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ORIGINALS

Development and validation of an animated infographic for health education of people with cardiometabolic diseases

Desarrollo y validación de infografía animada para la educación en salud de personas con enfermedades cardiometabólicas

Desenvolvimento e validação de infográfico animado para educação em saúde de pessoas com doenças cardiometabólicas

Francisco Marcelo Leandro Cavalcante[1]
Dariane Veríssimo de Araújo[2]
Thamires Sales Macedo[2]
Angelina Germana Jones[1]
Luciana Mara Monti Fonseca[3]
Lívia Moreira Barros[1]

[1] Health Science Institute, University for International Integration of the Afro-Brazilian Lusophony, Brazil. marceloleandrocavalcante98@hotmail.com
[2] Department of Nursing, Federal University of Ceará, Brazil.
[3] Ribeirão Preto School of Nursing, University of São Paulo, Brazil.

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ABSTRACT:

Objective: To develop and validate an animated infographic to health education of individuals with Cardiometabolic Diseases.

Methods: Methodological study carried out from November 2021 to January 2023, in three phases: pre-production, production and post-production. In the pre-production, the infographic's content was identified from a comprehensive scoping review and the storyboard script were developed. In production, the prototype of the infographic was constructed, the audio recording of the script content and its synchronization with the infographic screens were also made. In post-production, the finalization and storage of the infographic was carried out. Thus, its content and visual appeal were assessed by experts and target audience. The Content Validity Index and Appearance Validity Index were calculated to ensure the infographic's validity. A minimum agreement of 0.80 was considered.

Results: The infographic's content featured illustrative images, animations, explanatory texts, and audio. Over eight minutes and 57 seconds, it addressed key modifiable cardiovascular risk factors, potential complications, healthy lifestyle practices, adherence to pharmacological treatments, and the importance of multiprofessional health monitoring. The overall validity indices were 0.97 from the experts and 1 from the target audience.

Conclusion: The animated infographic proved to be a valid, comprehensible, and engaging educational resource which can be a useful educational technology in health education for individuals with Cardiometabolic Diseases.

Keywords: Chronic Disease; Educational Technology; Animation; Health Education; Health Promotion.

RESUMEN:

Objetivo: Desarrollar y validar una infografía animada para la educación en salud de personas con Enfermedades Cardiometabólicas.
Método: Estudio metodológico realizado de noviembre de 2021 a enero de 2023, en tres fases: preproducción, producción y postproducción. En la preproducción, se identificó el contenido de la infografía a partir de una revisión de alcance integral y se desarrolló el guion del *storyboard*. En producción, se construyó el prototipo de la infografía, se realizó la grabación de audio del contenido del guion y su sincronización con las pantallas infográficas. En la postproducción se llevó a cabo la finalización y almacenamiento de la infografía. Además, su contenido y apariencia han sido validados por expertos y público objetivo. Se calculó el Índice de Validez de Contenido y el Índice de Validez de Apariencia para evaluar la validez de la infografía. Se consideró una concordancia mínima de 0,80.
Resultados: El contenido de la infografía incluyó imágenes ilustrativas, animaciones, textos explicativos y audio. A lo largo de ocho minutos y 57 segundos, se abordaron los principales factores de riesgo cardiovascular modificables, las posibles complicaciones, las prácticas de estilo de vida saludable, la adherencia a los tratamientos farmacológicos y la importancia del seguimiento multiprofesional de la salud. Las tasas de validez global fueron de 0,97 para los expertos y de 1 para el público objetivo.
Conclusión: La infografía animada ha demostrado ser un recurso educativo válido, comprensible y atractivo que puede ser una tecnología educacional útil en la educación en salud de personas con Enfermedades Cardiometabólicas.

Palabras clave: Enfermedad crónica; Tecnología Educativa; Animación; Educación en Salud; Promoción de la Salud.

RESUMO:

Objetivo: Desenvolver e validar um infográfico animado para educação em saúde de pessoas com Doenças Cardiometabólicas.
Método: Estudo metodológico realizado no período de novembro de 2021 a janeiro de 2023 em três fases: pré-produção, produção e pós-produção. Na pré-produção, identificou-se o conteúdo do infográfico a partir de uma revisão escopo abrangente e o roteiro do *storyboard* foi desenvolvido. Na produção, o protótipo do infográfico foi construído. Também foi feita a gravação em áudio do conteúdo do roteiro e a sincronização com as telas do infográfico. Na pós-produção, foi realizada a finalização e armazenamento do infográfico. Ademais, seu conteúdo e aparência foram validados por especialistas e público-alvo. O Índice de Validade de Conteúdo e o Índice de Validade de Aparência foram calculados para avaliar a validade do infográfico. Considerou-se concordância mínima de 0,80.
Resultados: O conteúdo do infográfico contou com imagens ilustrativas, animações, textos explicativos e áudio. Ao longo de oito minutos e 57 segundos, abordou os principais fatores de risco cardiovascular modificáveis, possíveis complicações, práticas de estilo de vida saudável, adesão a tratamentos farmacológicos e a importância do monitoramento multiprofissional da saúde. Os índices de validade geral foram de 0,97 dos especialistas e 1 do público-alvo.
Conclusão: O infográfico animado mostrou-se um recurso educacional válido, compreensível e envolvente que pode ser uma tecnologia educacional útil na educação em saúde de indivíduos com Doenças Cardiometabólicas.

Palavras-chave: Doença Crônica; Tecnologia Educacional; Animação; Educação em Saúde; Promoção da Saúde.

INTRODUCTION

Cardiometabolic diseases (CMD), such as Diabetes Mellitus (DM), Systemic Arterial Hypertension (SAH), obesity and Cardiovascular Diseases (CVD), are among the leading causes of morbidity and mortality globally, with a direct and significant impact on the burden of disease and financial costs to health care systems[1,2].

There are several risk factors for the development of these diseases, of which the modifiable ones stand out, such as: sedentary lifestyle, unhealthy diet, smoking, overweight and abusive use of alcoholic beverages. While the prevalent non-modifiable risk factors include aspects such as sex, age, race, and heredity[3,4]. Most risk factors are changeable, but the reduction and control of CMD through lifestyle modifications is still a challenge for patients.

Thus, the association between behavioral and socioeconomic factors contributes to the high incidence and prevalence rates of CMD worldwide, as well as to the acute and chronic complications associated with these diseases, and premature death[5,6,7]. These chronic conditions also contribute to disability, which results in early retirement and absence from social, economic and productive activities, thereby affecting the quality of life and well-being of the population[1].

This challenging scenario reinforces the importance of educational interventions and technologies to health promotion of people with CMD, as they can help maintain healthy lifestyle habits, improve knowledge, quality of life and self-care, and prevent health complications[8,9,10]. Among the educational technologies for this purpose, animated infographic is highlighted as a tool in digital animation format that presents short informative texts combined with audiovisual resources such as photos, maps, illustrations, animations and audio to address a topic of interest. This resource increases the accessibility of information, facilitates motivation, and captures the attention of the audience in teaching-learning process[11,12].

A meta-analytic review showed that educational technologies in the form of digital animations are effective as aids in health education for a variety of audiences, as they promote meaningful learning by stimulating motivation and active participation of patients in educational interventions, enhancing the process of selecting, organizing, and integrating the information conveyed[13].

Animated infographics are increasingly being used as an educational technology in Nursing area[14,15]. However, it's still little explored as an educational resource in health education and health promotion for people with CMD. Most existing studies focus on other educational technologies such as mobile health, websites, flipchart, and booklets. These resources help patients in the process of building the individual's learning about their health condition and self-care measures. Researchers still reinforce the relevance of using interactive technology, while it has gained prominence for generating positive impacts on changes in habits and lifestyle[16]. In addition, they can help patients facilitate their interactions with health professionals[17].

Therefore, this reinforces the relevance of new research on development and validation of animated infographics on this topic. Such endeavors hold potential to

produce effective educational tools that can significantly enhance health promotion and health education initiatives for the people with CMD[18]. Furthermore, it is believed that the development of educational interventions mediated by the animated infographic could facilitate adherence to self-care behaviors and healthy lifestyle, corroborating with the prevention and screening of complications and health problems. Considering the above, the present study aimed at developing and validating an animated infographic to health education of individuals with CMD.

METHODS

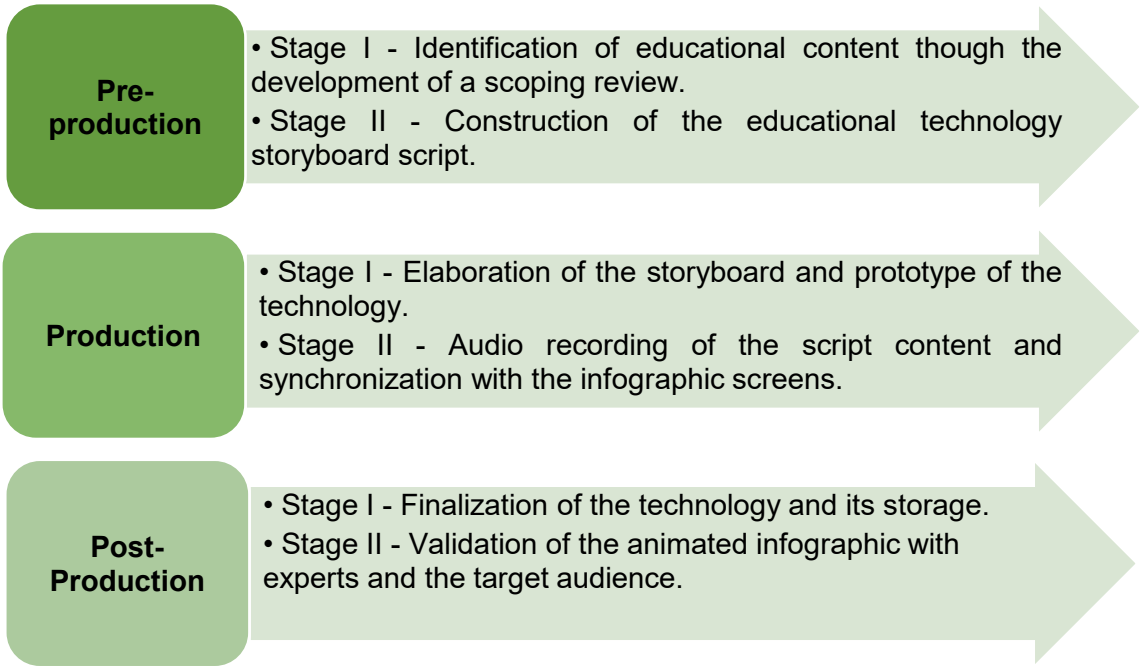
Study design

This is a methodological study about the process of developing and validating an animated infographic to promote the health of CMD individuals. The study occurred between November 2021 and January 2023.

Development of the animated infographic

The development of the animated infographic took place in the following stages: pre-production, production and post-production[19], as summarizes Figure 1.

Figure 1. Development stages of the animated infographic.



Source: The authors.

As illustrated in Figure 1, a preliminary scoping review was conducted to map out nursing care directed towards health promotion of individuals with CMD[20]. The findings of the review were used to develop the animated infographic script. Thus, the content was structured based on the guidelines of the theoretical-methodological framework of Doak, Doak and Root (1996)[21], including strategies such as the construction of sentences in the active voice to facilitate understanding and stimulate the reader's attitudes, the use of short sentences, accessible language, and the

avoidance of technical terms, and the incorporation of interactions through illustrations and questions directed at patients are employed to enhance clarity and memorability.

Subsequently, information from the script was recorded in audio format for subsequent synchronization with the screens of the animated infographic. Additionally, the script delineated specifications for the graphic designer responsible for developing educational technology, including instructions for creating the educational technology's characters and illustrations.

The graphic designer proceeded to construct the storyboard utilizing the Adobe After Effects CC program. At this juncture, the color palette, characters, images, and animations to be utilized in the preliminary sketch of each screen were delineated, in addition to the textual information pertaining to the educational technology. Subsequently, the prototype of the infographic was constructed in digital media format, with all the elements assembled, thus enabling the technology to be visualized in advance. At this juncture, the audio recording of the content of the script was synchronized with the screens of the infographic.

Once the animated infographic had been constructed, it underwent a final review by the researchers. During this process, the textual information and illustrations that had been previously defined were reassessed and adjusted. Subsequently, the educational technology was finalized and stored on Google Drive. Thereafter, it was submitted for validation by experts and the target audience.

Expert validation

The content and appearance of the animated infographic were validated by nurses with expertise in CMD, educational technologies, and/or health education. The sample of experts was defined by applying the formula $n=Za^2.P.(1-P)/e^2$, whose stipulated values were: confidence level (Za)=95%, proportion of expert agreement (P)=85%, and accepted difference from what is expected (e) = 15%. This resulted in a sample size of 22 experts[22].

The experts were selected according to the criteria established by Jasper (1994)[23]: 1 - to possess knowledge and skills related to the subject matter, such as supervision of dissertations and theses related to cardiometabolic diseases or educational technologies, or 2 - to possess knowledge and skills derived from their professional experience, as to have teaching experience in the field of nursing in CMD or experience in caring for the target population, or 3 - to possess expertise in a specific area, such as experience in developing educational technologies, participation in evaluation boards related to the subject, and having published articles on CMD or educational technologies; holding at least an undergraduate degree.

The experts were sent via e-mail the form built on Google Forms with the invitation letter to participate in the research, the Informed Consent Form (ICF), the link to access the animated infographic and the Educational Content Validation Instrument in Health (ECVIH), validated with good reliability (ICC>0.8; p <0.05).

The ECVIH comprises 18 items, divided into three domains: objectives, structure/presentation, and relevance of the educational technology. For each item in the domains, the experts provided a rating on a Likert scale, with scores of 2 =

"adequate," 1 = "partially adequate," and 0 = "inadequate"[24]. The deadline stipulated for evaluation was 14 days. It is important to note that the experts should provide suggestions for infographic improvement, especially for the items assigned by response 1. It is noteworthy that a space was made available for recording suggestions or justifications from the experts. The suggestions were analyzed and forwarded to the graphic designer to make the necessary adjustments to the animated infographic.

Target audience validation

Following expert validation, the animated infographic underwent further validation by patients diagnosed with CMD. This stage was crucial for determining the suitability of the language and structure of the technology. This stage was conducted at a Family Health Center (FHC), which is part of the Primary Health Care (PHC) system from a municipality in northeastern Brazil, with a convenience sample 22 participants. This sample size was determined using the formula $n=Za^2.P.(1-P)/e^2$, with the stipulated values being confidence level (Za)=95%, proportion of experts agreement (P)=85%, and accepted difference from what is expected (e)=15%[22].

Individuals aged 18 or above, literate, followed up at a PHC service, and diagnosed with CMD, such as hypertension, diabetes, obesity, or CVD were included in this study. Individuals were excluded from the study if they had any physical or mental limitations that would compromise their ability to participate in the evaluation of the animated infographic.

Once informed consent had been obtained, the sociodemographic characterization form was administered to the target audience in a private setting. The form collected information on a range of variables, including gender, age, level of education, marital status, occupation, and comorbidities. Subsequently, the animated infographic was played back once on Tablet A. It is noteworthy that the researcher remained near the participants to address any queries they might have.

Immediately following its reproduction, the educational technology was evaluated by the target audience using the Health Education Technology Visual Validation Tool, which addresses 12 questions through which participants evaluated various aspects of the educational technology, including shapes, colors, images, text, the number and sizes of figures, language, motivation for learning, and stimulus to change behavior. For each item, participants provided a rating on a Likert scale of 1 = "totally disagree" to 5 = "totally agree"[25]. Based on these scores the Appearance Validity Index (FVI) was calculated. On the evaluation, the participants were able to record comments or suggestions to animated infographic improvement.

Data analysis

The data was organized in Microsoft Excel 2016 and then exported to the Software R for statistical analysis. The experts and target audience were characterized using descriptive statistics, including absolute and relative frequencies. To verify the validity of the animated infographic by experts, the Content Validity Index (CVI) was calculated. This involved calculating the item-level content validity index (I-CVI) for each item and the overall CVI for the validation instruments as a whole. Furthermore,

the FVI in the target evaluation was calculated based on CVI estimation method, in which FVI for each item (FVI-I) and Total FVI (FVI-T) were calculated[25]. Thus, it is worth noting that the animated infographic was considered valid with a minimum agreement of 0.80 in both the evaluation by the experts and the target audience[26].

Furthermore, the binomial test was employed to verify statistically validation agreement of the experts and the target audience, separately, in relation to the items with a CVI and FVI equal to or greater than 0.80[27].

Ethical Considerations

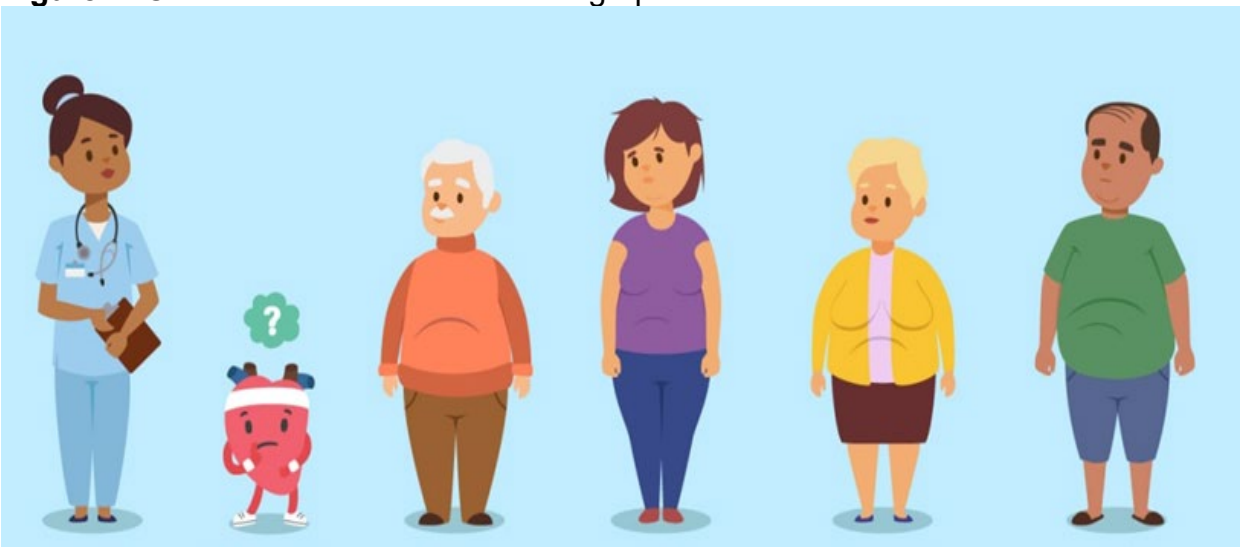
The study is an excerpt from the project entitled “Effectiveness of digital educational intervention to promote the health of people with cardiometabolic diseases post-COVID-19”, which, in compliance with Resolution nº 466/2012 of the Brazilian National Health Council, was approved by the Research Ethics Committee of University for International Integration of the Afro-Brazilian Lusophony, under opinion number 4.429.720 and CAAE 37047620.1.0000.5576.

RESULTS

Considering the results of the scoping review, the educational content of script included nine topics focused on promoting a healthy lifestyle and self-care, controlling cardiovascular risk factors, and encouraging adherence to multidisciplinary monitoring. Thus, these topics were: (1) describing what CMD are, (2) healthy eating and water intake, (3) practicing physical activity, (4) weight control, (5) medication management, (6) smoking and alcohol cessation, (7) improving sleep, (8) stress control, and (9) follow-up with the multidisciplinary team and proper adherence to treatment.

Once the script was complete, the professional graphic designer proceeded to create the storyboard, which defined the images that would represent the educational content and the characters. The main character, representing a nurse, introduced and led the educational information, accompanied by the cardio mascot, as illustrated in Figure 2.

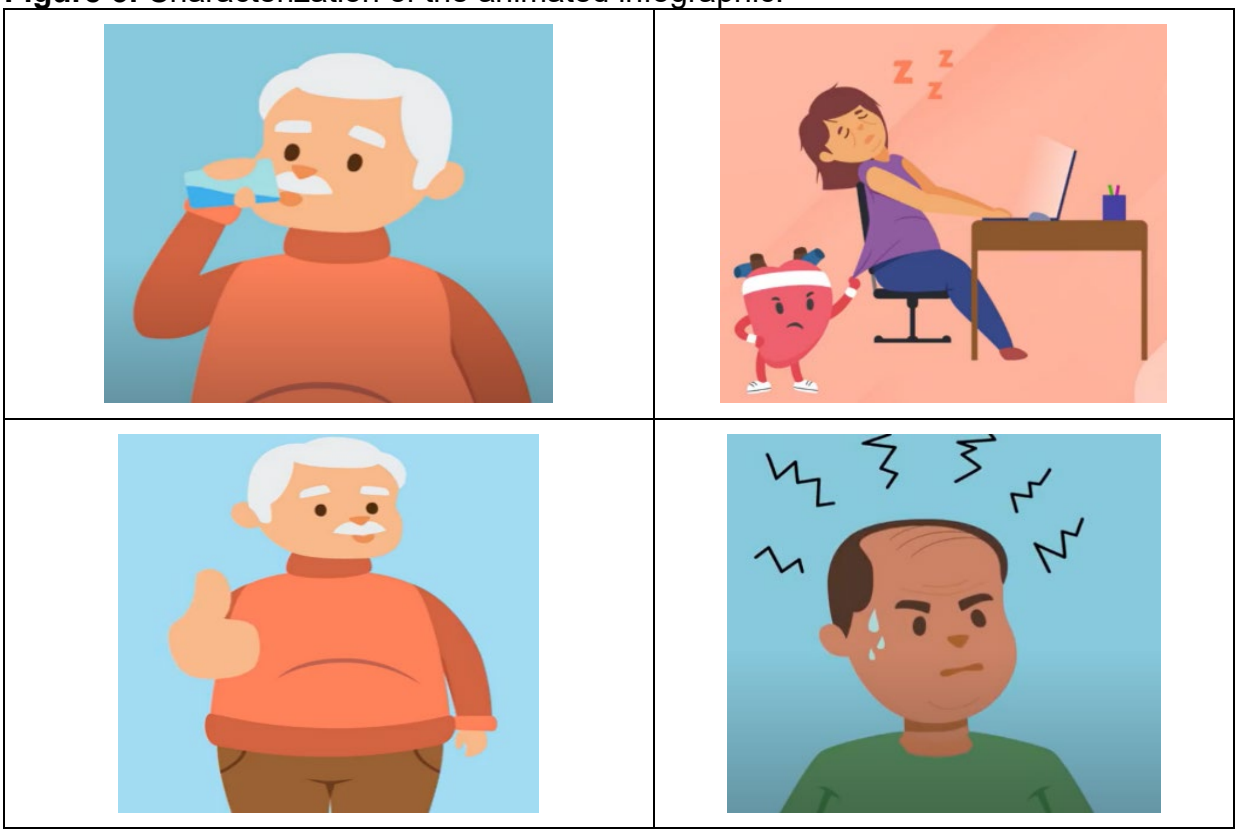
Figure 2. Characters in the animated infographic.



Source: The authors.

Throughout the animation, the characters were endowed with physical characteristics that faithfully represented the situations exemplified, as illustrated in Figure 3. This aspect facilitates the characters' comprehension of the underlying themes, as it enables them to associate the image with the content described.

Figure 3. Characterization of the animated infographic.

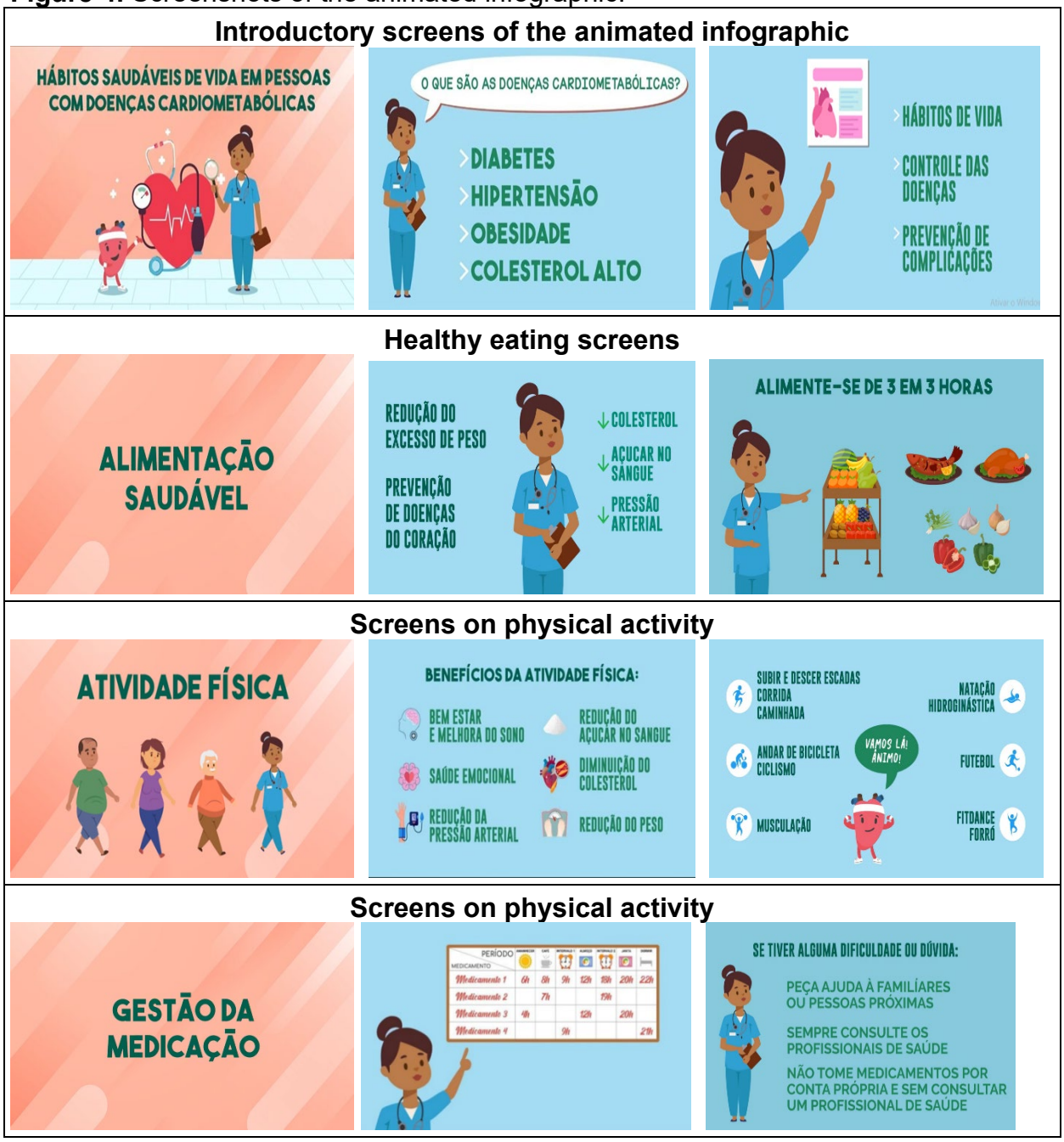


Source: The authors.

The educational content is presented in a logical sequence, with each topic situated on a separate screen. The educational content was structured using illustrative images and animations that represent everyday aspects and habits, as well as objective texts structured in accessible language and with an active voice, which allows for a conversational tone with the patient. Furthermore, explanatory audio was employed to enhance the intelligibility of the subject matter.

The animated infographic, entitled "Healthy Lifestyle Habits in People with Cardiometabolic Diseases," comprised the first version in Brazilian Portuguese, which lasted 8 minutes and 57 seconds. Figure 4 presents examples of the screens in the animated infographic.

Figure 4. Screenshots of the animated infographic.



Source: The authors.

Nurses from 25 to 56 years old participated in infographic validation, of whom 19 (86.4%) were female and three (13.6%) were male, all from northeastern Brazil. Regarding their academic degrees, 15 (68.2%) had a specialization degree, three (13.6%) had a master's degree, three (13.6%) had only the bachelor's degree, and one (4.5%) had a PhD degree. Table 1 presents the items assessed and their respective I-CVI.

Table 1: Distribution of experts' agreement on the content assessment of the animated infographic (N=22).

Items	Experts evaluation				
	A* n (%)	PA† n (%)	I‡ n (%)	I-CVI§	p‖
Objectives					
1. Addresses the proposed theme	21 (95.5)	1 (5)	-	0,90	0.95
2. Suitable for the teaching-learning process	21 (95.5)	1 (5)	-	0,90	0.95
3. Clarifies potential doubts about the discussed topic	22 (100)	-	-	1	1
4. Promotes reflection on the topic	22 (100)	-	-	1	1
5. Encourages behavior change	20 (90.9)	2 (9.1)	-	0,81	0.90
Structure and Presentation					
6. Language appropriate for the target audience	21 (95.5)	1 (5)	-	0,90	0.95
7. Language appropriate for educational material	22 (100)	-	-	1	1
8. Interactive language, allowing active engagement	20 (90.9)	2 (9.1)	-	0,81	0.90
9. Correct information	21 (95.5)	1 (5)	-	0,90	0.95
10. Objective information	22 (100)	-	-	1	1
11. Clarifying information	22 (100)	-	-	1	1
12. Essential information	22 (100)	-	-	1	1
13. Logical sequence of ideas	22 (100)	-	-	1	1
14. Current topic	22 (100)	-	-	1	1
15. Appropriate text size	21 (95.5)	1 (5)	-	0,90	0.95
Relevance					
16. Animated infographics enhance learning	22 (100)	-	-	1	1
17. Contributes to knowledge in the field	22 (100)	-	-	1	1
18. Stimulates interest in the topic	21 (95.5)	1 (5)	-	0,90	0.95

Source: The authors.
*A: Adequate; †PA: Partially adequate; ‡I: Inadequate; §I-CVI: Item-level Content Validity Index; ‖P: Teste binomial.

Table 1 demonstrates that all items were evaluated favorably by the experts, achieving I-CVI values ≥ 0.90. The overall CVI of 0.97 affirms the adequacy and validity of both the content and visual presentation of the animated infographic. Experts provided key recommendations for enhancement, including rectifying spelling errors, consolidating similar educational guidelines, and incorporating more illustrations depicting unhealthy foods. Experts characterized the educational technology as clear, objective, comprehensible, well-structured, and pertinent to the health promotion and education of individuals with CMD.

Evaluation of the technology among the target audience involved 22 participants, aged between 32 and 79 years (mean age = 58.27 years). Table 2 details the clinical and sociodemographic characteristics of participants.

Table 2: Sociodemographic profile of the target audience (n=22)

Variable	n (%)
Sex	
Male	4 (18.2)
Female	18 (81.8)
Education	
Incomplete primary education	16 (72.7)
Complete high school	3 (13.6)
Incomplete high school	2 (9.1)
Complete primary education	1 (4.5)
Marital status	
Single	11 (50.0)
Married	8 (36.4)
Widower	2 (9.1)
Divorced	1 (4.5)
Profession	
Retired	14 (63.6)
Homemaker	6 (27.3)
General services assistant	1 (4.5)
Housekeeper	1 (4.5)
Self-reported comorbidities	
Systemic Arterial Hypertension	20 (90.9)
Dyslipidemia	9 (40.9)
Diabetes Mellitus	6 (27.3)
Obesity	3 (13.6)
Cardiac arrhythmia	1 (4.5)
Coronary syndrome	1 (4.5)

Source: The authors.

As for the validation of educational technology by the target audience, an FVI-T=1 was obtained, with 100% agreement on the items, obtaining FVI-I=1 (p=1), as described in Table 3.

Table 3: Distribution of agreement among target audience representatives on the evaluation of the animated infographic appearance (N=22).

Items	n (%)	I-FVI*	p†
Objectives			
1. The illustrations are appropriate for the target audience.	22 (100.0)	1	1
2. The illustrations are clear and easy to understand.	22 (100.0)	1	1
3. The illustrations are relevant to the target audience's understanding of the content.	22 (100.0)	1	1
4. The colors of the illustrations are appropriate for the type of material.	22 (100.0)	1	1
5. The shapes of the illustrations are appropriate for the type of material.	22 (100.0)	1	1
6. The illustrations depict the daily lives of the target audience.	22 (100.0)	1	1
7. The layout of the illustrations is consistent with the text.	22 (100.0)	1	1
8. The figures used clarify the content of the educational material.	22 (100.0)	1	1
9. The illustrations help explain the topic and are in a logical sequence.	22 (100.0)	1	1

Items	n (%)	I-FVI*	p†
10. The number of illustrations is appropriate.	22 (100.0)	1	1
11. The illustrations in the instructional materials are of an appropriate size.	22 (100.0)	1	1
12. The illustrations help change the behavior and attitudes of the target audience.	22 (100.0)	1	1

Source: The authors.
I-FVI: Item-level Appearance Validity Index; †Binomial test.

No participant suggested modification. However, they reported the infographic clarifies important information in an easy, attractive, illustrative and understandable manner, and stimulate self-care and behaviors of healthy lifestyle. Thus, it stimulates the adherence to pharmacological and professional follow-up. A participant reinforced that the content was very well explained, even for those who cannot read, the learning is stimulated by images, animations, and listening.

DISCUSSION

The animated infographic was deemed valid by both experts and the target audience, as it was perceived as an understandable and attractive technology that stimulated the construction of learning and behavioral change. Consequently, it can be inferred that this educational tool can contribute to health promotion and education actions for people with CMD, empowering them in the self-care process.

In accordance with this conclusion, other studies that have developed animated infographics have indicated the potential of this educational technology in the teaching-learning process. Infographics employ diverse multimedia resources that facilitate the capture of the audience's attention, simplify the transmission of complex information, and effectively build knowledge[14,15]. Thus, as teaching tools, infographics enhance engagement, memory and knowledge retention, comprehension, recall, development of communication skills, and health literacy[28].

In this context, the content of the educational technology developed in this study was deemed appropriate and encompassed the primary modifiable cardiovascular risk factors and their associated complications, as well as strategies aimed at maintaining a healthy lifestyle, adherence to pharmacological treatment, and multi-professional monitoring, with the objective of encouraging self-care, modifying behavior, and preventing health complications.

This information is of the utmost importance, given that cardiovascular risk factors, incipient knowledge of measures to prevent complications, and inadequate adherence to healthcare are notable vulnerabilities that permeate the reality of the population with CMD[29,30]. In addition, researchers address that difficulty in accessing reliable information and/or inadequate understanding of these are obstacles to effective health literacy. In view of this, it is reinforced the relevance of educational resources for health education of target audience as a strategy to help overcome such obstacles[31,32].

It is therefore believed that the animated infographic provides the population with CMD access to relevant health information that can reinforce the care provided by nurses

during consultations, health promotion and education. Consequently, it could facilitate the effective construction of learning, greater retention of guidelines, as well as stimulating patients' autonomy and self-efficacy for self-care, decision-making and attitudes needed to change behaviors and seek better health outcomes.

The experts deemed the organization and approach of the educational technology content to be objective, logical, and easy to understand, with appropriate and comprehensible language, and interactive, dynamic, and playful images that arouse the interest and motivation of the public. In accordance with this, the approach utilized to present the educational content of the infographic was also deemed to be explanatory, clear, and easy to understand during the evaluation with the target audience. This data is relevant in influencing greater acceptance and adherence to educational technology, as well as stimulating interaction, protagonism, and the active participation of the subject in the learning process[14,33].

This reinforces the fact that the use of simple messages, with language familiar to patients and without technical terminology, the presentation of clear and concrete ideas, the use of a conversational tone, the presentation and logical organization of the content, are effective communication strategies, since they simplify the information passed on, promote a better memorization of the subjects, and allow the knowledge acquired to last over time and consequently favor changes in behavior in the short, medium, and long term[34,35,36].

A study reinforces that the set of aspects, including images, language, and sounds, used in the animated infographic enables meaningful, transformative, and emancipatory learning. This is because it gives the idea of seriousness to the content transmitted, stimulates co-responsibility and social commitment of the subjects in relation to the health practices addressed, and provides playfulness, interactivity, and dynamism in the presentation of content[37,38].

Additionally, researchers have observed that the use of illustrations in the form of animations and dynamic images, combined with audio narratives and texts, enhances the patient's ability to process information and significantly expands learning. This is because these elements serve to reinforce the topics covered, in accordance with the so-called redundancy principle[13,38]. These observations serve to reinforce the position that the animated infographic is a relevant educational technology for health education and promotion, contributing to internet-based health promotion intervention.

The final duration of the animated infographic was 8 minutes and 57 seconds, which corroborates the results of a systematic review that identified a variation of 1.25 to 31 minutes in the duration of the digital animations available in the literature[39]. Similarly, other studies have developed animated infographics that lasted between 4 minutes and 20 seconds and 6 minutes and 26 seconds[14,15,40].

While researchers caution that the animated video should not overload the cognitive capacity of the target audience, they emphasize that the appropriate length is five to six minutes[13], as prolonged exposure to technology can impair the attention and retention of information by the subjects[41]. Consequently, the length of the infographic developed in this study is deemed appropriate, and the necessity of assessing user satisfaction and acceptability of the length of infographics in future studies is reiterated.

Given the aforementioned considerations, this study contributes to the development of an innovative and valid tool for use in educational practice and health promotion for individuals with CMDs. The animated infographic can offer enhanced educational support to patients. It can be available in digital media and information and communication technologies, allowing viewers to access it in various locations, including their homes, and as many times as they deem necessary, navigating through the different contents. Additionally, the animated infographic could be broadcast on television in health service waiting rooms, thus facilitating the mediation of educational sessions developed by nurses. Furthermore, the material can be adapted and updated at any time.

The study's limitations include the costs required to develop animated infographics, which can hinder the development of new similar technological resources, given that funding for these is sometimes scarce. Thus, it is worth noting that low response rate of the invited experts did not guarantee the representativeness of all Brazilian regions.

CONCLUSION

The final version of the animated infographic is 8 minutes and 57 seconds in length and is accessible on YouTube in Portuguese **(**https://www.youtube.com/watch?v=OgM9ccgTdpY**).** To facilitate comprehension of the information presented in the animated infographic, a variety of resources were employed, including illustrations in image format and animations, audio narration, and short, objective texts presented in topic-specific sections. These resources were utilized to reinforce the key points covered. The guidelines were conveyed in a clear and concise manner, employing short sentences and an active voice, to facilitate comprehension and encourage the subjects to adhere to healthy behaviors. The technology was deemed valid and appropriate in terms of content and appearance by both experts and representatives of the target audience, with an overall CVI and IVA of 0.97 and 1, respectively.

The infographic thus presents itself as a potentially accessible, engaging, and playful educational tool that can support nursing care and health education for individuals with CMD. Furthermore, it is important to note that the educational technology will be able to support users in their daily self-care actions, as it can be accessed from any location and as often as necessary. Future experimental studies should focus on evaluate the efficacy of the technology in enhancing the health of this target population, and translating the infographic, making it available in English and/or Spanish.

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