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Original Article

Validation of the content of the comic strip "I have diabetes and what now?"

Validação do conteúdo da história em quadrinho “Tenho diabetes e agora?”

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ABSTRACT
Objective: to analyze the evidence of content validity of the comic strip “I have diabetes, what now?” **Methods**: methodological research into the production of health technology in the form of a comic book to support family members and hospitalized children diagnosed with type 1 diabetes mellitus. After developing the educational technology, the content was validated with six children and seven family members using a Likert scale, with indicators analyzed using the Content Validity Index. **Results:** the educational technology showed good validation indices according to the evaluation of the children (0.833) and family members (1.000). **Conclusion:** the children identified with the character in the story and agreed that it was a tool for understanding the disease, and family members said that it would be useful to disseminate the technology in other health services. **Contributions to practice:** there are situations that permeate aspects related to the care of children with diabetes, so the comic book could contribute to the quality of multi-professional care for this population affected by Diabetes Mellitus.
Descriptors: Health Education; Educational Technology; Diabetes Mellitus, Type 1; Validation Study; Self Care.

RESUMO
Objetivo: analisar as evidências de validade de conteúdo da história em quadrinho “Tenho diabetes e agora?”. Métodos: pesquisa metodológica na produção de tecnologia em saúde no formato de história em quadrinhos para apoio a familiares e crianças internadas, com diagnóstico de Diabetes *Mellitus* tipo 1. Após elaboração da tecnologia educativa, ocorreu a etapa de validação do conteúdo com seis crianças e sete familiares, na qual se aplicou a escala *Likert,* com indicadores analisados por meio do Índice de Validade de Conteúdo. **Resultados:** a tecnologia educativa apresentou bons índices de validação conforme avaliação das crianças (0,833) e familiares (1,000). **Conclusão:** as crianças se identificaram com o personagem da historinha e concordaram ser uma ferramenta para o entendimento da doença, e os familiares afirmaram ser oportuno propagar a tecnologia em outros serviços de saúde. **Contribuições para a prática**: há situações que permeiam aspectos relacionados ao cuidado com crianças com diabetes, portanto, a história em quadrinhos poderá contribuir para a qualidade da assistência multiprofissional a essa população acometida pelo Diabetes *Mellitus*.
Descritores: Educação em Saúde; Tecnologia Educacional; Diabetes Mellitus Tipo 1; Estudo de Validação; Autocuidado.

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Introduction

Diabetes Mellitus (DM) is a chronic disease whose diagnosis implies changes in everyday family life. It is classified as type 1 (DM-1) and type 2 (DM-2), the former being prevalent in children, adolescents, and young adults[1]. Because it is chronic, the diagnosis of DM-1 involves numerous changes in everyday family life, requiring support in making the diagnosis and guidance from health professionals. It has three broad aspects: physical, psychological, and social.

These changes impact on social life, family relationships, leisure, and productivity, resulting in care for the child, such as food restriction, physical activity, glycosimetry and insulin therapy. The responsibility placed on family caregivers can overwhelm them, especially in accepting the disease, understanding, and convincing them of the importance of treatment, the difficulty of controlling blood glucose, and their inclusion in school life. In this sense, there is a need to use educational tools to support treatment[1-2], such as educational technology in health (ETH).

ETHs are used to help health professionals assist children and their guardians to understand the problems related to the disease, and to enhance their own abilities to control and balance their health[3-6]. For this reason, health education on diabetes is necessary to support children and their guardians in their difficulties in relation to the disease, such as understanding the importance of intensive care, learning the proper administration of medication, and giving fundamental autonomy to daily self-care, and thus facilitating communication and guidance for those involved[6-8].

Some ETHs have been identified in relation to the care of children with DM-1[3-4], but there have been few studies of validation evidence[5-6]. Therefore, there is a need for studies that focus not only on aspects related to insulin, glycemic signs and situations related to the disease, but also on other essential aspects of DM-1, such as physical activity, healthy eating and coping with psychosocial situations.

It is necessary to minimize the effects and acute complications of diabetes, so studies should be carried out on the development and validation of ETH, with criteria of reliability and safety, for the use of health professionals, in the support and practice of self-care, promotion and prevention of children with DM-1 and their families, using clear, objective, and attractive language. It also stimulates the development of research and scientific production, and enables health promotion, as it helps children and their families to cope with their insecurities and difficulties in managing DM-1, as well as being considered a potential for innovation in the application of educational strategies.

The objective of this study was to analyze the evidence of content validity of the comic strip "I have diabetes, what now?".

Methods

This is methodological research[9] of the technological production type for the development of the content of the comic strip "I have diabetes and what now?". It was organized into two phases: development and validation of the technology.

The elaboration phase was divided into three sub-phases: literature review; situational diagnosis[10]; studies developed in 2017 and 2018 respectively; and the production of the comic book[11] in 2019, updated in 2022. Validation was carried out in two sub-phases: with specialists[12], developed in 2020, considered valid by judges (nurses, doctors, physiotherapists, nutritionists), in relation to objectives, structure and relevance (CVI=0.875), classified as high; and with the target audience, reported in this study, in which the judges analyzed the ability to understand the comic through the indicators presented, developed between August 2022 and March 2023.

Phases	Sub-phases	Content
Elaboration	Literature review	An integrative review was carried out to answer the question: what information should be included in the TES to promote self-care for children with diabetes? The following databases were used: Digital Library of Theses and Dissertations - University of São Paulo, Coordination for the Improvement of Higher Education Personnel (CAPES, in Portuguese), Brazilian Institute of Information, Science and Technology (IBICT. in Portuguese); Medical Literature Analysis and Retrieval System Online (MEDLINE); Latin American Health Sciences Literature (LILACS); and Nursing Database (BDENF, in Portuguese). The aim was to identify which types of printed technology are most used and indicated for use with children with type I diabetes mellitus to promote self-care. The descriptors "teaching materials", "health education", "health technology assessment" and "educational and dissemination materials" were used. The controlled descriptor "chronic disease" was used in association with the descriptors using the Boolean operator AND.
	Situational diagnosis[10]	This was a qualitative study of 16 children with diabetes mellitus 1 (DM-1). The objective was to gain an insight into the daily lives of children diagnosed with DM-1 and treated at the Federal District's Specialized Health Center for Diabetes, Obesity and Hypertension. This health center is linked to the Federal District State Health Department and belongs to the North Central Regional Health Coordination. Four thematic categories were identified in the narratives: the significance of diabetes mellitus for children and adolescents; feelings related to the changes caused by diabetes mellitus; aspects related to lifestyle habits; and significant changes in life. These themes were used to identify the relevant aspects for developing the technology.
	Technology development[11]	The comic strip "I have diabetes and what now?" was produced for children. Editing and layout were carried out.
Validation	Content validation[12]	This study describes the process of validating the comic strip "I have diabetes and what now?" for children with diabetes. Methodological research was carried out with 12 expert judges. A Likert scale was used. A satisfactory level of reliability was observed, according to Cronbach's alpha coefficient (0.7121). Content validity index (0.875) and level of agreement (91.67). Educational health technology provides educational and playful actions involving self-care for children with DMI-1.

Figure 1 – Content development and validation phases with experts. Brasília, DF, Brazil, 2022

The validation phase with children and family members of the educational health technology took place in the Pediatrics units of a public hospital in Brasília, Federal District, belonging to the Southern Regional Health Coordination, which serves the maternal and child population. This pediatric health unit receives an average of two to three new cases of DM-1 per month, and an average of one case of readmission due to glycemic decompensation.

The care given to children with DM-1 in this hospital involves an initial health education approach. After the clinical condition has stabilized, in approximately five days, the child and their guardian are referred to the Specialized Center for Chronic Disease Care, where they are given more in-depth information on specific situations related to the disease, such as guidance on carbohydrate counting, a fundamental strategy for glycemic control and the role of each member of the multi-professional team.

The sampling was a non-probabilistic convenience with the sample made up of children and their families. The children were approached during hospitalization, during which time eight children and their families were hospitalized. After talking to everyone, only six children agreed to take part. Of the two who refused, one was not interested, and the other was being prepared for discharge from hospital, claiming not to have the time. The selection process was carried out using the following criteria: inclusion: children aged between 5 and 13, hospitalized for five days, diagnosed with DM-1, accompanied by family members providing direct care for the child. The ex-

clusion criteria were children with an unstable and severe clinical condition, and family members without cognitive limitations.

Data collection began with the sociodemographic and clinical characterization of the children, such as age; gender; whether they attended school; place of residence; and reason for hospitalization. The family members' sociodemographic variables were family degree; profession; and level of education. The ETH were then validated with the children and their families. For validation, a Likert scale was used to specify the level of agreement and reliability. Data were collected between January and March 2022.

Agreement with the Content Validity Index (CVI)[13] was used. The CVI can be calculated in different ways, considering the mean value (adequate values divided by the total) or absolute agreement (positive values considering only items with all adequate responses). In this study, the mean value was used. The acceptable CVI value is 0.78. To be considered satisfactory, the minimum percentage must be 80%, according to the Percentage of Agreement method.

The study met all the requirements of Resolution 466/12 and was approved by the Research Ethics Committee of the School of Health Sciences, with Certificate of Presentation for Ethical Appraisal: 53246921.4.0000.5553 and Opinion No. 5,192,420/2022.

Results

Regarding the children, the majority were female and in the fourth grade, aged between 5 and 13. The reasons for hospitalization were decompensated blood glucose, high blood glucose, dizziness, sudden weight loss, constant sleepiness, hyperglycemia, vomiting, shortness of breath and decompensated blood glucose. Regarding family members, the majority was female, and most were mothers. According to their level of education, the family members had studied up to higher education.

It was observed that the children identified with the story presented, understood the text presented and the content, and collaborated in the treatment. They were interested in using the technology and said that the comic book helped them understand the disease and self-care. The item with the lowest CVI value (0.500) was 'did you like the pictures presented' (in the questionnaire aimed at children) (Table 1). Also, regarding the CVI, in the analysis answered by the children, it was noted that seven of the eight indicators received the minimum agreement to be considered representative, above 0.8.

Table 1 – Descriptive analysis of the apparent validation of the educational health technology, comic strip "I have diabetes and now what?", answered by six children with Diabetes mellitus 1 (n=6). Brasília, DF, Brazil, 2022

Variables	n (%)	CVI*
Did you find it interesting to use educational technology in health		
Yes	6 (100.0)	1.000
Educational health technology has helped you to understand Diabetes		
More or less	1(16.7)	0.833
Yes	5(83.3)	
Educational health technology helped you to take care of Diabetes		
More or less	1(16.7)	0.833
Yes	5(83.3)	
Did you like the pictures		
More or less	3(50.0)	0.500
Yes	3(50.0)	
You identified with the story presented		
More or less	1(16.7)	0.833
Yes	5(83.3)	
You understood the subject		
More or less	1(16.7)	0.833
Yes	5(83.3)	
The health education technology used contributes to their treatment		
More or less	1(16.7)	0.833
Yes	5(83.3)	
The subject covers the content of Diabetes treatment	6(100.0)	1.000
Total	6(100.0)	

*CVI: Content Validity Index

In the validation of family members, they stated that it was appropriate to disseminate the use of technology in other health services, agreeing that the indicators were relevant, that their statements were clear and that the subject was representative. The comic has a logical sequence, contributes to health education about the child's treatment, and makes it easier to understand (Table 2).

Table 2 – Descriptive analysis of the apparent validation of the health education technology, "I have diabetes and now what?", answered by seven family members of children with DM-1 (n=7). Brasília, DF, Brazil, 2022

Variables	Adequate	
	n (%)	CVI
It would be appropriate to spread the use of this ETH to other health services	7(100.0)	1.000
The ETH presents relevance and agreement of the items	7(100.0)	1.000
The ETH makes it possible to assess the relevance of its applicability	7(100.0)	1.000
The ETH makes the statements clear	7(100.0)	1.000
The ETH made it easy to read and interpret the information	7(100.0)	1.000
The topic addressed in the ETH was representative	7(100.0)	1.000
The ETH presented a logical sequence of information	7(100.0)	1.000
The subject covered was in line with knowledge about DM-1	7(100.0)	1.000
The ETH used contributes to health education about the child's treatment	7(100.0)	1.000
The ETH is suitable for children	7(100.0)	1.000
ETH facilitated understanding	7(100.0)	1.000
Total	7(100.0)	

ETH: Educational technology in health; CVI: Content Validity Index; DM-1: Diabetes mellitus 1

It's worth noting that the children and their families asked for suggestions for adjustments to the comic: reinforcing the approach to explaining the function of insulin in the body, putting the warning signs of hypoglycemia and hyperglycemia and the use of different types of insulin. Regarding the figures, it was suggested that the characters be improved. Suggestions for adjustments and recommendations were therefore accepted. The version has now been adjusted and is available at https://drive.google.com/file/d/1_m2OSadvJMFlswlcxA5yrMqf83IzPdC5/view?usp=drivesdk. This corresponds to the application phase, for which another study is being developed.

Discussion

DM-1 is a chronic and complex disease that involves systemic disorders and requires educational intervention strategies for health promotion to help care for and treat this target group[1]. Educational strategies are essential in this regard and require the skill and knowledge of health professionals. In this sense, the technology developed needs to be validated to enable the creation of quality educational material for the day-to-day care of children with DM-1[14-15].

The comic strip "I have diabetes and now what?" took a long time to develop, from 2017 to 2022, when the last version was produced. During this period, the educational technology was produced with content based on systematically updated information about available knowledge. To measure the reliability, interest in this content, and understanding by the target audience, there was a need for validation and thus reinforcement of the technical and scientific quality, since it is necessary for educational technology to be important information and awareness strategy, not only involving the aspect of the disease, but also playfulness in the care of people with DM-1[16-17].

The indicators analyzed corroborate other similar studies, in which the ETH collaborate with diabetes care, highlighting the importance of building a supportive relationship with the individual about the health/disease process, contributing to their self-care[15,18]. The ETH aims to improve autonomy and self-care, highlighting aspects of diabetes treatment, with an emphasis on knowledge of the disease, physical activity, diet control, blood glucose control and insulin application[15,18-19]. In this study, the CVI was

0.833 for children and 1,000 for family members, indicating good acceptance of the technology.

When designing technology for a particular audience, opinions and suggestions for adjustments should be considered. These suggestions should be accompanied by clarifications with illustrations to emphasize the important aspects of the disease and its care[20-21]. Family members and the target audience rated the comic book as understandable and appropriate, and supported the dissemination of this technology to other health services, as they considered it relevant to health promotion, strengthening the knowledge learned, playful content, colorful, clear, and understandable information.

There is a need to promote studies on the production of educational materials, as well as resources that facilitate knowledge and self-care practices for children with DM-1. ETH published and launched on the market are presented in various formats, such as audiovisual media, booklets, manuals, children's stories, campaigns, and educational games, among other formats[4-6,8,13]. In addition to providing attractive reading and innovative design, they promote effective intervention for the control and treatment of DM-1[15,21].

The difference in quality between this technology for health promotion and others produced is the fact that it is a validated educational tool, given how few technologies related to health education for children with DM-1 have been developed and made available, but without scientific rigor. Another relevant aspect that favors this ETH is its accessibility, as not everyone has access to information technology, the internet and/or digital devices, so the different socio-economic levels of the public involved must be considered.

Quantifying what the target audience thinks about technology is an essential factor in qualifying the product. Another factor is the use of illustrations, as this maintains the attractiveness, playfulness, clear language and visual charm, as well as defining the theoretical basis on which this tool is based, for which up-to-date government and non-government studies and manuals were used. When designing the technological tool, it is necessary to ensure that it meets the needs of the target audience, taking language and content into account. The aim is to guarantee the quality and safety of the material released to the public[22-23].

The relevance of health technology, when developed for children's education, is reinforced by the fact that it is appropriate for the target audience, for whom it is necessary to present clear information, easy to read, interpret and understand, showing care in adapting the language to the target audience, not using technical terms, but words that are suitable for children, making sure that it is understandable and in line with their reality[11,15,18,22].

The children understood the subject, which is in line with the literature which states that both verbal and non-verbal language, associated with comics, interact with the reader, helping the teaching-learning process[12]. As a result, the child can better understand the story and thus suggest possible changes and analogies, such as better explaining the action of insulin in the human body.

Health education is essential for patients and their families to gain new skills[11-12,15]. Considering that the comic book contributes to health education and that it is also in line with knowledge about DM-1, demonstrates the importance of technology being validated as a scientific product, ensuring that it fulfills its objective and adds quality care, making it possible to change the reality of the target audience[15,24].

The comic book offers easy applicability and an ideal approach to the subject, giving people the chance to participate in the story by drawing the pictures and a better understanding due to the use of language aimed at children, highlighting the importance of using it as a tool in the health field[10-11]. It should be noted that people with DM-1 need reliable sources of information about the disease, highlighting the importance of comics for the development of self-care, patient skills and active participation in health care, as stated in the National Health Promotion Policy[21].

Study limitations

A study limitation was the selection of the sample of participants, since the validation was only carried out with the public attending the public hospital, and it was necessary to include children from other Brazilian hospitals. Another limitation was the validation of the educational technology (comics) by the target audience, using the questionnaire, which made it necessary to analyze the validity of the content. The term "validity" is more commonly used when the instrument is evaluated by judges, and the term "content validity" can be replaced by "content agreement", since the calculation of the CVI is still an index of agreement when one or two categories are considered appropriate in relation to all the response options for each item. However, these limitations did not prevent us from verifying the potential of this instrument for the education and health of the target audience.

Contributions to practice

This study is relevant regarding the importance of implementing educational technologies in health, since the Ministry of Health recommends increasing the production of this instrument in health, and the use of these technologies can contribute to the process with advances in clinical practice, by helping and complementing the patient's knowledge, also contributing to the development of their responsibility for their own health. It is suggested that further research be carried out to understand the needs of each individual and their family according to the disease involved, thus intervening in health education to sensitize them to self-care and autonomy, considering the great facilitating influence on the lives of individuals affected by DM1.

Conclusion

The comic strip "I have diabetes and what now?" was well evaluated by the children and their families, obtaining good validation rates for its content. This technology could provide educational actions, as it involves prevention and health promotion in self-care for this target audience.

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Authors' contribution

Conception and design or data analysis and interpretation: Araújo SS, Maconi GM, Sá SLM, Melo MC.
Writing of the manuscript or relevant critical review of the intellectual content, Final approval of the version to be published and Responsibility for all aspects of the text in ensuring the accuracy and integrity of any part of the manuscript Araújo SS, Maconi GM, Sá SLM, Ferreira FA, Boeckmann LMM, Dutra LMA, Melo MC.

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