ORIGINAL ARTICLE

REVISTA ENFERMAGEM ATUAL IN DERME

TECHNOLOGIES FOR PROMOTING SELF-CARE IN YOUNG PEOPLE WITH TYPE I DIABETES MELLITUS: A SCOPE REVIEW

TECNOLOGÍAS PARA PROMOVER EL AUTOCUIDADO EN JÓVENES CON DIABETES MELLITUS TIPO I: UNA REVISIÓN DE ALCANCE

TECNOLOGIAS PARA A PROMOÇÃO DO AUTOCUIDADO EM JOVENS COM DIABETES MELLITUS TIPO I: UMA REVISÃO DE ESCOPO

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Submission: 03-03-2025
Approval: 15-08-2025

ABSTRACT
OBJECTIVE: to map the technologies used to promote self-care in young people with type I Diabetes Mellitus (T1DM). **METHODS:** This is a scoping review, as proposed by the Joanna Briggs Institute, based on the following guiding question: "What technologies are used to promote self-care in young people with type I Diabetes Mellitus?". The search was conducted in the following databases: Latin American and Caribbean Literature on Health Sciences (LILACS); Pubmed/Medline, Embase, Virtual Library on Health Nursing (BDENF), and Scientific Electronic Library Online (SCIELO). The Rayaan software was used to select the articles. The sample consisted of ten articles. **RESULTS AND DISCUSSIONS:** Data analysis identified four main categories: (1) Validation of innovative technologies, which demonstrated a positive impact on glycemic control and insulin acceptance; (2) Use of educational tools, such as social networks and interactive games, to aid in learning about the disease; (3) Interactive games and gamification, which make the management of DM1 more attractive and accessible; and (4) Support network, highlighting the importance of family and professional participation in supporting young people with DM. **FINAL CONSIDERATIONS:** Technologies, such as apps and educational activities, are essential for the self-care of young people with DM1, facilitating adherence to treatment. However, there are still challenges in managing the disease, highlighting the need for new research to develop innovative tools that improve the support and autonomy of these patients.
Keywords: Young People; Technology; Type I Diabetes Mellitus.

RESUMEN
OBJETIVO: mapear las tecnologías utilizadas para promover el autocuidado en jóvenes con Diabetes Mellitus Tipo I (DM1). **MÉTODOS:** Se trata de una revisión de alcance, según lo propuesto por el Instituto Joanna Briggs, basada en la siguiente pregunta guía: "¿Qué tecnologías se utilizan para promover el autocuidado en jóvenes con diabetes mellitus tipo I?" La búsqueda se realizó en las bases de datos Literatura Latinoamericana y del Caribe en Ciencias de la Salud (LILACS); Pubmed/Medline, Embase, Biblioteca Virtual en Enfermería y Salud (BDENF), Biblioteca Electrónica Científica en Línea (SCIELO). Para la selección de artículos se utilizó el software Rayaan. La muestra estuvo compuesta por diez artículos. **RESULTADOS Y DISCUSIONES:** El análisis de datos identificó cuatro categorías principales: (1) Validación de tecnologías innovadoras, que demostraron un impacto positivo en el control glucémico y la aceptación de la insulina; (2) Utilización de herramientas educativas, como redes sociales y juegos interactivos, que ayuden al conocimiento de la enfermedad; (3) Juegos interactivos y gamificación, que hacen más atractiva y accesible la gestión del DM1; y (4) Red de apoyo, destacando la importancia de la participación familiar y profesional en el apoyo a los jóvenes con DM. **CONSIDERACIONES FINALES:** Las tecnologías, como aplicaciones y acciones educativas, son esenciales para el autocuidado de los jóvenes con DM1, facilitando la adherencia al tratamiento. Sin embargo, aún existen desafíos en el manejo de la enfermedad, lo que pone de relieve la necesidad de más investigaciones para desarrollar herramientas innovadoras que mejoren el apoyo y la autonomía de estos pacientes.
Palabra clave: Jóvenes; Tecnología; Diabetes Mellitus.

RESUMO
OBJETIVO: mapear as tecnologias utilizadas para a promoção do autocuidado em jovens com Diabetes Mellitus tipo I (DM1). **MÉTODOS:** Trata-se de uma revisão de escopo, conforme a proposta do Joanna Briggs Institute, com base na seguinte questão norteadora: "Quais as tecnologias utilizadas para a promoção do autocuidado em jovens com Diabetes Mellitus tipo I?". A busca foi realizada nas bases de dados Literatura Latino-americana e do Caribe em Ciências da Saúde (LILACS); Pubmed/Medline, Embase, Biblioteca Virtual em Saúde Enfermagem (BDENF), Scientific Electronic Library Online (SCIELO). Para a seleção dos artigos, foi utilizado o software Rayaan. A amostra foi composta por dez artigos. **RESULTADOS E DISCUSSÕES:** A análise dos dados identificou quatro categorias principais: (1) Validação de tecnologias inovadoras, que demonstraram impacto positivo no controle glicêmico e na aceitação da insulina; (2) Uso de ferramentas educativas, como redes sociais e jogos interativos, auxiliando no aprendizado sobre a doença; (3) Jogos interativos e gamificação, que tornam o gerenciamento do DM1 mais atrativo e acessível; e (4) Rede de apoio, ressaltando a importância da participação familiar e profissional no suporte aos jovens com DM. **CONSIDERAÇÕES FINAIS:** As tecnologias, como aplicativos e ações educativas, são essenciais para o autocuidado de jovens com DM1, facilitando a adesão ao tratamento. No entanto, ainda há desafios no gerenciamento da doença, destacando a necessidade de novas pesquisas para desenvolver ferramentas inovadoras que aprimorem o suporte e a autonomia desses pacientes.
Palavra chave: Jovens; Tecnologia; Diabetes Mellitus Tipo I.

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INTRODUCTION

Diabetes Mellitus (DM) can be defined as a spectrum of metabolic disorders of diverse etiologies, defined by chronic hyperglycemia due to reduced tissue sensitivity to insulin action and/or lack of insulin secretion. It is considered a difficult-to-control chronic disease characterized by elevated serum glucose levels (hyperglycemia).

DM is classified as Type 1 Diabetes Mellitus (T1DM), which refers to insulin deficiency due to autoimmune destruction of beta cells detected by laboratory tests (type 1a) or idiopathic insulin deficiency (type 1b); Type 2 Diabetes Mellitus (T2DM), which corresponds to progressive loss of insulin combined with insulin resistance; gestational diabetes, which is hyperglycemia diagnosed during pregnancy in the absence of previous diabetes criteria; and other types of diabetes (monogenic MODY, neonatal diabetes, diabetes secondary to endocrine disorders, exocrine pancreatic disorders, isolated diabetes, and medications). A study shows that the prevalence of DM1 is increasing among people with diabetes, even though it is not as common as DM2, accounting for only 10% of all DM cases. However, it is most frequently diagnosed in children and adolescents[3]. An estimated 127,200 children and adolescents under the age of 20 have been diagnosed with DM1 in South and Central America, with approximately 75% of these children and adolescents residing in Brazil, resulting in the country ranking third globally for the incidence and prevalence of DM1 in the under-20 age group[3].

Furthermore, it is estimated that only 10% of the global population with DM has effective blood glucose control.4 In this context, it is essential to emphasize that when DM is not satisfactorily controlled, there is a high risk of developing various complications such as retinopathy, nephropathy, heart disease, among others. In the micro and macrovascular context, it increases vulnerability to infections[4]. Meanwhile, it is noteworthy that Brazil has the fourth highest mortality rate due to DM complications in the world, making it a public health problem. Furthermore, it is known that such complications cause harm to various aspects of an individual's health[5].

DM complications, such as stroke, neuropathy, nephropathy, and retinopathy, have been shown to be directly related to a poorer health-related Quality of Life (QoL)[4]. Thus, complications resulting from poor glycemic control can negatively affect QoL, generating significant physical and emotional impacts, culminating in reduced autonomy and self-confidence, altering their self-perception, and leading to feelings of inability to achieve their goals. 6 Furthermore, they can affect adherence to DM treatment and management.

Based on the above, it is evident that DM constitutes a complex metabolic

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syndrome that requires comprehensive care, and especially empowerment, strengthening of self-management of care, from the perspective of self-care so that it becomes effective interventions, actions and care based on clinical knowledge and scientific judgment in the promotion, protection, recovery and rehabilitation of health for patients with DM[7].

Meanwhile, health education stands out as an important tool for glycemic control and promoting self-care. One study found that diabetes education significantly reduced glycated hemoglobin in patients with T2DM, indicating better glycemic control[8]. Furthermore, diabetes education also improved treatment adherence and increased knowledge about the disease and its potential complications, consequently improving daily self-care[8].

Therefore, various technological tools can be used for this purpose, including the use of technology through easily accessible apps to empower adolescents with DM, given their greater familiarity with technology, and their families, enabling access to reliable, evidence-based, and easily understood information.

Therefore, this study aims to map the technologies used to promote self-care in young people with type 1 diabetes mellitus.

METHODOLOGY

This is a scoping review study, as proposed by the Joanna Briggs Institute. 9 The research question was constructed using the PCC strategy, which represents a mnemonic for Population, Concept, and Context, defined as follows: P = Young People, C = Technologies, and C = Self-Care in Type I Diabetes Mellitus. The following guiding question was established to search for and select studies: "What technologies are used to promote self-care in young people with Type I Diabetes Mellitus?"

Table 1 - PCC strategy used for study, Fortaleza, Ceará, 2025.

	Acromion		
	P (Population)	**C (Concept)**	**C (Context)**
Extraction	Young	Technologies	Self-care in Type I Diabetes Mellitus
Conversion	(Young Adult OR Adolescent)	Technology	Self Care AND Diabetes Mellitus, Type 1
Combination	Young Adult Young Adolescent	Technology Information Technology	Self Care AND Diabetes Mellitus, Type 1
Construction	(“Young Adult” OR Young OR Adolescent)	(Technology OR “Information Technology”)	“Self Care” AND “Diabetes Mellitus, Type 1”

Use	(“Young Adult” OR Young OR Adolescent) AND (Technology OR “Information Technology”) AND “Self Care” AND “Diabetes Mellitus, Type 1”

The search was conducted from May to June 2024 in the databases Latin American and Caribbean Literature in Health Sciences (LILACS); Pubmed/Medline, Embase, Virtual Library in Nursing Health (BDENF), and Scientific Electronic Library Online (SCIELO). The search strategy used in the databases was incorporated according to the Health Sciences Descriptors (DeCS/MESH), along with the Boolean operators AND and OR.

Inclusion criteria included papers that included the terms "Technology and Self-Care" and "Type I Diabetes Mellitus," filtering articles published between 2019 and 2024, with publications in the last 5 years. Articles focusing on self-care for adult diabetes mellitus, repeatedly indexed articles, letters to the editor, abstracts in conference proceedings, incomplete articles, and studies in the project phase were excluded.

For article selection, the Rayaan software was used, which assists in the eligibility control of articles. The first stage consisted of reading the title and abstract of pre-selected articles. In this stage, the authors used double-blind review to minimize conflicts of interest. A third reviewer was added to decide which articles would be selected for the data extraction stage. Next, the papers were read in full, and after applying the inclusion criteria, the final number of articles was reached, totaling [9]. Once the articles were selected, data extraction and coding of the selected articles was performed according to title, study type, objective, results, and author/year.

The data analysis was performed using the R Interface for Multidimensional Analysis of Texts and Questionnaires (IRaMuTeQ) software[10]. This enabled statistical analysis of the textual corpus to identify the main information and discourses highlighted in the results of the included studies. Similarity analyses were performed to identify common keywords associated with the concept of young people with type 1 diabetes mellitus, based on the findings.

The search formula used consisted of the following Health Descriptors (HMDs) and a Boolean operator: Technologies and self-care and Type 1 Diabetes Mellitus. The texts were complete and in Portuguese, English, and Spanish. Initially, 590 articles were found, but 41 were removed before screening for duplicates. After applying filters that identified those that did not answer the question and reading them in full, nine articles remained for inclusion in the review.

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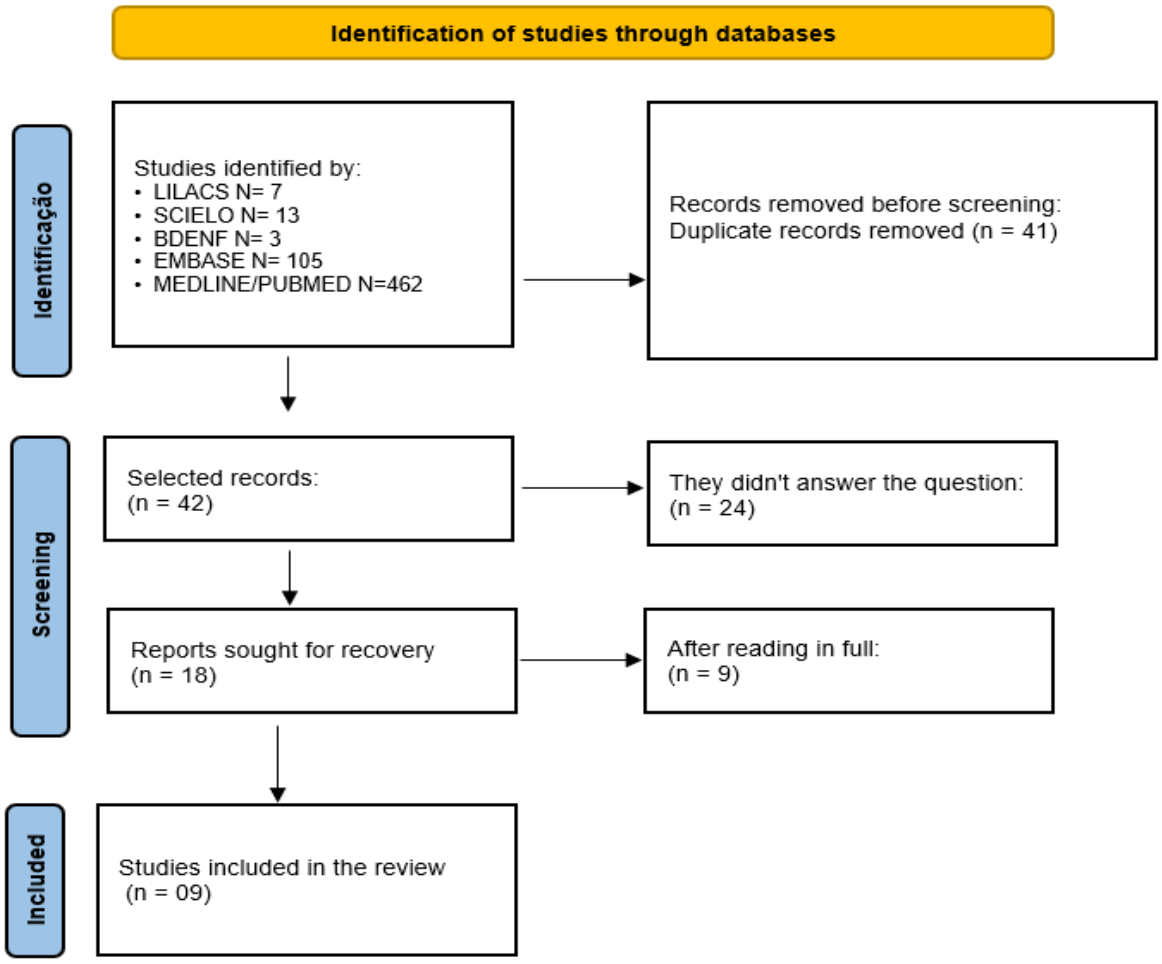
RESULTS AND DISCUSSIONS

Figure 1 - Flow diagram showing inclusion and exclusion strategies.



Source: Own authorship, 2024.

The study characteristics are described in Table 1 with the following information in Table 2: Title, type of study, objective, results, and authors with year of publication described to help answer this research question.

Table 2 - Characteristics of the reviewed studies, Fortaleza, Ceará, 2025.

Title	Type of study	Aim	Results	Authors (year)
Validation of the content of the comic strip "I have diabetes, what now?"[11]	Methodological study	Analyze the content validity evidence of the comic strip "I have diabetes, what now?"	In the family's validation, they affirmed that it was appropriate to promote the use of technology in other health services, agreeing to present the relevance of the indicators, the clarity contained in their statements, and that the topic addressed	Solaine da Silva Araújo; Geovanna Meira Maconi; Sâmia Letícia Moraes de Sá; Flávia Avancini Ferreira; Lara Mabelle Milfont Boeckmann;

			is representative. The comic strip presents a logical sequence, contributes to health education regarding the child's treatment, and facilitates understanding.	Luz Marina Alfonso Dutra; Manuela Costa Melo (2023/24)
"Descomplica, Dona Bete": Development of an Application for the Prevention of Acute Complications of Diabetes Mellitus[12]	Descriptive and exploratory study	Build an application for health education for people with Diabetes Mellitus on preventing acute complications of the disease	Educational activities are the best way to raise awareness among young people with DM about the importance of self-care. When these activities are conducted in groups, the benefits can be enhanced, as they allow for the exchange of experiences, the reformulation of concepts, and the production of new knowledge.	loisa Melo da Silva; Francineide Pereira da Silva Pena; Álefe Mateus Sena Guimarães; Mércia Gabrielle Bruno Bastos; José Luis da Cunha Pena; Érika Tatiane Fernandes de Almeida Rodrigues; Elizabeth Teixeira; Camila Rodrigues Barbosa Nemer; (2020).
Perspective of young people with diabetes on educational intervention on the social network Facebook®[13]	Methodological study	To understand the perspectives of young people with diabetes mellitus regarding participation in a self-care group on social media. Facebook®	Adolescents with T1D face several barriers, including self-care, which includes healthy eating; regular physical activity (at least 20 minutes a day); frequent insulin injections; and blood glucose monitoring (at least five times a day). In addition to immaturity and barriers to self-care, hormonal changes can also make achieving blood glucose control even more challenging during adolescence.	Evelin Matilde Arcain Nass; Sonia Silva Marcon; Elen Ferraz Teston; Pamela dos Reis; Hellen Emília Peruzzo; Lorenna Viccentine Coutinho Monteschio; Aline Gabriela Bega; Maria do Carmo Fernandez Lourenço Haddad; (2019).
Development, validation and adaptation of a protocol for an application in type 1 diabetes[14]	Methodological study	Develop, validate content, and culturally adapt the AGITO protocol for self-care in type 1 diabetes	It's worth noting that the virtual world represents the challenges faced by adolescents with DM1, but that in their daily lives, they must face and overcome them with the support of social networks, including family and healthcare professionals. The serious game also features audio alerts, such as an alarm clock when waking up and voice-over commands, so that players can understand the rules and how to operate. Music was included to motivate Didi when performing physical activities, such as cycling and skateboarding, allowing players to simulate the real world.	Fernanda Figueredo Chaves; Emerson Cabrera Paraíso; Adriana Silvina Pagano; Ilka Afonso Reis; Ivani Novato Silva; Heloísa Carvalho Torres; (2020).
Development of serious games for adolescents with type 1 diabetes mellitus[15]	Methodological study	Building serious educational games for adolescents with type 1 diabetes mellitus	By effectively engaging with adolescents with diabetes, understanding their needs, and educating them on how to take care of their health, you empower them to choose healthy lifestyle habits, given their chronic condition. In this way, they become responsible for their health. However, this responsibility is a process that affects all adolescents, ensuring the maintenance of healthy lifestyles (universal self-care); however, for adolescents with T1D, this responsibility should focus on self-care.	Andréia Régia Rodrigues de Matos Serafim; Amanda Newle Sousa Silva; Caroline Magalhães de Alcântara; Maria Veraci Oliveira Queiroz; (2019).
Development	Methodological	To develop and	Therapeutic play, from this perspective,	Larissa de Fátima Pontes

and validation of a MHEALTH technology to promote self-care for adolescents with diabetes[16]	cal study	validate a mobile application (APP) to promote self-care in adolescents with DM1	is an essential communication tool for nursing professionals, as it allows them to understand the reality experienced by children and provides a playful way to teach and adapt blood glucose monitoring and control practices, in addition to encouraging coping with the disease. This tool also provides an opportunity to clarify doubts and curiosities, minimizing fears and assimilating the inevitability of performing these procedures.	Aguiar Alves; Manoel Miqueias Maia; Márcio Flávio Moura de Araújo; Marta Maria Coelho Damasceno; Roberto Wagner Júnior Freire de Freitas; (2021).
Therapeutic toy for children with type I diabetes mellitus: home interventions[17]	Methodological study	To describe the use of therapeutic toys in the home care of children with type 1 Diabetes Mellitus.	Video games can include tasks that help players overcome treatment barriers or even make them easier. Injecting insulin into a dummy to overcome the fear of handling syringes and needles is one example. Older children may respond better to cognitive behavioral therapies, which include relaxation, training, guided imagery, behavioral rehearsal, and reinforcement. Relaxation techniques can be organized by a significant other and promote relief from pain, distress, anxiety, and stress, making them feel more confident in their ability to perform a given activity.	Letícia Roberta Pedrinho; Bianca Machado Cruz Shibukawa; Gabrieli Patricio Rissi; Roberta Tognollo Borota; Maria de Fátima Garcia Lopes Merino; Ieda Harumi Higarashi; (2021).
Conceptual framework for developing video games for children with type 1 diabetes mellitus[18]	Methodological study	Present a conceptual theoretical framework for the development of video games for children with type 1 diabetes mellitus.	In this context of growing DM, diabetes education is the primary tool for ensuring self-care, enabling patients to self-manage, and should extend to family members and caregivers. Furthermore, family support is central to diabetes management. Diabetes education's basic principles include developing the seven behaviors of diabetes self-care: eating healthily; exercising; monitoring levels; taking medications; problem-solving; reducing risks; and adapting healthily.	Valéria de Cássia Sparapani; Sidney Fels; Noreen Kamal; Lucila Castanheira Nascimento; (2019).
Mobile Application Features for Self-Care and Self-Management of Type I Diabetes Mellitus: An Integrative Review[19]	Integrative review	Identify the resources available in mobile applications that promote self-care and self-management of type 1 diabetes mellitus.	The use of an app that assists with self-care and management of AMD has achieved high satisfaction rates among its users and medical staff, resulting in a positive impact on glycemic control. Furthermore, a study reveals that users' confidence in using the apps resulted in a positive subjective evaluation of their use. Another study emphasizes that carbohydrate counters, blood glucose levels, and physical activity tracking are the most commonly preferred app features among people living with AMD.	Maira Scaratti; Carla Argenta; William Xavier de Almeida; Elisangela Argenta Zanatta; (2021).

Source: Own Authorship, 2024.

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DISCUSSION

The studies selected for the scoping review, although they have different objectives, converge on the conclusion that technologies are important tools in encouraging self-care among young people with type 1 diabetes mellitus. These studies present numerous technologies used for this purpose, including Facebook[13], mobile applications[12,16,19], serious games[14,15], video games[17,18], and comic books[11]. The analyses of the articles highlight the importance of using technologies to understand the disease as an essential means of fostering self-care.

Thus, given the results found in the identified articles, the importance of technologies in self-care and self-management of young people in the treatment, monitoring, and questions about diabetes mellitus was observed, through interactive games[14,15], which improve the interaction between young people and the disease. Therefore, a support network is a fundamental element during this technological process.

Therefore, the importance of technologies as self-management strategies for chronic diseases for young people with Diabetes Mellitus is highlighted, with the use of educational tools such as Facebook, groups, video games, serious games, and other innovations for better monitoring and even overcoming treatment acceptance.

However, it is important to consider that despite the significant increase in information disseminated online through various websites and social networks such as WhatsApp, Facebook, Instagram, Twitter, and others, not everything published is true. Therefore, it is important to be cautious, especially with fake news[20].

Therefore, the importance of innovative technologies to present truthful information is emphasized, with the development and validation of innovative technologies as alternatives for improving adherence among these young people. Studies[17,19] have shown that the use of these therapeutic approaches has diverse results in glycemic control and even in insulin acceptance.

The use of validated educational technologies provides a greater degree of reliability to the teaching-learning process, strengthens communication in healthcare, revalidates the reliability of the guidelines presented, and enhances the coherence of the information in meeting the proposed objective, thus serving as a mediator in the relationship between the target audience and healthcare professionals[21].

Therefore, the objective of educational technologies in healthcare is justified as facilitating instruments in the teaching-learning process. Therefore, strategies are needed to ensure that information about the types of healthcare actions disseminated through digital channels accessed by the population is truthful. This is not limited to its content; the reliability of the sources must also be verified[22]. In this

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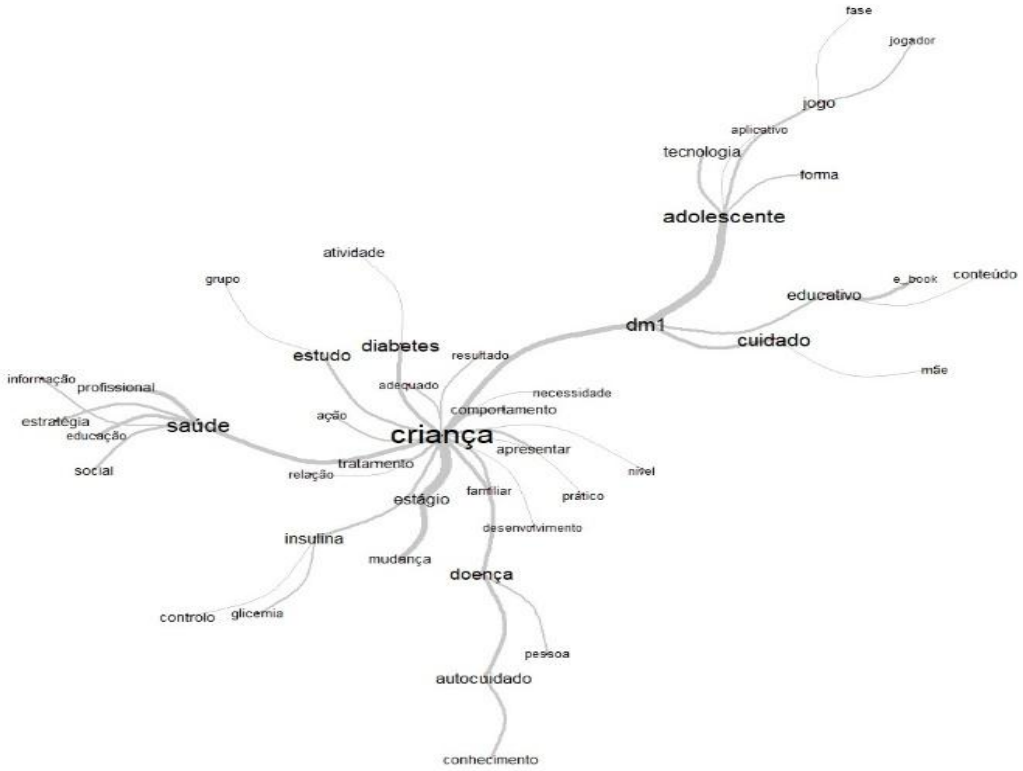
context, the role of nurses in primary care education in Brazil stands out[22].

Therefore, it is necessary to evaluate the various aspects involved. Therefore, a similarity analysis was performed according to iRAMUTEQ, which is based on graph theory. This allows for the identification of occurrences between words and their resulting indications of connectivity, thus aiding in the identification of the representation structure. [23]

From the graphic representation in Figure 1, it can be seen that a semantic range of the most frequent words occurred: Child, Health, Adolescent, DM1, and Care, as shown below.

Figure 1 - Analysis of similarity between words, Fortaleza- Ceará. 2024.



Source: Own authorship, 2024.

After a generic analysis of the similarity tree, using the IRAMUTEQ software, it can be concluded that the word "Child" has the highest centrality and strong connectivity with the words "health," "disease," and "DM1," which appear to structure the tree at other poles.

The term "Child" appears with the highest centrality in the maximum similarity tree, as illustrated in its excerpt in Figure 3, establishing connections with other words in dimensions such as family, behavior, treatment, change, and appropriate.

The word "Health," which structures the similarity tree at another pole, presents high connectivity with the term "child" and links to the terms "professional," "information,"

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"strategy," "education," and "social." This configuration highlights the importance of healthcare professionals through access to information and education in practice, ensuring the therapeutic success of young people through access to information on prescriptive norms and rules of conduct, regardless of the child's context.

The term "dm1," which refers to Type I Diabetes Mellitus, constitutes the third pole of the similarity tree, strongly connected to the central term "child" and other less closely related terms such as "care," "educational," "e-book," and "hand." The word "dm1" structuring one of the poles of the similarity tree refers to its significance and importance in the context of mother-child care and the relevance of using educational methods in the treatment of DM1. The term "Teenager," which is linked to the "dm1" cluster, highlights the importance of using technology to monitor and uncover new information regarding self-care, using interactive games to better serve adolescents.

Finally, a word cloud (Figure 2) was generated to more easily identify which words stand out in the corpus under analysis, allowing for a better understanding of the context of self-care for young people with type 1 diabetes mellitus. The word cloud method also grouped and organized words graphically based on their frequency, enabling quick identification of keywords in the textual corpus and simple lexical analysis.

Below is the word cloud generated by IRAMUTEQ. In the word cloud, the terms with the highest frequency and importance within the corpus are closer to the center and larger. Thus, we can conclude that educational technologies are being used in the health care of children and adolescents with type 1 diabetes mellitus.

Figure 2 - Word cloud, Fortaleza, Ceará, 2024.

Source: Own authorship, 2024.

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The context of children and adolescents is clearly marked by the emphasis on self-care and the process of insulin management through behavioral changes. The importance of using educational technologies in glycemic control was also highlighted, through strategies such as apps addressing knowledge levels and interactive games.

FINAL CONSIDERATIONS

The results of this study demonstrate the importance of using technologies to encourage self-care through apps and educational initiatives, which were well-received by young people with type 1 diabetes mellitus. These results also indicate that the use of these tools can constitute an important strategy for health services to engage with young people, especially those with chronic conditions, helping them clarify doubts, adhere to treatment correctly, and, consequently, manage the disease.

However, despite the relevance of this topic, various forms of treatment, monitoring, and self-care management are evident, especially among young people. This reinforces the need for further research, especially new educational technologies that incorporate the resources discussed here as important tools for self-care and self-management of type 1 diabetes mellitus.

We suggest that further research in the areas of technology and nursing be conducted, further developed, and disseminated. Thus, this scoping review may support other studies with a view to obtaining elements for the development of technological tools for self-care in young people living with IMD.

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Declaration of Conflict of Interest

Nothing to declare

Funding
The research received no funding.

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Substantial contribution to the conception and/or planning of the study; data collection, analysis, and/or interpretation; and drafting and/or critical review and final approval of the published version.

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