Revista Brasileira de Enfermagem
REBEn

THEMATIC EDITION
ADVANCED NURSING PRACTICES

ORIGINAL ARTICLE

# Serial album on Continuous Insulin Infusion System as an innovative educational technology in diabetes

*Álbum seriado sobre Sistema de Infusão Contínua de Insulina como tecnologia educativa inovadora no diabetes*

*Álbum en serie sobre el Sistema de Infusión Continua de Insulina como tecnología educativa innovadora en diabetes*

**Raquel Rodrigues da Costa Brilhante**[I]
ORCID: 0000-0002-3870-4324

**Thereza Maria Magalhães Moreira**[II]
ORCID: 0000-0003-1424-0649

**Sherida Karanini Paz de Oliveira**[II]
ORCID: 0000-0003-3902-8046

**Raquel Sampaio Florêncio**[II]
ORCID: 0000-0003-3119-7187

**Vera Lúcia Mendes de Paula Pessoa**[II]
ORCID: 0000-0002-8158-7071

**Virna Ribeiro Feitosa Cestari**[II]
ORCID: 0000-0002-7955-0894

[I] *Centro Integrado de Diabetes e Hipertensão. Fortaleza, Ceará, Brazil.*
[II] *Universidade Estadual do Ceará. Fortaleza, Ceará, Brazil.*

**How to cite this article:**
Brilhante RRC, Moreira TMM, Oliveira SKP, Florêncio RS, Pessoa VLMP, Cestari VRF. Serial album on Continuous Insulin Infusion System as an innovative educational technology in diabetes. Rev Bras Enferm. 2022;75(5):e20210277. https://doi.org/10.1590/0034-7167-2021-0277

**Corresponding author:**
Raquel Rodrigues da Costa Brilhante
E-mail: raquelcosta_ce@hotmail.com



**Submission:** 07-06-2021 **Approval:** 07-08-2022

## ABSTRACT

**Objective:** to build and validate a serial album content and appearance on insulin therapy using a Continuous Infusion System. **Method:** a methodological study, carried out in three stages in Fortaleza, Ceará, Brazil, from August to November 2018. The serial album construction and content and appearance validity were carried out by experts, and assessment, by the target audience. Content Validity Index and Concordance Index were calculated. **Results:** the judges considered the serial album content and appearance to be valid, which means that the material is suitable as an educational technology. Experts suggested adjustments, incorporated into the material for print production of the final version. The target audience also assessed the serial album positively. **Conclusion:** we realized that the serial album was considered an innovative educational technology in diabetes, valuable for promoting knowledge about Continuous Insulin Infusion System, with rich, updated content, combined with clarity, suitable format and explanatory illustrations.
**Descriptors:** Diabetes Mellitus; Insulin Infusion Systems; Educational Technology; Validation Study; Nursing Care.

## RESUMO

**Objetivo:** construir e validar conteúdo e aparência de álbum seriado sobre insulinoterapia por Sistema de Infusão Contínua. **Método:** estudo metodológico, realizado em três etapas em Fortaleza, Ceará, Brasil, nos meses de agosto a novembro de 2018. Realizou-se a construção do álbum seriado e a validação de conteúdo e aparência pelos especialistas, e avaliação do público-alvo. Calcularam-se Índice de Validade de Conteúdo e Índice de Concordância. **Resultados:** os juízes consideraram válidos o conteúdo e a aparência do álbum, o que representa que o material é adequado como tecnologia educativa. Os especialistas sugeriram ajustes, incorporados ao material para produção impressa da versão final. O público-alvo também avaliou de forma positiva o álbum seriado. **Conclusão:** percebemos que o álbum seriado foi considerado uma tecnologia educacional inovadora em diabetes, valiosa para a promoção do conhecimento sobre Sistema de Infusão Contínua de Insulina, com conteúdo rico, atualizado, aliado à clareza, formato adequado e ilustrações explicativas.
**Descritores:** Diabetes Mellitus; Sistemas de Infusão de Insulina; Tecnologia Educacional; Estudo de Validação; Cuidados de Enfermagem.

## RESUMEN

**Objetivo:** construir y validar el contenido y la apariencia de un álbum en serie sobre terapia con insulina utilizando un Sistema de Infusión Continua. **Método:** estudio metodológico, realizado en tres etapas en Fortaleza, Ceará, Brasil, de agosto a noviembre de 2018. La construcción del álbum en serie y la validación de contenido y apariencia fueron realizadas por los especialistas, y evaluación del público objetivo. Se calcularon el Índice de Validez de Contenido y el Índice de Concordancia. **Resultados:** los jueces consideraron válido el contenido y la apariencia del álbum, lo que significa que el material es apto como tecnología educativa. Los expertos sugirieron ajustes, incorporados al material para la producción impresa de la versión final. El público objetivo también evaluó positivamente el álbum en serie. **Conclusión:** percibimos que el álbum en serie fue considerado una tecnología educativa innovadora en diabetes, valiosa para la promoción del conocimiento sobre el Sistema de Infusión Continua de Insulina, con contenido rico y actualizado, combinado con claridad, formato adecuado e ilustraciones explicativas.
**Descriptores:** Diabetes Mellitus; Sistemas de Infusión de Insulina; Tecnología Educacional; Estudio de Validación; Atención de Enfermería.

ONLINE VERSION ISSN: 1984-0446

## INTRODUCTION

Subcutaneous insulin administration has evolved over time. In recent years, technology has grown exponentially to assist in diabetes mellitus (DM) treatment. The use of continuous infusion of subcutaneous insulin has greatly improved patient care and quality of life[1].

The Continuous Insulin Infusion System (CIIS), more commonly called an insulin pump, is a technological device that attempts to physiologically simulate the function of the pancreas, favoring a profile similar to the physiological one, being also an alternative to the multiple daily application of insulin[2]. Moreover, it is able to make decisions independently, correcting dosage errors and maintaining the glycemic target[1].

The literature shows favorable effects with the use of CIIS[3-5]. However, patients, when starting treatment with the device, because it is a relatively new technology, need educational support for the proper handling of the device, information about possible adverse events that may occur and how to reverse them, enabling satisfactory glycemic control.

Among the educational strategies used by health professionals, the serial album technology stands out, which allows new possibilities in this educational process, by providing knowledge, in a more interactive way, which would facilitate health promotion, contributing to the construction of patients' knowledge[6].

In this context, a search was carried out in the national and international literature[7], in which studies show educational strategies for patients with CIIS through the use of an interactive application through CD-ROM (Compact Disc Read-Only Memory), educational programs and remote communication technology. We perceive a lack of printed educational technologies aimed at CIIS.

A review study[8] pointed out that educational technologies for patients with type 1 diabetes mellitus (1DM) are concentrated on digital platforms, educational workshops, case simulation, poster and educational booklet. We identified that none of them involved CIIS or education through serial album.

The literature highlights that there is a gap in research on validated technologies for health education for people with DM[9]. Therefore, this research is part of existing gap, qualifying assistance, as patients who use CIIS need to obtain guidelines based on scientific knowledge that enable its use in a safe and effective way, contributing to glycemic control.

Such guidelines must be carried out by a duly qualified health professional. Thus, nurses are indispensable in this multidisciplinary team, which needs scientific support to provide clinical nursing care to the person with DM using CIIS, as well as to promote educational approaches that transform the reality of these patients, with the purpose of facilitating the adaptation of healthy individual behaviors.

The proposed educational technology becomes, therefore, a subsidy for nurses and other professionals to scientifically support care and promote safety and quality of care. The serial album may favor comprehensive care that seeks not only to focus on the pathology, but also on communication and the well-being of people involved.

## OBJECTIVE

To build and validate CIIS insulin therapy serial album content and appearance.

## METHODS

### Ethical aspects

The research was approved by the teaching institution's Research Ethics Committee, respecting the principles of Resolution 466/2012 of the Brazilian National Health Council. The study also followed the ethical principles of the Declaration of Helsinki.

### Study design, period, and place

This is a methodological study, carried out in Fortaleza, Ceará, Brazil, from August to November 2018. This study followed the following steps: 1) bibliographic survey; 2) serial album construction; 3) content and appearance validity by professional experts; and 4) serial album suitability according to the target audience. The SQUIRE 2.0 instrument was used.

### Population or sample; inclusion and exclusion criteria

The choice of experts was made with access and search on the Lattes Platform as follows: after accessing the "*Platforma Lattes*" website, in the "*Curriculum Lattes*" window, the "Search" option was chosen in the "*Curriculum Lattes* Search" window. The first step was to choose the search mode, clicking on the "Subject" box and on the placeholder, "Diabetes mellitus", "Insulin Infusion System" and "Technology" were written. Then, filters were applied to the results by "Professional performance", selecting the large area "Health Sciences" and the area "Nursing".

For the selection of experts, the number from six to twenty is recommended in the validity process[10]. The criteria adopted as an expert in content validity were: being a professional with a body of specialized knowledge or skill; have extensive experience in the specific field of practice; have highly developed levels of standard recognition and quality recognized by others[11].

Due to the difficulty found in reaching the number of expert judges on the subject, judges were divided into two groups for the validity process. The sample of expert judges in CIIS consisted of 10 participants and two advertising and marketing judges. Judge selection took place through snowball sampling[12]. Thus, when a subject was selected who fit the established eligibility criteria, he was asked to indicate other possible participants. Selected experts were invited to participate in the study. Upon agreement, we sent an invitation letter via e-mail with the study's purpose, method used and judge's role in the research. After consent, we sent three electronic instruments by email (characterization forms, content and appearance validity), created in Microsoft Word® and made available in PDF file, as well as the serial album file.

After assessment by the judges, patients assed the serial album for suitability (attributes related to content, writing style (literacy requirement), illustrations, layout and presentation, encouragement/motivation of learning and material cultural suitability),

with six people with DM who used CIIS as therapy, whose criteria used for including participants in this phase were: 1) people with diabetes using CIIS; and 2) being 18 years old or older. The exclusion criteria adopted were: not having 20 to 30 minutes available to participate in the serial album presentation; and answering the assessment instrument and presenting difficulties that made communication and instrument responses unfeasible, such as blood glucose changes at the time of data collection.

There is still no consensus in the literature about how many people should constitute the sample for this phase. Therefore, as it is a difficult population to identify, we opted for a network sampling (snowball sampling)[12]. A health professional who had a reputation in the field and extensive experience with CIIS therapy recommended the first patient. Thus, when there was the first selection, we requested recommendations of other possible participants, who indicated the next ones. In the end, six patients who used CIIS as therapy and who were linked to the diabetes clinic of a referral hospital in Fortaleza, Ceará, constituted the final sample.

### Study protocol

Initially, an integrative literature review was carried out to elucidate educational strategies on insulin therapy by CIIS for diabetics. The selected articles were organized in a Microsoft Excel® database, and we explored the following items: article identification (title, authors, language, country, location, journal and year); methodological aspects (research design, objectives, sampling, data processing and level of evidence); assessment of studies included in the review for at least. two researchers, and, in case of disagreement, by a third party, in order to avoid bias; critical analysis (results and conclusions) and evidence of educational technologies in CIIS.

The survey of publications took place from August to October 2018. We searched the bibliographic databases as follows: Public MEDLINE (PubMed) (422 articles); Cumulative Index to Nursing & Allied Health Literature (CINAHL) (201 articles); Scopus (Elsevier) (324 articles); Latin American and Caribbean Literature on Health Sciences (LILACS) (2 articles) and Scientific Electronic Library Online (SciELO) (2 articles). After applying the inclusion and exclusion criteria, reading titles and abstracts and reading the full text, the sample consisted of 4 PubMed articles.

Still at this stage, we thoroughly analyzed the literature: Brazilian Society of Diabetes Guidelines (*Diretrizes da Sociedade Brasileira de Diabetes*)[13], Primary Care Report 36[14] and CIIS instruction manuals as follows: MiniMed 640G[15], Accu-Chek Spirit Combo[16] and Paradigm Veo[17]. After reading the scientific material that supported the technology creation, a content script was prepared to be addressed, in a logical sequence, dividing the serial album into three main subjects: 1) about the device; 2) on adverse events with CIIS; and 3) about device care and treatment.

Ideas about technology content, such as the figures' logical sequence, description of figures that would be created according to pre-defined themes, script text, were organized into slides in Microsoft Power Point®, version 2010, and then sent to a technical professional to prepare the graphic designs and layout. To make the art, a professional received guidance on the type of engraving, according to the serial album's theoretical content, prepared by the researcher, building attractive and easy-to-understand illustrations, using Adobe Illustrator CS3 (2D) and Adobe InDesign CS6 to diagram the serial album. Afterwards, the serial album was submitted for validity by experts (CIIS expert judges and advertising and marketing judges).

Serial album content was assessed for purpose, clarity, understanding, relevance, organization, writing style, and motivation, through the Educational Content Validity Instrument in Health (ECVIH)[18], which has 18 items grouped into objectives, structure/presentation and relevance, with response options ranging from 0 to 2 (0 = Disagree; 1 = Partially agree ; 2 = Totally agree).

For appearance validity, we used an educational technology assessment instrument developed by Souza[19], adapting the instrument considering the replacement of terms related to hypertension by CIIS, analyzing images' characteristics and layout (colors, shapes, size and harmonization with the text) present in the serial album.

For experts, a period of 30 days was assigned to return the material. To those who did not return within the previously established period, a new contact was made, giving them more information, emphasizing the importance of review, as well as giving them an additional 15 days for a return. Experts who did not respond within 45 days were excluded from the survey.

The target audience assessed the serial album using the Suitability Assessment of Materials (SAM) instrument, developed by Doak, Doak and Root[20], translated and adapted into Brazilian Portuguese by Sousa, Turrini and Poveda[21], which allows assessing the educational material for its suitability for patients. In its validity process, 56.7% of items had a Content Validity Index (CVI) above 80%[21].

Patients were invited to participate in validity and, after acceptance, signed the Informed Consent Form. Then, an explanation on the serial album content was carried out, with a copy.

### Analysis of results, and statistics

The instrument used for content validity according to ECVIH[18] has a response scale: 0 - I disagree; 1 - Partially agree; 2 - Totally agree, the CVI being calculated by the average of the answers with grade "2" selected by the judges. We considered excellent item CVI (iCVI) > 0.78 and total CVI of >0.90[12].

The Concordance Index (CI), used in appearance validity analysis by judges, was calculated by the average of the answers with grades "3" and "4", selected by the judges, since the instrument[19] applied has a response scale: 1 - Disagree; 2 - Partially agree; 3 - Agree; 4 - Totally agree. The item CI (iCI) > 0.78 and the total CI of >0.90 was considered excellent, and the proportion of 0.8 agreement was considered relevant.

To assess the technology suitability by the target audience, the calculation of the total suitability score was made from the sum of the scores obtained, divided by the total scores and multiplied by 100, to transform into a percentage. In all situations, the interpretation of the SAM estimate percentage occurs as follows: 70-100% (superior material), 40-69% (suitable material) or 0-39% (unsuitable material)[20]. Items with an agreement rate lower than or equal to 39% (unsuitable material) are considered worthy of alteration.

The data obtained were compiled in Statistical Package for the Social Sciences (SPSS), version 20.0.

## RESULTS

The initial version was titled "Continuous Insulin Infusion System (CIIS): Innovation and quality of life in diabetes management", comprising 24 pages, covering three main subjects (about the device (CIIS), on adverse events with CIIS and on device care and treatment), with subdivisions, in order to encompass the main topics that cause questions in patients using CIIS.

Content and appearance validity was performed by 12 judges. There was a predominance of females (83.3%), with a minimum age of 27 years and a maximum of 57 years. The majority (66.6%) belonged to the Southeast. There was a diversity of professionals who participated in validity, being five nurses (41.6%), four nutritionists (33.3%), one pharmacist (8.3%) and two advertisers (16.6%). Among the functions performed by these professionals, 33.3% were clinical experts in CIIS (33.3%). Most had a specialization (58.3%) and three had a master's degree (25%). Table 1 shows the results of the content validity instrument. The "Objective" domain had the lowest CVI (0.76), followed by the "Structure/Presentation" domain (CVI=0.84) and "Importance" (CVI=0.90). The total CVI of the serial album was 0.83.

Of the 16 items assessed, only three did not reach the minimum CVI (0.78). The items that received scores below the recommended were "Provides reflection on the topic", "Encourages behavior change" and "Correct information". No judge disagreed with the statements and six judges partially disagreed on any item.

About item 9, "correct information", most partially agreed (60%); however, the judges commented on what information would be diverging from the updated literature and at the end of the assessment changes were made in the serial album.

Expert advertising and marketing judges assessed the serial album appearance (Table 2). Appearance validity received an overall score of 0.90, and four items had a score equal to 1.0 (items 3, 7, 8 and 10). Items 2.1, 2.6 and 2.9 were lower scored. Considering appearance assessment by experts and the total score calculated, the serial album was approved by the judges.

Although the overall CVI was satisfactory, the judges made suggestions for changes relevant to improving the serial album, exposed in Chart 1. The changes to be made were compiled, according to judges' assessments, and a new contact was made with the graphic designer to incorporate the changes to the material. After performing the relevant adjustments in the serial album, validity was performed with the target audience.

After validity was carried out by the target audience, of the 13 items assessed, there was no item considered inappropriate. Items related to textual comprehension and cultural adequacy were considered suitable by all participants (Table 3).

Most of the participating target audience was female (83.3%), with a mean age of 28.6 years (standard deviation: 2.28), all with complete higher education and working as a biotechnologist (1), nurse (2), nutritionist (2), administrator (1).

According to the items analyzed, the serial album was considered validated by the target audience, as all assessed the serial album with a SAM score between 21 and 25 points, therefore, higher than the minimum 10 points required for the educational material to be considered suitable. There was high agreement among experts for the items, individually, and for the serial album as a whole, considering the technology validated for its content and suitability.

## DISCUSSION

Due to the complexity of treatment with CIIS, educational strategies become fundamental, as they help in the acquisition of knowledge, experiences and skills in disease management, which, for this purpose, requires professional training. CIIS training should enable learning about manufacturer characteristics to master equipment operation and acquire diabetes self-management skills successfully in CIIS therapy. In this sense, the purpose of the material produced was to improve knowledge about insulin therapy by CIIS.

**Table 1** - Content analysis (objectives, structure, presentation and importance of serial album) by judges, Fortaleza, Ceará, Brazil, 2019

| Variables | Totally agree | | iCVI[a] |
|---|---|---|---|
| | n | % | |
| Objectives: purposes, goals or aims | | | 0.76 |
| 1. Contemplates proposed theme | 9 | 90 | 0.90 |
| 2. Suitable for the teaching-learning process | 8 | 80 | 0.80 |
| 3. Clarifies doubts about the topic covered | 8 | 80 | 0.80 |
| 4. Provides reflection on the topic | 7 | 70 | 0.70 |
| 5. Encourages behavior change | 6 | 60 | 0.60 |
| Structuring/presentation: organization, structure, strategy, coherence and sufficiency | | | 0.84 |
| 6. Language suitable for the target public | 9 | 90 | 0.90 |
| 7. Language appropriate to educational material | 8 | 80 | 0.80 |
| 8. Interactive language, allowing active involvement in the educational process | 8 | 80 | 0.80 |
| 9. Correct information | 4 | 40 | 0.40 |
| 10. Objective information | 10 | 100 | 1.00 |
| 11. Enlightening information | 8 | 80 | 0.80 |
| 12. Necessary information | 10 | 100 | 1.00 |
| 13. Logical sequence of ideas | 10 | 100 | 1.00 |
| 14. Current topic | 9 | 90 | 0.90 |
| 15. Appropriate text size | 8 | 80 | 0.80 |
| Importance: significance, impact, motivation and interest | | | 0.90 |
| 16. Encourages learning | 8 | 80 | 0.80 |
| 17. Contributes to knowledge in the field | 10 | 100 | 1.00 |
| 18. Arouses interest in the theme | 9 | 90 | 0.90 |

*a = Item Content Validity Index. Response scale: 0 - Disagree;1- Partially agree; 2 - Totally agree.*

**Table 2 -** Serial album appearance analysis by judges, Fortaleza, Ceará, Brazil, 2019

| Variables | Agree | | Totally agree | | CI[a] |
|---|---|---|---|---|---|
| | n | % | n | % | |
| 1. Figures are appropriate for the target audience | 4 | 33.3 | 6 | 50.0 | 0.83 |
| 2. Figures are clear and convey ease of understanding | 5 | 41.6 | 5 | 41.6 | 0.83 |
| 3. Figures are in appropriate quantity and sizes on the serial album | 7 | 41.6 | 5 | 41.6 | 1.00 |
| 4. Figures are related to the serial album text and elucidate the content | 6 | 50.0 | 5 | 41.6 | 0.91 |
| 5. Figures' colors and shapes are suitable for the type of material | 5 | 41.6 | 5 | 41.6 | 0.83 |
| 6. Figures depict the daily life of people that use the Continuous Insulin Infusion System | 4 | 33.3 | 6 | 50.0 | 0.83 |
| 7. Figure arrangement is in harmony with the text | 5 | 41.6 | 7 | 58.3 | 1.00 |
| 8. Figures help in exposing the theme and are in a logical sequence | 6 | 50.0 | 6 | 50.0 | 1.00 |
| 9. Figures help in insulin therapy treatment with Continuous Insulin Infusion System | 4 | 33.3 | 6 | 50.0 | 0.83 |
| 10. Figures are relevant to the understanding content by the target audience | 5 | 41.6 | 7 | 58.3 | 1.00 |
| Total CI | | | | | 0.90 |

*a = Concordance Index. Response scale: 1 - Disagree; 2 - Partially agree; 3 - Agree; 4 - Totally agree.*

**Chart 1 –** Suggestions from judges for modifications to serial album, Fortaleza, Ceará, Brazil, 2019

| **Experts' suggestions** | |
|---|---|
| Figure 1 | - Modify the sentence: "This system is used externally to the body in the subcutaneous tissue, just below the skin..." for "This system is used externally to the body, with the application of a catheter in the subcutaneous...".<br>- Remove the word "pulse" and leave only the word "bolus" |
| Figure 2 | - Explain that the choice of ultra-fast insulin would be due to the fact that it has an early peak of action and is more predictable than regular insulin, and not only because it causes less hypoglycemia than regular insulin.<br>- Modify change time from 3 days to "change every 2-3 days" or "change at most every 3 days". |
| Figure 5 | - Review the phrase: "air bubble occlusion".<br>- Replace the word "insufficient" with "inappropriate" in the phrase "Infection by insufficient cleaning".<br>- The change to "System occlusion: by wire bending (catheter)" was performed. |
| Figure 6 | - Change the sentence "The consumption of a snack before bed (supper) (milk or bread with cheese and ham) can help in nocturnal hypoglycemia prevention" by "Check the best snack option with your professional".<br>- Review the text about blood glucose values between 60-50 mg/dL that cause symptoms of hypoglycemia, as some feel at 80-70 mg/dL, depending on patients' threshold.<br>- Include hypoglycemia corrections: 15 g of carbohydrate with blood glucose below 70 mg/dL and with 30 g of carbohydrate, if blood glucose is below 50 mg/dL. |
| Figure 8 | - Do not specify the type of battery to be used in CIIS, as each device model requires a specific model.<br>- Include in the emergency kit the long-acting insulins, in case of failure in the device that prevents its operation for a longer time.<br>- Replace the phrase "fast-acting glucose tablets" with "fast-absorbing carbohydrates" and exemplify<br>- Include applicator figure and 70% swabs. |
| Figure 10 | - In Medtronic's CIIS models, the guidelines are the use of no cleaning product other than 70% alcohol. |

**Table 3** – Distribution of responses to the Suitability Assessment of Materials by users, Fortaleza, Ceará, Brazil, 2019

| Variables | PS[a] | S[b] |
|---|---|---|
| 1 Content | | |
| 1.1 Objective is evident facilitating a prompt understanding of the material | 1 | 5 |
| 1.2 Content addresses information related to insulin pump treatment | 1 | 5 |
| 1.2 The purpose is limited to such purposes as the viewers can reasonably understand in the time allowed. | 1 | 5 |
| 2 Language | | |
| 2.1 Reading level is suitable for readers' understanding | 1 | 5 |
| 2.2 Conversation style makes it easy to understand the text | - | 6 |
| 2.3 Vocabulary uses common words | 1 | 5 |
| 3 Graphic illustrations | | |
| 3.1 Cover attracts attention and depicts the purpose of the material | 2 | 4 |
| 3.2 Illustrations feature key visual messages so that readers can understand the key points alone, without distractions | 2 | 4 |
| 4 Motivation | | |
| 4.1 There is interaction of text and/or figures with readers, leading them to solve problems, make choices and/or demonstrate skills | 2 | 4 |
| 4.2 Desired behavior patterns are modeled or well demonstrated | 1 | 5 |
| 4.3 There is motivation for self-efficacy, i.e., people are motivated to learn because they believe that tasks and behaviors are feasible | 2 | 4 |
| 5 Cultural suitability | | |
| 5.1 The material is culturally appropriate to the target audience's logic, language and experience | - | 6 |
| 5.2 Displays culturally appropriate images and examples | - | 6 |

*a = Partially suitable; b = Suitable. Response scale: 2 – Suitable; 1- Partially suitable; 0 – Unsuitable.*

The process of adapting the educational material to judges' suggestions is an essential step to make the technology more complete, more scientifically rigorous and effective during the health education activity[22]. In this sense, the importance of multidisciplinarity of the judges who analyzed the serial album is highlighted. The assessment by professionals from different areas is the opportunity in which it can really be said that the work is being done as a team, making it possible to standardize and officialize the conducts in the care of patients, with the participation of all[23]. Thus, educational technologies involving CIIS become crucial tools, since there are several models of CIIS on the market, and standardizing this care by addressing the common points of each device optimizes patients' learning.

The judges suggested emphasizing that the device is applied to the subcutaneous tissue through a catheter; in this way, it allows patients to understand the device's application route, in addition to allowing them to adapt to the nomenclature of the CIIS components. Treatment education is one of the five main components of disease management, so patients need to understand that catheters are inserted with the help of a guide needle, which is removed and discarded after application, leaving only a Teflon cannula in patients' subcutaneous tissue[24].

The term "bolus" was suggested by the judges, due to "pulses". The CIIS is an electronically controlled mechanical device that continuously injects insulin, which can be in basal (continuous) or bolus form. Insulin bolus infusion is the way to maintain blood glucose stability after food intake or to correct hyperglycemia[25].

In relation to insulin and CIIS, the choice of ultra-rapid insulin for administration by CIIS is emphasized, as it has an earlier and more predictable peak of action than the regular one, and not only because it causes less hypoglycemia[26]. Insulins peaking even earlier than these analogues (such as faster-acting insulin aspart, Fiasp®), approved in Brazil, Canada and Europe, have been used and have shown better results than current ultrafast insulins[27].

Clinical trials carried out in individuals with 1DM, using ultra-rapid insulin, demonstrate twice as fast the onset of exposure in the bloodstream and in the first 30 minutes, in addition to a 74% superior insulin action in the first 30 minutes[28]. For this, it is necessary to maintain the infusion integrity set for proper functioning and better results. The literature indicates that the cannula should be changed every 2 to 3 days in order to avoid allergic reactions, insertion site infections or obstructions[24].

We sought to adapt the serial album content with regard to hypoglycemia, the most important limiting factor in achieving optimal glycemic control in patients with 1DM, excluding psychosocial aspects such as lack of adherence to treatment and unsuitable family support[24]. In 2017, a new classification of hypoglycemia was suggested, divided into levels: level 1 (glycemia ≤ 70 mg/dL, but ≥ 54 mg/dL); level 2 (glycemia < 54 mg/dL, with onset of neuroglycopenic symptoms); level 3 (severe hypoglycemia, associated with cognitive and/or physical impairment and need for help from others)[29].

In this area, to improve the technology developed, information was included on the amount of carbohydrates needed according to blood glucose value, and not just an example. It was noticed that, thus, it became clearer for patients to understand the appropriate way to correct hypoglycemia. The literature indicates that level 1 hypoglycemia can be treated with 15 g of carbohydrates; level 2, with 30 g of carbohydrates; and level 3, with medical emergency intervention[24].

A common finding in patients with 1DM is asymptomatic nocturnal hypoglycemia. Guidance to detect and prevent this event is essential, as repeated nocturnal hypoglycemia can compromise daytime performance and counter-regulation of patients[30]. Regarding nocturnal hypoglycemia prevention, we emphasized that patients should check the best snack option with their professional, because when patients have adjusted basal/bolus rates, there is no need to maintain this conduct. Moreover, each patient must have a nutritional or insulin dose orientation before bed and there is also a CIIS model that has a system to avoid hypoglycemia.

As for emergency kits, there are CIIS cells and batteries, which must be used according to the recommendations of each manufacturer. However, it is important to include long-acting insulins in the event that the device fails to function for a longer period of time. Literature warns about keeping an emergency kit with syringe or pen and needles for pens and physician-prescribed basal/bolus insulins in case of problems or inability to use the pump[24]. It is noteworthy that, more important than having the emergency kit for patients, is knowing how to use it correctly. To address the lack of information on this topic, we opted for the development of a figure illustrating the recommendations on the items that should compose the emergency kit, being something innovative for patients' health education.

The target audience also positively assessed the serial album, considering it important to promote knowledge, with rich content combined with clarity, suitable format and explanatory illustrations. Validating an educational material with representatives of the target audience is a necessary attitude and an important benefit for the researcher and the team involved. It is a moment in which it is realized what is really missing, what was not understood and the distance that exists between what is written and what is understood and the way it is understood[22].

The results obtained by validity with judges and the target audience were fundamental for improving the innovative technology developed. Additionally, there is a need for support from government agencies for the reproduction, dissemination and wide distribution of this material in health services, in different media, in addition to the printed version.

### Study limitations

A limitation of this study highlights the lack of clinical validity stands, i.e., application to a larger group of CIIS users. Therefore, it is suggested to expand the study to test the construct and instrument effectiveness validity in the context of educational actions on insulin therapy through CIIS. Furthermore, in Brazil, there are still locations without access to diabetes technology, such as CIIS, which reduces the material scope and educational content dissemination.

### Contributions to nursing, health or public policy

The instrument developed may contribute as a tool capable of facilitating communication and assisting educational interventions for the proper management of CIIS, enabling better glycemic control and quality of life for people with DM using the device.

In addition to this, it will direct and systematize the guidelines applicable to nurses in this process.

## CONCLUSION

The serial album "Continuous Insulin Infusion System (CIIS) in diabetes management", was designed as an innovative diabetes educational strategy, validated with excellent CVI and appearance. The proposal to present information on insulin therapy through CIIS presented practical and scientific relevance, having the potential to contribute to a more suitable and systematized approach on the subject in educational processes.

It is noteworthy that the study does not end here, since the technology needs continuous updates, due to scientific advances. Therefore, follow-up aims to verify the serial album's effectiveness and efficiency as an educational technology on insulin therapy by CIIS.

## SUPPLEMENTARY MATERIAL

The study data came from a dissertation entitled "*Álbum seriado sobre insulinoterapia por Sistema de Infusão Contínua de Insulina: contrução e validação*"[27], and were shared in repository. Link: https://doi.org/10.48331/scielodata.Y0GOUW

## REFERENCES

1. Beobide-Telleria I, Martínez-Arrechea S, Ferro-Uriguen S, Alaba-Trueba J. Prevalencia de diabetes mellitus tipo 2 y su tratamiento farmacológico en personas institucionalizadas en centros residenciales. Farm Hosp. 2020;44(3):92-5. https://doi.org/10.7399%2Ffh.11375
2. Kesavadev J, Saboo B, Krishna MB, Krishnan G. Evolution of insulin delivery devices: from syringes, pens and pumps to DIY Artificial Pancreas. Diabetes Ther. 2020;22(6):1251-69. https://doi.org/10.1007/s13300-020-00831-z
3. Azevedo S, Saraiva J, Caramelo F, Fadiga L, Barros L, Baptista C, et al. The impacto f prolonged use of continuous subcutaneous insulin infusion in the controlo f type-1 diabetes. Acta Med Port. 2019;32(1):17-24. https://doi.org/10.20344/amp.10778
4. Jendle J, Pöhlmann J, Portu S, Smith-Palmer J, Roze S. Cost-effectiveness analysis of the MiniMed 670G Hybrid Closed-Loop System versus continuous subcutaneous insulin infusion for treatment of type 1 diabetes. Diabetes Technol Ther. 2019;21(3):110-8. https://doi.org/10.1089/dia.2018.0328
5. Quirós C, Viñals C, Giménez M, Roca D, Conget I. Evaluación de la efectividad de la terapia ISCI a largo plazo mediante el objetivo combinado de descenso de HbA1c y aysencia de hipoglucemia grave. Endocrinol Diabetes Nutr. 2019;66(9):534-9. https://doi.org/10.1016/j.endinu.2019.03.009
6. Santos SB, Ramos JLS, Machado APA, Lopes MTN, Abreu LC, Bezerra IMP. Tecnologia educativa para adolescentes: construção e validação de álbum seriado sobre sífilis adquirida. Rev Bras Promoç Saúde. 2020;33:9970. https://doi.org/10.5020/18061230.2020.9970
7. Brilhante RRC. Álbum seriado sobre insulinoterapia por Sistema de Infusão Contínua de Insulina: contrução e validação [Internet]. Universidade Estadual do Ceará. 2018 [cited 2021 Oct 6]. Available from: http://www.uece.br/ppcclis/wpcontent/uploads/sites/55/2019/12/RAQUEL.pdf
8. Costa JD, Marques KMAP, Frota KC, Oliveira LS. Tecnologias educacionais no cuidado às crianças com Diabetes Mellitus tipo 1: síntese do conhecimento. Espac Saúde. 2021;22:e732. https://doi.org/10.22421/1517-7130/es.2021v22.e732
9. Gama DM, Corcini LMCS, Schimith MD, Badke MR, Palha PF, Weiller TH, Fernandes MNS. Validated educational technologies for health education for people with diabetes mellitus: integrative review. Res Soc Develop.2022;11(4):e37311427443. https://doi.org/10.33448/rsd-v11i4.274432
10. Pasquali L. Psicometria: teoria dos testes na psicologia e na educação. Petropólis: Vozes; 2011.
11. Jasper MA. Expert: a discussion of the implications of the concept as used in nursing. J Adv Nurs. 1994;20(4):769-76. https://doi.org/10.1046/j.1365-2648.1994.20040769.x
12. Polit DF, Beck CT. Fundamentos de pesquisa em enfermagem: avaliação de evidências para a prática da enfermagem. 9 ed. Artmed; 2019.
13. Sociedade Brasileira de Diabetes (SBD). Diretrizes da Sociedade Brasileira de Diabetes 2017-2018. São Paulo: Clannad, 2017.
14. Ministério da Saúde (BR). Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Estratégias para o cuidado da pessoa com doença crônica: diabetes mellitus. Brasília: Ministério da Saúde; 2013.
15. Meditronic. MiniMed 640G: Guia do utilizador do sistema [Internet] Medtronic MiniMed. 2015 [cited 2020 Jun 25]. Available from: https://www.medtronicdiabeteslatino.com/br/wp-content/uploads/2018/12/Sistema-Minimed-640G.pdf
16. Accu Chek Spirit Combo. Sistema de Infusão Contínua de Insulina. Instruções de uso [Internet]. Roche. 2012 [cited 2020 Jun 25]. Available from: //www.accu-chek.com/sites/g/files/iut341/f/accu-chek-spirit-combo-user-guide-en_0.pdf
17. Meditronic. Paradigm Veo: Guía del usuário [Internet]. Medtronic Minimed. 2008 [cited 2020 jun 25]. Available from: https://www.medtronicdiabeteslatino.com/br/wp-content/uploads/2018/12/Veo-754.pdf
18. Leite SS, Áfio ACE, Carvalho LV, Silva JM, Almeida PC, Pagliuca LMF. Construction and validation of na educational content validation instrument in health. Rev Bras Enferm. 2018;71(Suppl 4):1635-41. https://doi.org/10.1590/0034-7167-2017-0648
19. Souza ACC. Construção e validação de tecnologia educacional como subsídio à ação do enfermeiro na promoção da qualidade de vida e adesão ao tratamento de pessoas com hipertensão [Tese]. Fortaleza (CE): Universidade Estadual do Ceará; 2015.

20. Doak C, Doak L, Root J. Teaching patients with low literacy skills [Internet]. Philadelphia: JB Lippincott; 1996 [cited 2021 Sep 25]. Available from: https://www.hsph.harvard.edu/healthliteracy/resources/teaching-patients-with-low-literacy-skills/

21. Sousa CS, Turrini RNT, Poveda VB. Translation and adaptation of the instrument Suitabilty Assessment of Materials (SAM) into portuguese. Rev Enferm UFPE. 2015;9(5):7854-61. https://doi.org/10.5205/reuol.6121-57155-1-ED.0905201515

22. Lima ACMACC, Bezerra KC, Sousa DMN, Rocha JF, Oriá MOB. Development and validtion of booklet for prevention of vertical HIV transmission. Acta Paul Enferm. 2017;30(2):181-9. https://doi.org/10.1590/1982-0194201700028

23. Santiago JCS, Moreira TMM. Booklet content validation on excess weight for adults with hypertension. Rev Bras Enferm. 2019;72(1):95-101. https://doi.org/10.1590/0034-7167-2018-0105

24. Sociedade Brasileira de Diabetes. Diretrizes da Sociedade Brasileira de Diabetes 2019-2020. São Paulo: Clannad; 2019.

25. Sikes KA, Van Name MA, Tamborlane WV. Type 1 diabetes in children and adolescents. Pediatric Endocrinol. 2018;717-36.

26. Pozzilli P, Battelino T, Danne T, Hovorka R, Jarosz-Chobot P, Renard E. Continuous subcutaneous insulin infusion in diabetes: patient populations, safety, efficacy, and pharmaco economics. Diabetes Metab Res Rev. 2016;32(1):21-39. https://doi.org/10.1002/dmrr.2653

27. Danne T, Phillip M, Buckingham B, Jarosz-Chobot P, Saboo B, Urakami T, et al. ISPAD Clinical Practice Consensus Guidelines 2018: insulin treatment in children and adolescents with diabetes. Pediatr Diabetes. 2018;19(27):115-35. https://doi.org/10.1111/pedi.12718

28. Heise T, Pieber TR, Danne T, Erichsen L, Haahr H. A Pooled Analysis of Clinical Pharmacology Trials Investigating the Pharmacokinetic and Pharmacodynamic Characteristics of Fast-Acting Insulin Aspart in Adults with Type 1 Diabetes. Clin Pharmacokinet. 2017;56:551-9. https://doi.org/10.1007/s40262-017-0514-8

29. Cryer PE. Individualized glycemic goals and an expanded classification of severe hypoglycemia in diabetes. Diabetes Care. 2017;40(12):1641-3. https://doi.org/ 10.2337/dc16-1741

30. Bachmann S, Hess M, Martin-Diener E, Denhaerynck K, Zumsteg U. Nocturnal hypoglycemia and physical activity in children with diabetes: new insights by continuous glucose monitoring and accelerometry. Diabetes Care. 2016;39:e95–e96. https://doi.org/10.2337/dc16-041