora Clannad; 2019

8. Gouveia BLA, Sousa MM, Almeida TCF, Sousa VAG, Oliveira, SHS. Crenças relacionadas ao uso de insulina em pessoas com Diabetes mellitus tipo 2. Rev. Bras. Enferm., 73(3), 2020. Doi: https://doi.org/10.1590/0034-7167-2019-0029

9. Fontenele MSM, Cunha GH da, Lopes MV de O, Siqueira LR, Lima MAC, Moreira LA. Development and evaluation of abooklet to promote healthy lifestyle in people with HIV. Rev Bras Enferm. [Internet]. 2021[cited 2024 fev. 27]. Disponível em: http://dx.doi.org/10.1590/0034-7167-2020-0113

10. Reis P dos, Marcon SS, Nass EMA, Arruda GO de, Back IR, Lino IGT, et al. Desempenho de pessoas com diabetes mellitus na insulinoterapia. Cogitare enferm. [Internet]. 2020 [acesso em 30 set 2023]; 25. Disponível em: http://dx.doi.org/10.5380/ce.v25i0.66006

11. Peters MDJ et al. Scoping reviews (2020 version). In: Aromataris E, Munn Z, editors. Joanna Briggs Institute manual for evidence synthesis. Adelaide: JBI; 2020.

12. Tricco AC. et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explantion. Annals of Internal Medicine, 2018;169(7)467–473. DOI: https://doi.org/10.7326/M18-0850

13. Arksey H, O'malley L. Scoping studies: towards a methodological framework. International Journal of Social Research Methodology, 2005; 8 (1)19–32.

14. Araújo WC. O. Recuperação da informação em saúde. ConCI: Convergências em Ciência da Informação, 2020; 3(2)100–134. https://doi.org/10.33467/conci.v3i2.13447

15. Ouzzani, M. et al. Rayyan—a web and mobile app for systematic reviews. Systematic Reviews, 2016; 5(1)210. https://doi.org/10.1186/s13643-016-0384-4

16. Page MJ, Moher D, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. PRISMA 2020 explanation and elaboration: updated guidance and exemplars for reporting systematic reviews. BMJ 2021;372(71). https://doi.org/10.1136/bmj.n71

17.Miranda LSP, Ezequiel DGA, Vanelli CP, Colugnati FAB, Ferreira M, Moreira RO, Silva MR, Corrêa JOA. Impact of an educational intervention in the management of individuals with uncontrolled type 2 diabetes mellitus using insulin therapy. Primary Care Diabetes 16 (2022) 496–501. https://doi.org/10.1016/j.pcd.2022.01.006

18.Huang W, Wei Wei RN, Wang J. Effectiveness of a nurse-led online educational programme based on basic insulin therapy in patients with diabetes mellitus: A quasi-experimental trial. J Clin Nurs. 2022;31:2227–2239. https://doi.org/10.1111/jocn.16041

19.Bassi G, Giuliano C, Perinelli A, Forti S, Gabrielli S, Salcuni S. A Virtual Coach

(Motibot) for Supporting Healthy Coping Strategies Among Adults With Diabetes: Proof-of-Concept Study. JMIR Hum Factors 2022;9(1):e32211). doi: https://doi.org/10.2196/32211

20.Bramwell SE, Meyerowitz-Katz G, Ferguson C, Jayaballa R, McLean M, Maberly G. The effect of an mHealth intervention for titration of insulin for type 2 diabetes: A pilot study. European Journal of Cardiovascular Nursing 2020;19(5):386–392. https://doi.org/10.1177/1474515119889764

21.Menon A, Gray L, Fatehi F, Bird D, Darssan D, Karunanithi M, Russell A. Mobile-based insulin dose adjustment for type 2 diabetes in community and rural populations: study protocol for a pilot randomized controlled trial. Ther Adv Endocrinol Metab. 2019;10(1):1-9. https://doi.org/10.1177/2042018819836647

22.Song Z, Guo X, Ji L, Huang X, Hirsch LJ, Strauss KW. Insulin Injection Technique in China Compared with the Rest of the World. Diabetes Ther (2018);9:2357–2368. Disponível em: https://doi.org/10.1007/s13300-018-0525-y

23.Inoriza JM, Ibanez A, Pérez-Berruezo X, Inoriza-Nadal C, Coderch J. Diabetes Ther (2018) 9:2357–2368. Disponível em: https://doi.org/10.1007/s13300-018-0525-y.

24.Levy N, Moynihan V, Nilo A, Singer K, Bernik LS, Etiebet M, Fang Y, Cho J, Natarajan S. The Mobile Insulin Titration Intervention (MITI) for Insulin Adjustment in an Urban, Low-Income Population: Randomized Controlled Trial. J Med Internet Res 2015;17(7):e180. https://doi.org/10.2196/jmir.4716

25.Diehl LA, Souza RM, Alves JB, Gordan PA, Esteves RZ, Jorge MLSG, Coelho ICMC. InsuOnline, a Serious Game to Teach Insulin Therapy to Primary Care Physicians: Design of the Game and a Randomized Controlled Trial for Educational Validation. JMIR Res Protoc 2013;2(1):e5. Doi: https://doi.org/10.2196/resprot.2431.

26.Cunha GH, Fontenele MSM, Siqueira LR, Lima MAC, Gomes MEC, Ramalho AKL. Insulin therapy practice performed by people with diabetes in Primary Healthcare. Rev Esc Enferm USP. 2020;54:e03620. Disponível em: https://doi.org/10.1590/S1980-220X2019002903620

27. Ribeiro ASR, Silva JG, Ferreira CRS, Pena JL da C, Santos KC, Pena LDS, et al. Construction and validation of educacional technology on insulin therapy: methodological study. Cogitare Enferm. [Internet]. 2023 [cited 12, feb 2023]; 28. Disponível em: https://dx.doi.org/10.1590/ce.v28i0.89207

28. Reis P dos, Marcon SS, Nass EMA, Arruda GO de, Back IR, Lino IGT, et al. Desempenho de pessoas com diabetes mellitus na insulinoterapia. Cogitare enferm. [Internet]. 2020 [acesso em 12, fev 2023]; 25. Disponível em: http://dx.doi.org/10.5380/ce.v25i0.66006.

29. Lim A, Song Y. The role of psychological insulin resistance in diabetes self-care management. Nurs Open. 2020;7(3): 887-894. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7113521/.

30.Sena, J.F.de. Construção e validação de tecnologia educativa para o cuidado de pessoas com estomia intestinal. 2017. 104f. Dissertação (Mestrado em Enfermagem) - Centro de Ciências da Saúde, Universidade Federal do Rio Grande do Norte, Natal, 2017. Disponível em: Acesso em: 12 maio 2019.

31. Oliveira OS, Garcia RC, Oliveira DN, Batista DM, Silva GV, Bertolini SMMG. Inclusão tecnológica: efeitos na saúde mental e qualidade de vida de idosos. Saud Pesq. 2023;16(1):e-10988. Doi: https://doi.org/10.17765/2176-9206.2023v16n1.e10988

32. Cunha GH da, Fontenele MSM, Siqueira LR, Lima MAC, Gomes MEC, Ramalho AKL. Insulin therapy practice performed by people with diabetes in Primary Healthcare. Rev Esc Enferm USP. [Internet]. 2020 [cited 2023 fev. 11];54:e03620. Disponível em: http://dx.doi.org/10.1590/S1980-220X2019002903620.

Received: 25 jan. 2024
Accepted: 29 feb. 2024