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Original article

Game guide "alphabet of pediatric foot care" for diabetes educators*

Guia do jogo "alfabeto dos cuidados com os pés de crianças" para educadores em diabetes

Guía del juego "alfabeto del cuidado de los pies de los niños" para educadores en diabetes

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Abstract

Objective: to build the guide for the educational game "alphabet for pediatric foot care" for diabetes educators. **Method:** development study focused on technological innovation, conducted in two phases: knowledge synthesis and guide production. **Results:** the first phase yielded three foot-assessment dimensions: hygiene and care, anatomy, and neuromotor and sensory. In the second, the game guide was produced with pre-textual elements, text with seven sections (what is type 1 diabetes mellitus? what is diabetic foot? what does the alphabet game for foot care entail – from A to Z? materials for game implementation, game implementation strategies – step by step, rationale, creating the game), and post-textual elements. **Conclusion:** producing the guide grounded in knowledge synthesis proved a successful strategy for developing educational-material products, with potential to enhance diabetes educators' work processes.
Descriptors: Educational Technology; Diabetes Mellitus, Type 1; Diabetic Foot; Health Education; Child

Resumo

Objetivo: construir o guia do jogo educativo "alfabeto dos cuidados com os pés de crianças" para educadores em diabete. **Método:** estudo de desenvolvimento de inovação tecnológica, realizado em duas fases: síntese do conhecimento e produção do guia. **Resultados:** da primeira fase emergiram três dimensões de avaliação dos pés: higiene e cuidados, anatomia e, neuromotora e sensitiva. Na segunda, produziu-se o guia do jogo com elementos pré-textuais, texto com sete sessões (o que é diabetes mellitus tipo 1? o que é pé diabético? em que consiste o jogo alfabeto do cuidado com os pés – de A a Z? materiais para a aplicação do jogo, estratégias de aplicação do jogo – passo a passo, fundamentação, criando o jogo), e elementos pós textuais. **Conclusão:** a

produção do guia baseada na síntese do conhecimento revelou-se estratégia exitosa no desenvolvimento de produtos do tipo material didático, podendo qualificar o processo de trabalho de educadores em diabetes.
Descritores: Tecnologia Educacional; Diabetes Mellitus Tipo 1; Pé Diabético; Educação em Saúde; Criança

Resumen

Objetivo: elaborar la guía del juego educativo «alfabeto del cuidado de los pies de los niños» para educadores en diabetes. **Método:** estudio de desarrollo de innovación tecnológica, realizado en dos etapas: síntesis del conocimiento y elaboración de la guía. **Resultados:** de la primera etapa surgieron tres dimensiones de evaluación de los pies: higiene y cuidados, anatomía y neuromotora y sensitiva. En la segunda, se elaboró la guía del juego con elementos pretextuales, texto con siete sesiones (¿qué es la diabetes mellitus tipo 1? ¿qué es el pie diabético? ¿en qué consiste el juego? En la segunda, se elaboró la guía del juego con elementos pretextuales, un texto con siete secciones (¿qué es la diabetes mellitus tipo 1? ¿qué es el pie diabético? ¿en qué consiste el juego del alfabeto del cuidado de los pies, de la A a la Z? materiales para la aplicación del juego, estrategias de aplicación del juego, paso a paso, fundamentos, creación del juego) y elementos post-textuales. **Conclusión:** la producción de la guía basada en la síntesis del conocimiento resultó ser una estrategia exitosa en el desarrollo de productos del tipo material didáctico, pudiendo cualificar el proceso de trabajo de los educadores en diabetes.
Descriptores: Tecnología Educacional; Diabetes Mellitus Tipo 1; Pie Diabético; Educación en Salud; Niño

Introduction

Type 1 diabetes mellitus (T1DM) is a polygenic, autoimmune disease resulting from destruction of pancreatic β cells, which leads to complete deficiency in insulin production. This requires use of that hormone as treatment to prevent ketoacidosis, coma, death, and other microvascular and macrovascular events. It occurs more frequently in children, adolescents, and young adults.[1]

Worldwide, T1DM in the 0–19-year age range accounted for 1,104,500 cases, with an estimated 132,000 new occurrences per year, characterizing a highly prevalent disease that has risen substantially in recent decades, especially among children younger than five years.[2] In Brazil, approximately 564,249 persons with T1DM are estimated, 109,827 younger than 20 years and 454,070 older than 20 years. This places the country third among countries with the largest number of individuals diagnosed with T1DM.[1]

Patients with T1DM require specific treatment, guidance, and long-term follow-up, demanding care by a professional specialized in diabetes education that must be continuous, comprehensive, and resolutive; within this process, access to educational

strategies that encourage self-care is necessary to strengthen reduction in risks of acute and chronic complications.[3] The chronic complications that most affect social and economic life in this population are foot ulcers or diabetic foot, and non-traumatic limb amputations.[2,4] Diabetic foot ulcers (DFU) stand among the most relevant complications of T1DM and impose high economic costs to society, with lifetime incidence of 19–34% and annual incidence of 2%, and recurrence rates of 40% after one year and 65% after three years, thus becoming a public health problem.[5]

Preventing DFU is crucial to reduce risks and the consequent economic burden to society,[5] and screening of complications in all persons with this condition is essential, which makes it paramount that diabetes educators, especially nurses, perform frequent foot examinations to identify persons at higher risk of developing DFU who may benefit from promotion and encouragement of self-care.[1-2,6] Information and practice regarding foot care are known to be fundamental to prevent injuries, and periodic assessment of lower limbs enables early detection and treatment of identified alterations. The severity of diabetic foot complications can be reduced if appropriate self-care methods and health education are implemented.[7]

Guided care practices offer promising perspectives for improving well-being and quality of life, with adoption of actions to prevent health problems and promote a healthier lifestyle.[8] Health education for T1DM is a primary strategy for disease management, since improved self-care management leads to better clinical variables of the disease and reduction in potential complications, and strategies must rely on updated, reliable, safe information tailored to the target audience. Within this scope, equipping diabetes educators with strategies and dynamics, as well as educational games, that strengthen foot self-care actions while outlining foot-care measures to encourage self-care among those living with T1DM becomes relevant.

In relation to this, one of the authors created the educational game “Alphabet for pediatric foot care” and began using that tool in activities with children and adolescents living with T1DM. The game is an educational technology with playful and interactive characteristics, composed of 23 foot-shaped pieces corresponding to letters in Brazilian alphabet except K, W, and Y. Each letter denotes one foot-care action, and each foot-shaped piece contains a command to be carried out to perform that care. The game

facilitates understanding of risk factors for DFU development and stimulates self-care actions. The creation occurred in 2019, based on research conducted at the Laboratory for Technologies for Work and Health Education LATTED/UEA.

However, since a usage guide had not been produced to enable game implementation by diabetes educators, the present production is justified, addressing theoretical and operational aspects and indicating step by step how to create and use the game.

Accordingly, this study aimed to build the guide for the educational game “alphabet for pediatric foot care” for diabetes educators.

Method

This was a study on technological innovation development,[9-10] characterized as a continuity project,[11] conducted in two phases: knowledge synthesis and construction of the game guide.

The first phase was conducted from March 2022 to June 2023 through an Integrative Literature Review (ILR),[12] aimed at identifying the main foot-care practices for children with T1DM, outlined in six steps: 1, formulation of the guiding question; 2, literature search or sampling; 3, data extraction; 4, critical appraisal of included studies; 5, results discussion; 6, presentation of the knowledge synthesis.[12]

For step 1, the PICo mnemonic was used (P - Population, I - Intervention, and Co - Context),[13] defined as P – children; I – foot care; Co – type 1 diabetes mellitus. The following guiding question was obtained: What are the foot-care practices (I) for children (P) with type 1 diabetes mellitus (Co)?

In step 2, the following databases were defined: Publisher Medline (PUBMED/MEDLINE), Latin American and Caribbean Health Sciences Literature (LILACS), and Nursing Database (BDENF). Descriptors were also defined: “type 1 diabetes mellitus,” “diabetic foot,” “child,” and their respective synonyms, connected by Boolean operators “AND” and “OR,” with title/abstract/subject search commands, resulting in the following strategy: (mh:("type 1 diabetes mellitus")) AND (mh:("diabetic foot")) AND (mh:("Child")). Eligibility criteria were original articles and reviews, available online and in full text, that addressed foot care for children with T1DM, published within the last five

years (2017–2022), in Portuguese, English, and Spanish. Duplicates, incomplete works, studies on hospital care, invasive methods, studies conducted with hospitalized children, and those that did not meet the study objective were excluded.

For step 3, a spreadsheet was used to extract relevant information, ensuring accuracy in record checking and serving as a database. Two sets of information were extracted: characterization data: title, authors, year, journal, language, and study design; operationalization data: objective, method, and foot care. Step 4 occurred through exhaustive readings of included articles, starting with titles, abstracts, and full text, applying the eligibility criteria.

In step 5, selected studies enabled identification of eight guidance topics: assessment of risk history; structured education on self-care for patients and professionals; foot inspection; treatment of risk factors; orthopedic guidance; exercise-related guidance; integrated care for patients with DM; and foot self-management. In step 6, topics were analyzed and yielded three synthesis dimensions for foot self-care: assessment of foot hygiene and care, physical and anatomical assessment of feet, and neuromotor and sensory assessment of feet.

The second phase occurred between November 2022 and July 2023, operationalized in three stages: description of the dynamics, scientific rationale, and guide layout. For the description of game dynamics, a non-participant observation was conducted during a T1DM event in the city of Manaus, State of Amazonas, where the author-creator applied the game with children. No contact occurred between the observer and participants. This stage provided inputs to identify the game sequence, supporting step-by-step description as well as detailed characterization of each step. The rationale relied on dimensions that emerged from the knowledge synthesis. During layout, Adobe InDesign software was used; for illustrations, free and editable images were selected with support from a professional in graphic design.

The guide is part of the production series of the VALIDTE Project (Educational Technologies for Well-Being of Individuals and Families within Chronic Diseases), integrated into LATTED (Laboratory for Technologies for Work and Health Education) at

Universidade do Estado do Amazonas (UEA). Accordingly, the guide structure follows textual, imagery, and layout recommendations from the "The Guide" series of the VALIDITE Project.

No research with human beings was conducted, and no confidential, organizational, or personal information was used. Production of the game guide was based on evidence from the literature, and thus the project did not require submission to or evaluation by a Research Ethics Committee.

Results

From the first phase, a total of 550 records emerged, 57 of which were selected for full reading following inclusion and exclusion criteria; six studies were considered eligible and included in the final sample (Table 1).

Table 1 - Sample distribution by authors (year), title, study design, and language. Manaus, Amazonas, Brazil, 2023

Authors (year)	Title	Study design	Language
Schaper *et al.* (2020)[14]	Practical Guidelines on the prevention and management of diabetic foot disease (IWGDF 2019 update)	Systematic Literature Review / Clinical Guideline	English
Bus *et al.* (2020)[5]	Guidelines on the prevention of foot ulcers in persons with diabetes (IWGDF 2019 update)	Systematic Literature Review / Clinical Guideline	English
Netten *et al.* (2019)[15]	Prevention of foot ulcers in the at-risk patient with diabetes: a systematic review	Systematic Literature Review / Clinical Guideline	English
Netten *et al.* (2020)[16]	Treatment of modifiable risk factors for foot ulceration in persons with diabetes: a systematic review	Systematic Literature Review / Clinical Guideline	English
Bus *et al.* (2020)[17]	State of the art design protocol for custom made footwear for people with diabetes and peripheral neuropathy	Systematic Literature Review / Clinical Guidelines	English
American Diabetes Association (2018)[18]	10. Microvascular Complications and Foot Care: Standards of Medical Care in Diabetes-2018	Systematic Literature Review / Clinical Guidelines	English

After analysis, evidence was organized into eight topics (T1 to T8): T1) guidance for risk-history assessment; T2) guidance on structured education regarding self-care for

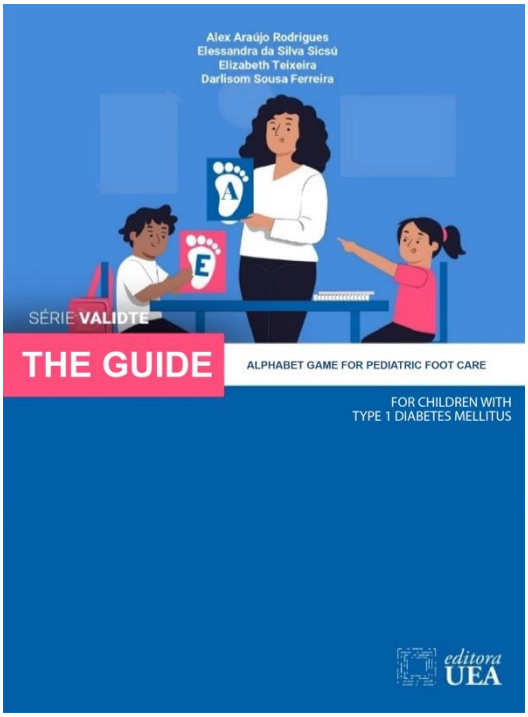
patients and professionals; T3) guidance on foot inspection; T4) guidance regarding treatment of risk factors; T5) orthopedic guidance; T6) guidance regarding physical exercise; T7) guidance regarding integrated care for patients with DM; T8) guidance on foot self-management. From these topics, three dimensions emerged (D1 to D3): D1) assessment of foot hygiene and care; D2) physical and anatomical assessment of feet; and D3) neuromotor and sensory assessment of feet. These dimensions guided organization of guide content.

In the second phase, the guide was produced, which is available for open and free access in UEA's repository and can be accessed in full by the title "The Guide - Alphabet Game for Pediatric Foot Care for Children with Type 1 Diabetes Mellitus", or via the link: https://ri.uea.edu.br/server/api/core/bitstreams/8b4f5d82-76cb-4bb5-a869-8d072c46fb65/content, composed of 27 pages that encompass pre-textual and textual elements, with seven sections: What is type 1 diabetes mellitus? What is diabetic foot? What does the alphabet game for foot care entail - From A to Z? Materials for game implementation; Strategies for game implementation step by step; Rationale; Creating the game; and Post-textual elements (Figure 1).

In the textual elements, the first two sections are introductory and conceptual. In the third, the game is presented through alphabet letters, the activity that participants must perform, and the material required to perform the activity that the educator must provide (Figure 1).

In the fourth section, all materials that the educator must have at hand for participants to carry out activities are described, namely: basin, soap, plastic ball, small brushes, dance music, moisturizing cream, wet wipes, small mirror, cloth towels, nail clipper, socks and shoes, and an image showing nail trimming. In the fifth section, strategies for game implementation step by step are presented (Figures 1 and 2), so that the diabetes educator can operationalize the game with children.

Figure 1 – Presentation of the educational technology entitled "The Guide - Alphabet Game for Pediatric Foot Care for Children with Type 1 Diabetes Mellitus", from cover, table of contents, alphabet letters, and implementation strategy. Manaus, Amazonas, Brazil, 2023



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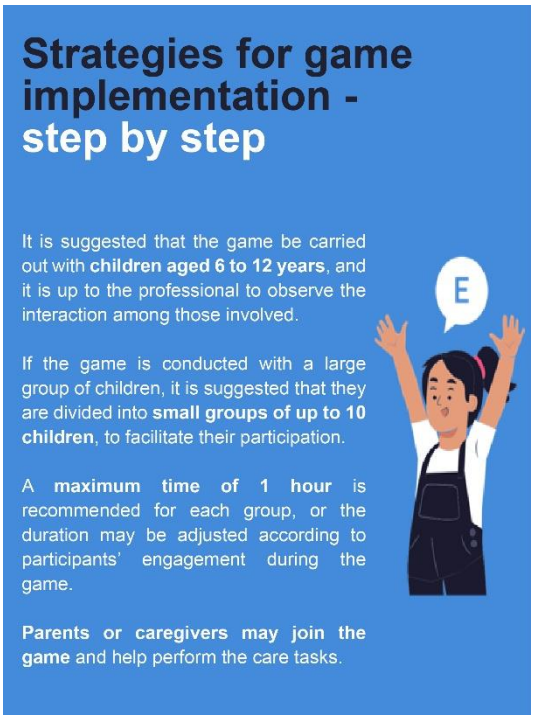
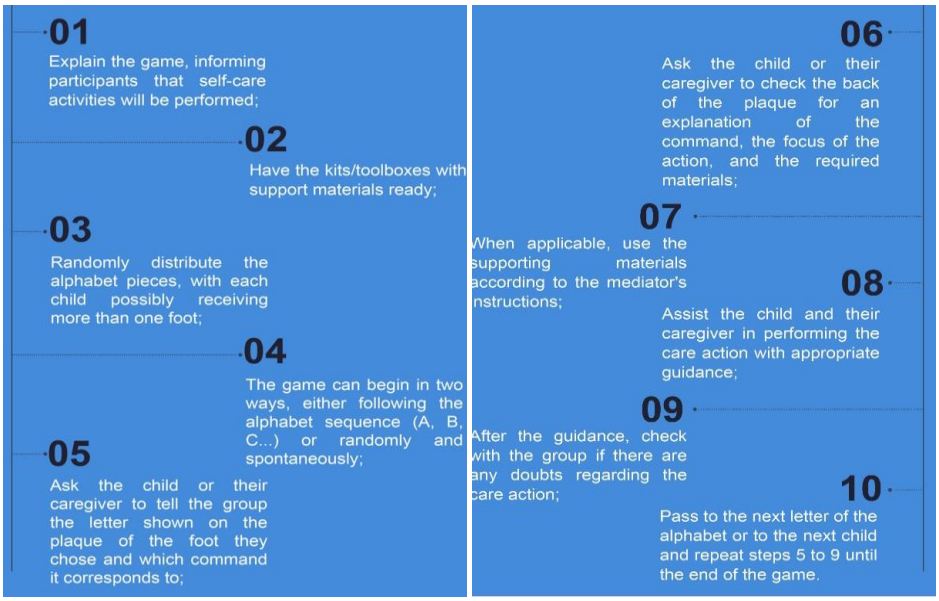
Alphabet Letter	Activities	Required Materials
A for **SUPORT** (*apoio*)	Balance on one foot	Use feet
B for **BATH**	Bathe feet with water and soap	Basin and soap
C for **Tickles** (*cócegas*)	Chuckle-feet tickles	Use feet and hands
D for **DEXTERITY**	Pass the ball to a teammate	Plastic ball
E for **BRUSHING** (*escovação*)	Brushing feet with small brushes	Small bruhes
F for **STRENGHT** (*força*)	Sit on the floor and touch feet with a partner	Use feet
G for **SWAY** (*gingado*)	Groove to music and dance	Dance music



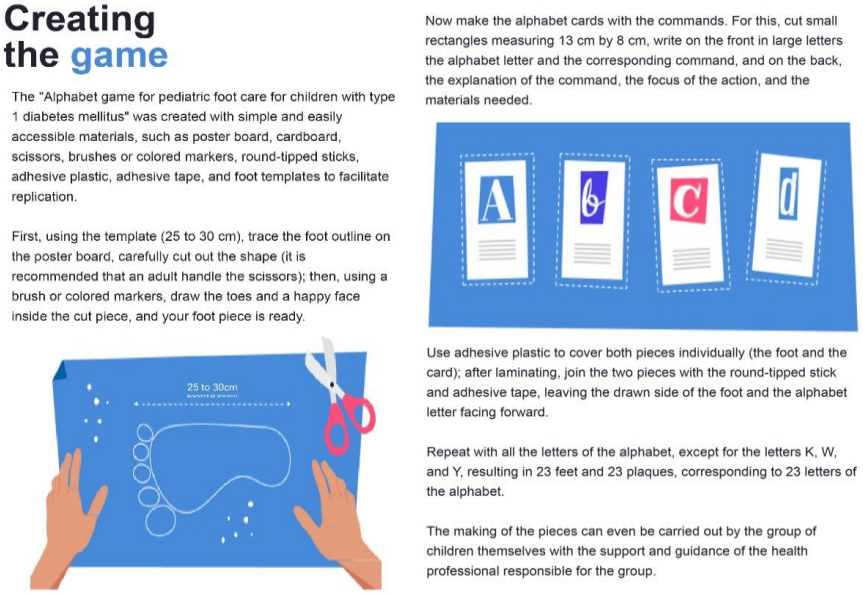
Note: is worth mentioning that the original guide was created in Portuguese and the words next to each letter begin with the corresponding letter. This feature may not necessarily be preserved in the English translation, making it impossible to reproduce the exact same effect.

Figure 2 – Step by step for implementation of the alphabet game for pediatric foot care. Manaus, Amazonas, Brazil, 2023



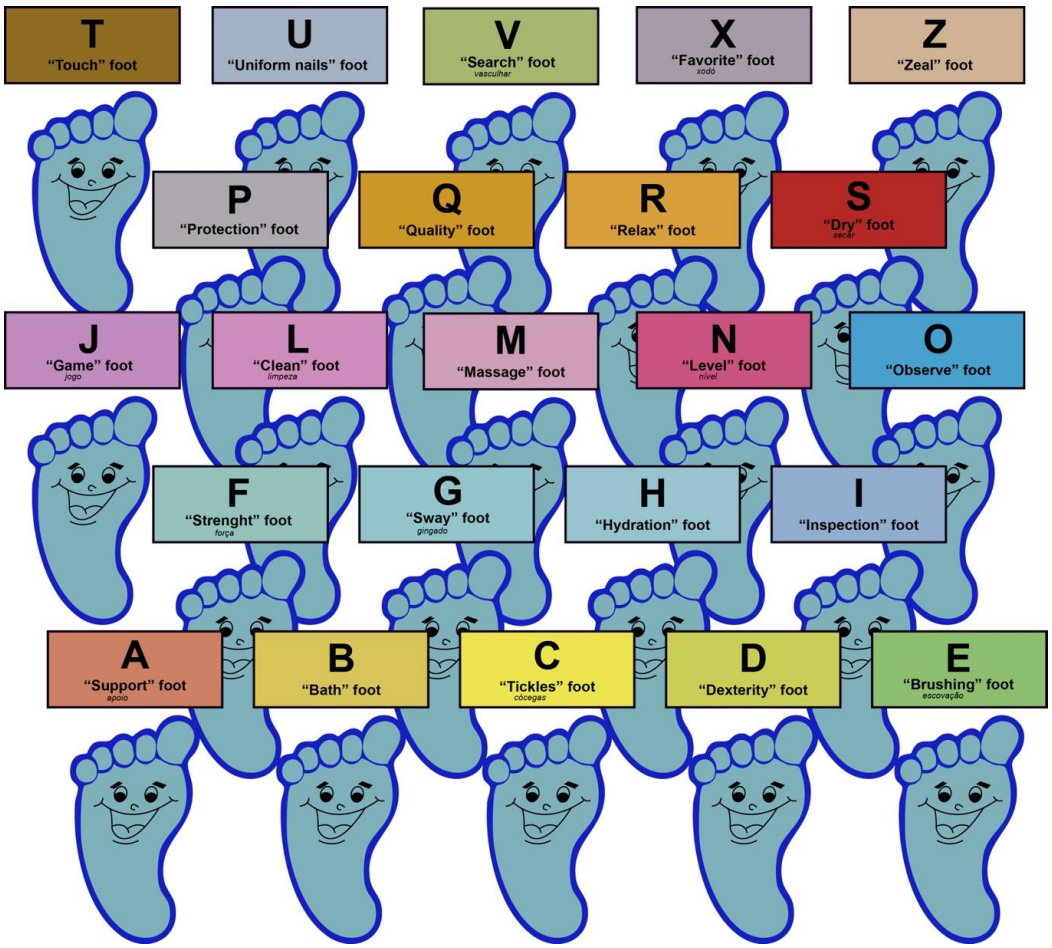
In the sixth section, corresponding to the rationale, the three evidence dimensions that emerged from the first stage are presented. In the seventh and final section, information necessary to guide preparation of game pieces (the feet) is provided, indicating the material to be used and respective dimensions (Figure 3).

Figure 3 – Materials and guidance required for crafting the feet and cards of the alphabet game for foot care. Manaus, Amazonas, Brazil, 2023



The game entitled "Alphabet for pediatric foot care" begins with random distribution of feet to each child, and depending on the number of participants, each one will hold a certain number of feet (Figure 4). The educator will explain how the dynamics will work. Participants will state which feet they hold and the respective letters, and they must execute the command written on the plaque fixed to the foot piece (Figure 4). Parents and/or guardians of each participant may take part in applying the educational game, supporting children and encouraging them to execute each action proposed in the activity.

Figure 4 – Illustration of feet used in the alphabet game for pediatric foot care. Manaus, Amazonas, Brazil, 2023



Note: is worth mentioning that the original guide was created in Portuguese and the words next to each letter begin with the corresponding letter. This feature may not necessarily be preserved in the English translation, making it impossible to reproduce the exact same effect.

Discussion

The Guide was developed to strengthen dissemination of the educational game "Alphabet for pediatric foot care". The game, as a health-promotion tool for children and adolescents living with T1DM, stands as an educational technology, since it will facilitate diabetes educators' work processes with this population.

Content that supported the guide's construction relied on evidence synthesis and clarified the main pillars in diabetic-foot prevention, such as identifying foot risks, regularly inspecting lower limbs, encouraging use of appropriate footwear, treating risk factors, and promoting education, which secures theoretical and scientific quality in the game guide on foot care for children with T1DM.

It is noteworthy that the game should be applied by professionals with specialization or training in diabetes education, since it requires skills for handling information and knowledge about T1DM, which are essential in self-care management. Within the educational context, professionals, especially nurses, rely on actions and information resources involving educational materials intended to facilitate communication and participants' understanding regarding foot care in T1DM. Therefore, the game is a proposal to stimulate and guide self-care, enabling individuals to be centered in decision-making about health and illness processes, ensuring autonomy regarding their therapeutic plan.[19]

In relation to the educational process, participatory methodologies are mentioned in conducting health-education practices to ensure protagonism and autonomy among individuals with diabetes and to support treatment management. Diabetes education is a fundamental strategy for disease control, since effective self-care management can improve clinical manifestations and mitigate risks of potential complications.[20]

The game lies within health promotion, understood as a process to empower and qualify individuals and communities that helps expand capacity to influence determinants of health and disease, and when carried out beyond the informational field, it leads to distinct forms of conduct and health practices.[21]

According to evidence represented by foot self-care dimensions, emphasis is placed on assessing foot hygiene and care. On this dimension, guidance includes

verifying hygiene, dirt, and fungal presence on feet and/or between toes, nail trimming, footwear quality, fit and inspection, physical limitations such as visual acuity and obesity, knowledge about foot care, as well as instructions on self-care and when to seek professional help. It also includes avoiding aggressive agents to feet (chemical products and devices), limiting exposure to climatic factors (cold and heat), and addressing hydration and dryness of extremities.[5,14-16,18]

The second dimension, anatomical and physical assessment of feet, refers to guidance regarding skin color, temperature, presence of calluses or edema and pre-ulcerative signs, verification of deformities and callosities, daily inspection of the entire surface of both feet, including areas between toes, in addition to strength and mobility.[5,14-16,18]

On the third dimension, neuromotor and sensory assessment of feet, guidance highlights pulse palpation, verification of claw or hammer-toe deformities, abnormally prominent bony structures or limited joint mobility, loss of protective sensation/sensitivity, presence or risk of peripheral arterial disease, pain, edema, and gait changes.[5,14-16,18]

In relation to the construction process of the educational technology grounded in evidence synthesis, it is underscored that the educational game addresses the main pillars in diabetic-foot prevention, such as identifying foot risks, regularly inspecting lower limbs, encouraging use of appropriate footwear, treating risk factors, and promoting education for patients, family members, and professionals,[17] while ensuring theoretical and scientific quality of evidence regarding foot care for children with T1DM.

Study limitations include the absence of content and face validation of the guide and lack of applicability assessment with the target audience. However, these steps are planned within a continuity project among researchers in the LATTED research group.

The guide contributes to disseminating the educational strategy as a health-promotion tool for children with T1DM and thus stands as an educational technological resource, by facilitating dissemination of the educational game to professionals in health services who work in this field of study.

Conclusion

The final product titled the guide to the game “Alphabet for pediatric foot care” was developed to assist diabetes educators in implementing the educational technology. The evidence synthesis revealed that foot care is multidimensional, encompassing dimensions focused on assessing foot hygiene and care, anatomical and physical assessment of feet, and neuromotor and sensory assessment of feet.

Producing the guide grounded in knowledge synthesis proved a successful strategy for developing educational-material products. The game guide stands as a resource that can qualify diabetes educators’ work processes and enable application of the game with children with T1DM.

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