

MONTACARDIO EDUCATIONAL TECHNOLOGY FOR HEALTH PROMOTION IN THE POSTOPERATIVE PERIOD OF CARDIAC SURGERY**TECNOLOGIA EDUCATIVA MONTACARDIO PARA PROMOÇÃO DA SAÚDE NO PÓS-OPERATÓRIO DE CIRURGIA CARDÍACA****TECNOLOGÍA EDUCATIVA MONTACARDIO PARA LA PROMOCIÓN DE LA SALUD EN EL POSTOPERATORIO DE CIRUGÍA CARDÍACA**

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ABSTRACT

Objective: To validate the content and usability of the Montacardio game for cardiovascular health promotion in patients in the postoperative period of cardiac surgery.

Method: This is descriptive methodological research with a mixed-methods approach, conducted at the *Hospital do Coração de Sobral*, involving 40 patients in the postoperative period of cardiac surgery and 10 technical judges. Data collection occurred between February and June 2024. **Results:** The validation of Montacardio demonstrated excellent reliability among the technical judges. For the target audience, it showed good usability and achieved its objectives of informing and raising awareness in a playful manner, even providing a more humanized approach to the care provided by nursing professionals. **Conclusion:** Therefore, the Montacardio game serves as a reliable ally for nursing professionals in clinical practice.

Keywords: Cardiac Surgery; Postoperative Care; Nursing; Health Promotion; Educational Technology.

RESUMO

Objetivo: Validar o conteúdo e a usabilidade do jogo Montacardio para promoção da saúde cardiovascular de pessoas em pós-operatório de cirurgia cardíaca. **Método:** Trata-se de uma pesquisa metodológica, descritiva, com abordagem mista, aplicada no Hospital do Coração de Sobral, com 40 pacientes no pós-operatório de cirurgia cardíaca e 10 juízes técnicos. A coleta de dados ocorreu entre os meses de fevereiro e junho de 2024.

Resultados: A validação do Montacardio, apresentou entre o julgamento dos juízes técnicos, uma excelente confiabilidade, e com o público-alvo, teve boa usabilidade e constatou-se alcance dos objetivos de informar e conscientizar de maneira lúdica, oportunizando até mesmo um caráter mais humanizado ao tratamento do profissional de enfermagem. **Conclusão:** Portanto, o jogo Montacardio caracteriza-se como um confiável aliado para o profissional de enfermagem na assistência.

Palavras-chave: Cirurgia Cardíaca; Cuidados Pós-Operatórios; Enfermagem; Promoção da Saúde; Tecnologia Educacional.

RESUMEN

Objetivo: Validar el contenido y la usabilidad del juego Montacardio para promover la salud cardiovascular en personas en el período postoperatorio de cirugía cardíaca. **Método:** Se trata de una investigación metodológica, descriptiva con un enfoque de métodos mixtos, aplicada en el Hospital del Corazón de Sobral, con 40 pacientes en el período postoperatorio de cirugía cardíaca y 10 jueces técnicos. La recolección de datos tuvo lugar entre febrero y junio de 2024. **Resultados:** La validación de Montacardio mostró una excelente confiabilidad entre los jueces técnicos y, con el público objetivo, tuvo una buena usabilidad y se encontró que había logrado sus objetivos de informar y crear conciencia de una manera lúdica, incluso proporcionando un carácter más humanizado al tratamiento por parte del profesional de enfermería. **Conclusión:** Por lo tanto, el juego Montacardio se caracteriza por ser un aliado confiable para el profesional de enfermería en el cuidado.

Palabras clave: Cirugía Cardíaca; Cuidados Postoperatorios; Enfermería; Promoción de la salud; Tecnología Educativa.

INTRODUCTION

Cardiovascular Diseases (CVDs), particularly Ischemic Heart Disease (IHD), have been a leading cause of death globally and a major contributor to disability¹. Among the primary intervention options for patients with IHD, Coronary Artery Bypass Graft (CABG) surgery is an invasive yet extremely important treatment option².

Notably, the postoperative (PO) period of patients undergoing this procedure is highly critical due to the elevated risk of hemodynamic instability caused by an increased physiological response and surgical stress, requiring continuous and specialized attention from the healthcare team³. In this context, patients undergoing invasive procedures, such as cardiac surgery, face a period of fears and challenges that directly interfere with their way of living⁴.

From this perspective, considering the importance of nursing care in the PO period of cardiac surgery to prevent complications and readmissions, educational technologies in health, based on educational planning, emerge as a means of promoting cardiovascular health after the surgical procedure. Educational technology is defined as a set of knowledge and practices related to therapeutic products and materials that encompass a work process and serve as instruments for carrying out health actions⁵.

Although guidelines for the postoperative period of cardiac surgery exist, a gap remains in the literature regarding the use of educational technologies designed to support healthcare professionals in providing health

education to patients after a cardiovascular event. Therefore, the use of an educational technology enables an innovative approach to health education, which is paramount for providing support that strengthens the process of lifestyle changes⁶.

Considering the above, this study proposes the validation of an educational game called Montacardio⁷, to be used as a therapeutic-educational tool in the postoperative period of patients undergoing CABG surgery. This serves as a strategy in clinical care to promote health and well-being, in alignment with Goal 3 of the Sustainable Development Goals (SDGs).

This study aimed to validate the content and usability of the Montacardio game for cardiovascular health promotion in patients in the postoperative period of cardiac surgery.

METHOD

This is a methodological study describing the development of technological strategies aimed at creating products or services that are evaluated and validated within an educational environment⁸. To conduct the study, we employed an educational technology development method comprising the following stages: situational diagnosis; literature and document review; content selection and summarization; script formulation based on theoretical frameworks and situational diagnosis; creation and layout design of images; and validation with specialists and the target audience⁹.

Because the game to be validated had already been previously developed, this investigation focused solely on the validation of the material. The validated educational technology was conceptualized and constructed in 2022, aiming to facilitate the self-care process during the postoperative period of cardiac surgery. It is worth noting that interest in its development arose primarily from the difficulties patients face in returning to their daily activities after the surgical procedure, highlighting the importance of such a product¹⁰.

Following the proposed phases for specialist validation, we recruited technical judges using snowball sampling, which is a non-probability method¹¹. The inclusion criteria for study participation were: being a nurse; working in an Intensive Care Unit (ICU), Coronary Care Unit (CCU), or inpatient wards; having more than one year of professional experience; and holding a specialization in intensive care or cardiology. Participants who did not respond to the survey within the estimated timeframe were excluded. We invited 20 professionals; ten did not return contact, resulting in a final sample of 10 participants.

All judges received an invitation letter explaining the origin of the developed material, the study objective, and the importance of validating the educational game for clinical application. Upon agreeing to participate, they received two copies of the Informed Consent Form (ICF) and an instrument for evaluating content and appearance adapted from Joventino¹². All files were electronically adapted

into a Google Forms online questionnaire, and a Google Drive video link demonstrating the game's application was also provided: <https://drive.google.com/file/d/1zyoz75y0UHmBNtzXCHODovveSfznugBg/view?usp=sharing>.

The instrument used by the judges was divided into three sections, consisting of eighteen items across three domains: objectives (five), structure/presentation (ten), and relevance (three), named the Educational Content Validation Instrument in Health (ECVIH). Because this educational technology is a game, item 15 (adequate text size) was removed from the evaluation form. The items within the three domains were rated using a three-point scale: 0 for disagree; 1 for partially agree; and 2 for fully agree¹³.

Following the specialist group, the game was validated by the target audience. This stage took place at the *Hospital do Coração* (HC), located in the city of Sobral, Ceará state, after obtaining an institutional agreement letter. The inclusion criteria established for the target audience were: being older than 18 years; being clinically fit to participate in the game; being admitted to the inpatient ward of the HC; and being in the postoperative period of cardiac surgery. The invitation was extended verbally, followed by an explanation of the project, and subsequently, the reading and signing of the ICF.

The exclusion criteria were: patients in unfavorable clinical conditions for participation (unstable vital signs, severe pain, and cognitive alterations or episodes of mental confusion); patients with visual impairment; and those who

did not agree to participate in data collection. During the collection process, 50 patients were invited; however, 10 declined to participate, resulting in 40 study participants. Thus, the final sample consisted of 40 patients who were present, accepted the application of the educational technology, and answered an adapted questionnaire¹⁴. It is emphasized that convenience non-probability sampling was used. Data collection took place from February to May 2024.

Data analysis was performed according to the type of question presented in the instrument. Closed-ended questions (quantitative data) were compiled in Microsoft Excel 2019 software, presented in tables and charts, and discussed in light of the relevant literature. For the qualitative approach, thematic analysis was adopted according to Minayo¹⁵, which is defined as a process that deeply investigates the universe of meanings in relationships and phenomena that cannot be reduced solely to exact data, and that answers specific questions.

For validation with the technical judges, we used the Content Validity Index (CVI),

which measures the proportion of evaluators in agreement on certain aspects of the instrument and its items¹⁶. The literature¹⁷ recommends a minimum CVI value of 0.78, which was adopted in this study; thus, items with a CVI equal to or greater than 0.78 were considered to demonstrate good content validity.

Consequently, in accordance with the aforementioned details, the ethical and legal aspects of research involving human subjects were respected, meeting the requirements of Resolution 466/2012 of the National Health Council. This study was approved by the local Research Ethics Committee, under opinion number 4.321.649.

RESULTS

This section is divided into two categories: 1) Validation of Montacardio with judges and 2) Validation of Montacardio with representatives of the target audience.

Validation of Montacardio with judges

The sample comprised 10 judges who met the inclusion criteria, characterized as shown in Table 1.

Table 1 - Characterization of technical judges in the validation of the Montacardio educational technology. Sobral, Ceará, Brazil, 2024.

Variables	Absolute Number (n)	Percentage (%)
Age		
Between 20-29 years	5	50%
Between 30-39 years	3	30%
Over 40 years	2	20%
Sex		
Female	7	70%

Male	3	30%
Highest Degree		
Specialization	9	90%
Master's degree	1	10%
Type of Occupation		
Clinical practice	10	100%
Management	0	0%
Total	10	100%

Source: Research data, 2024.

The mean age of the participants was 33 years. Based on the presented data, it is noteworthy that 9 (90%) of the judges hold a specialization degree and 10 (100%) work in direct clinical practice, which lends high credibility to the evaluation of the game and its applicability to daily nursing care.

Next, the responses from the ECVIH questionnaire¹³ were evaluated. This allowed for the assessment of the reliability of the educational technology according to each characteristic described in the three domains, as shown in Table 2.

Table 2 - Distribution of ECVIH items according to the CVI. Sobral, Ceará, Brazil, 2024.

Educational Content Validation Instrument in Health (ECVIH)				
Items	D (%)	PA (%)	FA (%)	CVI
Domain 1 - OBJECTIVES: purposes, goals, or ends				
1. Addresses the proposed theme	00	20%	80%	0.8
2. Suitable for the teaching-learning process	00	10%	90%	0.9
3. Clarifies doubts regarding the proposed theme	00	20%	80%	0.8
4. Encourages reflection on the theme	00	20%	80%	0.8
5. Encourages behavior change	00	20%	80%	0.8
Domain 2 - STRUCTURE/PRESENTATION: organization, structure, strategy, coherence, and sufficiency				
6. Language is appropriate for the target audience	00	10%	90%	0.9
7. Language is appropriate for educational material	00	20%	80%	0.8
8. Interactive language, allowing active involvement in the educational process	00	20%	80%	0.8

9. Correct information	00	20%	80%	0.8
10. Objective information	00	10%	90%	0.9
11. Explanatory information	00	10%	90%	0.9
12. Necessary information	00	20%	80%	0.8
13. Logical sequence of ideas	00	20%	80%	0.8
14. Current theme	00	20%	80%	0.8

Domain 3 - RELEVANCE: significance, impact, motivation, and interest

15. Stimulates learning	00	20%	80%	0.8
16. Contributes to knowledge in the field	00	20%	80%	0.8
17. Arouses interest in the theme	00	20%	80%	0.8

TOTAL CVI **0.81**

Legend: D - Disagree; PA - Partially Agree; FA - Fully Agree.
Source: Research data, 2024.

When evaluating the first domain, "objectives", which assesses the understanding of the content to be addressed, a level of full agreement ranging from 8 (80%) to 9 (90%) was obtained, indicating a strong prevalence of validity regarding the game's purpose, goals, and intent. Regarding Domain 2, "structure/presentation", all items met the required level of agreement, also ranging from 8 (80%) to 9 (90%), demonstrating that the educational technology possesses appropriate language and is highly comprehensible.

The third domain, "relevance", which denotes the significance of the construct for clinical use and its impact on the target audience, was rated with 8 (80%) agreement among the evaluators. Thus, it was observed that, overall, the responses of the technical judges demonstrated satisfaction regarding the format, language, and clinical importance of using the game.

The items that achieved 9 (90%) agreement among the judges were: 2) Suitable for the teaching-learning process; 6) Language is appropriate for the target audience; 10) Objective information; and 11) Explanatory information. Therefore, it is inferred that the technology in its current format facilitates communication between the nursing professional and the patient, enabling the establishment of a therapeutic bond through a playful yet informative approach. The remaining items achieved a full agreement level of 8 (80%), confirming a favorable evaluation of the material and demonstrating that it is coherent with its proposed objectives.

Regarding the calculation of the CVI, the first domain yielded an average of 0.82; the second domain concluded with an average of 0.83; and the third domain followed the same pattern, with a CVI of 0.80.



During the evaluation by the judges, two suggestions for adaptation and/or

improvement were received, which are detailed in Chart 1.

Chart 1 - Representation of identified issues and modifications suggested by professionals after validation. Sobral, CE, Brazil, 2024.

Judge (J)	Suggestions	Modifications Made	Game Statement Before Modification	Game Statement After Modification
J.8	<i>"Insert the importance of medical clearance and evaluation for resuming postoperative activities into the questions and emphasize medication adherence".</i>	Updated the statements in the game regarding physical activity and medication use.	<i>Statement 7.</i> <i>I can begin to return to my routine activities as soon as I feel ready.</i> <i>Statement 10.</i> <i>Medications must be taken at the prescribed time for the duration determined by the doctor.</i>	<i>Statement 7.</i> <i>It is permitted to start physical activities without medical clearance.</i> <i>Statement 10.</i> <i>One must not forget to take the medications.</i>
J.9	<i>"Insert the importance of changing the dressing at home in the statements".</i>	Updated the statement regarding surgical wound care, emphasizing the requested point.	<i>Statement 2.</i> <i>It is important to keep the surgical wound clean and dry daily.</i>	<i>Statement 2.</i> <i>There should be no foul odor or drainage from the surgical wound, and the dressing must be performed.</i>

Source: Research data, 2024.

The adjustments identified served to update the educational technology, thereby providing a material that addresses the primary needs of patients in the postoperative period of cardiac surgery. Thus, a new version of the game was obtained after these modifications. Given the nature of the suggested changes, it is evident that the construct aligns with clinical reality, rendering it highly satisfactory for use among professionals¹⁸.

Consequently, content validation by the technical judges established the Montacardio game as a safe tool for use in the health education process, serving as an accessible resource for health promotion in the postoperative period of cardiac surgery.

Validation of Montacardio with representatives of the target audience

The sample comprised 40 participants who met the inclusion criteria, characterized as shown in Table 3.

Table 3 - Characterization of the target audience in the validation of the Montacardio educational technology. Sobral, Ceará, Brazil, 2024.

Variables	N	%
Age (in years)	Mean: 65; Minimum: 38; Maximum: 82; Median: 75	
Marital status		
Married	26	65%
Single	8	20%
Widowed	4	10%
Divorced	2	5%
Education level		
No formal education	12	30%
Incomplete primary education	11	27.5%
Incomplete secondary education	7	17.5%
Complete secondary education	5	12.5%
Functional education	3	7.5%
Complete higher education	2	5%
Occupation		
Retired	24	60%
Farmer	5	12.5%
Self-employed	3	7.5%
Truck driver	2	5%
Unemployed	2	5%
Teacher	2	5%
Cook	1	2.5%
Housekeeper	1	2.5%
Origin		
Other municipalities	32	80%
Sobral	8	20%
Total	40	100%

Source: Research data, 2024.

Data analysis reveals that the sample was predominantly composed of individuals with a mean age of 65 years, who were married, retired, and had a low level of education. This sociodemographic profile is congruent with the literature¹⁹ investigating the characteristics of individuals with risk factors for cardiovascular

disease. Furthermore, only 8 (20%) of the participants resided in Sobral, the city where the study was conducted, while the remaining participants were from neighboring municipalities.

Table 4 presents the lifestyle and comorbidity profiles of the study participants.

Table 4 - Characterization of the target audience according to lifestyle profile and comorbidities. Sobral, CE, Brazil, 2024.

Variables	N	%
Smoking status		
Smoker	23	57.5%

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Non-smoker	17	42.5%
Alcohol consumption		
Non-drinker	21	52.5%
Drinker	19	47.5%
Illicit drug use		
Non-user	37	92.5%
User	3	7.5%
Hypertension		
Hypertensive	26	65%
Non-hypertensive	14	35%
Diabetes mellitus		
Yes	23	57.5%
No	17	42.5%
Total	40	100%

Source: Research data, 2024.

Based on the tabulated data, a prevalence of smokers, diabetic patients, and hypertensive patients was observed. These factors are among the primary contributors to cardiovascular disease, in alignment with the study by Brasil²⁰. Consequently, raising awareness among these patients regarding

postoperative self-care in cardiac surgery to prevent complications is highly necessary, and the Montacardio educational technology can facilitate this process¹⁰.

Additionally, a compilation of the target audience's feedback containing suggestions was drafted, as presented in Chart 2.

Chart 2 – Synthesis of target audience feedback and modifications made. Sobral, CE, Brazil, 2024.

Target Audience (TA)	Feedback	Modification made
TA 13	<i>"I found it fun, but I wish it were faster".</i>	Suggestion accepted: the length of the statements used was reduced, making them more objective.
TA 17	<i>"Yes, I liked it, interesting questions but they need to be reformulated".</i>	Suggestion accepted: the statements were replaced to make them more direct, with true/false answers.
TA 27	<i>"I found the game interesting, but exhausting".</i>	Suggestion accepted: the rules were modified to allow playing in pairs.

Source: Research data, 2024.

By compiling the participants' feedback, the need for adaptations to the educational technology to improve its comprehension was identified. Consequently, in accordance with

these requests, modifications were made, yielding a new format for the game's statements, as shown in Chart 3.

Chart 3 - Demonstration of the game statements before and after modifications. Sobral, CE, Brazil, 2024.

Game statement before modification	Game statement after modification
1. I usually consume low amounts of salt and fat in	1. One must not consume excessive salt or fat.

<https://doi.org/10.31011/reaid-2026-v.100-n.3-art.2715> Rev Enferm Atual In Derme 2026;100(3): e026070

my meals.	
2. It is important to keep the surgical wound clean and dry daily.	2. There should be no foul odor or drainage from the surgical wound, and the dressing must be performed.
3. I smoke and consume alcoholic beverages in small amounts, almost never, or I do not have this habit.	3. One must not consume alcoholic beverages, tobacco, or illicit drugs.
4. I prioritize good nights of sleep of at least eight hours per night, as well as my rest when tired.	4. It is important to sleep well.
5. It is necessary to attend follow-up appointments as scheduled by the doctor after cardiac surgery.	5. It is important to attend medical follow-up appointments after cardiac surgery.
6. It is always important to communicate any symptoms (fever, severe pain, pus, foul odor) to the caregiver.	6. It is important to report any changes in the surgical site to family members and the doctor.
7. I can begin to return to my routine activities as soon as I feel ready.	7. It is permitted to start physical activities without medical clearance.
8. Pain is a warning measure of what can and cannot be done.	8. It is normal to feel severe pain at the surgical site during the recovery period.
9. It is important to maintain positive thoughts and spirituality.	9. It is important to maintain positive thoughts and faith.
10. Medications must be taken at the prescribed time for the duration determined by the doctor.	10. One must not forget to take the prescribed medications.

Source: Research data, 2024.

DISCUSSION

By achieving a total CVI of 0.81, which exceeds the established threshold, the construct is proven to hold an excellent standard for clinical application. Studies^{14,18} highlight validation as a mechanism that facilitates the development of reliable and attractive instruments, emphasizing the importance of educational technologies in health promotion.

Consequently, this educational technology aligns with the findings of a study²¹ portraying the importance of evaluating health educational materials using content validation instruments. This process verifies whether these tools truly facilitate the work of healthcare professionals in guiding and educating patients and family members.

In this context, the relevance of educational technologies is reinforced, as they

serve as informational tools that enhance knowledge, enable better coping strategies, and rehabilitate the patient²¹. The development of educational materials in health is fundamental for information delivery; when validated scientifically and integrated into services, they become powerful allies in knowledge construction²².

Analyzing the first domain, items 2 and 6 stand out with a CVI of 0.9, supporting the premise that an educational technology must be capable of conveying information in an understandable manner²³. Although the educational technology has a playful design, its scientific rigor must be sustained through accurate information, which is corroborated by the analysis of items 10 and 11 of the second domain¹⁴.

Furthermore, a playful approach to

delivering information provides a positive experience for the patient during hospitalization. This prepares the patient for the postoperative rehabilitation process and reinforces the importance of lifestyle changes²⁴. This aspect is highly critical for patient acceptance of their current health status, as a playful format facilitates situational self-acceptance, thereby promoting health awareness and patient recovery²⁵.

The process of reflection prompted by the use of an educational technology is important because it fosters lifestyle changes when paired with health education; thus, the essential need to utilize educational technologies that facilitate this process is confirmed²⁵. Furthermore, the use of educational technology benefits the work of nursing professionals by providing innovative methods to deliver information that will contribute to postoperative care. These tools also revolutionize how nurses interact with patients, reducing misinformation and empowering them for self-care²⁶.

In this regard, the usability of Montacardio is highly significant, as it enables the dissemination of information to patients while raising awareness to improve self-care. It provides an excellent approach to health education, making nursing work more dynamic without losing its scientific character—indeed, reinforcing it. The Corridacardio educational technology is congruent with this assertion¹⁴.

Thus, the construct is aligned with the primary objective of an educational technology, which is to provide health education, foster

lifestyle changes, promote health, and prevent illness. These aspects are of utmost importance to ensure scientific rigor when using health educational materials in clinical practice²⁷.

Evaluating the compiled feedback in Chart 1 and Chart 2, very few suggestions for modification were made, indicating high acceptance by both the target audience and the judges, which demonstrates the excellent validation of this technology²⁸.

Nonetheless, necessary adjustments were made based on the suggestions, following a process similar to those used for the Corridacardio educational technology¹⁴ and the educational booklet¹⁸. This highlights the importance of adapting health educational tools as requested to make them more attractive and comprehensible to the audience. Grounded in Minayo's framework¹⁵, and examining the challenges highlighted in Chart 3, it is worth noting that the audience consisted primarily of older adults and their caregivers, who were under stress due to their current health status. Therefore, considering this situational aspect, it is crucial to view their feedback as a reflection of this state. This underscores the need for nursing professionals to develop strategies that minimize patient stress, highlighting the clinical utility of technologies that incorporate playful elements²⁵.

Consequently, addressing the requests as shown in Chart 3 required only a few changes that did not affect the original format of the game. This demonstrates that the usability of a technology in the health education process extends beyond merely conveying information,

aligning closely with the delivery of humanized care.

CONCLUSION AND IMPLICATIONS FOR PRACTICE

Based on this study, the Montacardio educational technology can be considered a valid tool for use with the target population, as the global CVI was 0.81, achieving a highly satisfactory validation score.

Reflecting on the implications for practice, the potential of its utilization within the context of nursing care is evident. It represents an innovative resource that merges playful and scientific elements, facilitating the transmission of information in a clear, objective, and interactive manner. Within this context, the strength of this study lies in the fact that an educational technology can expand health promotion strategies, while strengthening self-care, the prevention of complications, and improved therapeutic adherence.

Among the limitations of this study, the primary one to highlight is that the research was conducted in a single hospital center, restricting the generalizability of the findings to other clinical settings. Furthermore, the validation process addressed only content and usability, without evaluating long-term outcomes.

Finally, considering the findings of this study, it would be beneficial to conduct future research in diverse clinical settings to expand the validation of this technology. Comparative studies between Montacardio and other educational technologies are also recommended

to better elucidate its advantages and contribute to the refinement of the material.

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Substantially contributed to the conception and/or planning of the study; contributed to the drafting and/or critical revision and final approval of the published version.

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