

ORIGINAL RESEARCH

Educational technology for people living with implantable heart device

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ABSTRACT

Objective: To develop an educational technology for people living with an implantable heart device.

Methods: This is a methodological study carried out in the period from August 2020 to April 2021, carried out in two stages: integrative literature review and elaboration of educational technology.

Results: Based on the evidence, it was possible to list generating themes such as the perception of people living with an implantable cardiac device, which served as the basis for the creation of a podcast entitled “Alphabet of the pacemaker”, with self-care guidelines from A to Z for the after time implantation of the device.

Conclusions: The construction of evidence-based educational technology is a strategy to subsidize health educational practices and pacemaker users’ understanding of health care after device deployment.

Key Words: Artificial cardiac pacemaker, Artificial cardiac stimulation, Health education, Quality of life, Pacemaker

1. INTRODUCTION

Since the mid-twentieth century, the importance of the use of technologies has been increasing, so that it is currently almost impossible to provide quality health services without using this resource, since many are innovative and essential to human being.^[1]

Medical-scientific technologies have made enormous contributions to people’s health, such as artificial cardiac pacemaker devices, which have greatly contributed to reducing morbidity and mortality.^[1,2]

Among these technologies is the emergence of artificial cardiac pacemakers that consist of an artificial stimulation sys-

tem of the heart that transmits stimuli of an electrical nature through a pulse and electrode generator with the purpose of replacing the “natural cell” of the heart.^[3]

The normal heart rate is 60 to 100 beats per minute (bpm). Heart rate less than 60 bpm is defined as bradycardia that can present as asymptomatic or symptomatic. Because there are no adequate drugs for the treatment of irreversible symptomatic bradycardia, the definitive pacemaker implant is the most indicated treatment for these affects.^[4]

Indications for definitive pacemaker implantation are: sinus node disease, acquired Atrioventricular block, post-acute myocardial infarction, carotid sinus syndrome and neurocar-

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diogenic syncope, cardiomyopathy and transplanted.^[5]

The rapid development in recent decades of sophisticated devices and the increase in patient referral to pacemaker implantation draw attention. Cardiovascular diseases are among the leading causes of death in the world, becoming a public health problem.^[6]

It is noted that the lack of information to pacemaker users patients has generated many doubts regarding daily life after the implantation of the device, so it is important to develop a technology aimed at health education in this population.

Educational technologies have been very effective in the process of health education, because the teaching and learning process must always be delineated according to the context, in order to facilitate and dynamize this process with innovative methods.^[7]

Therefore, the aim of this study is to develop an educational technology for people living with pacemakers, respecting the determinations of Resolution No. 466/12 of the National Health Council.^[8] The project is part of the macroproject “Development and validation of interactive technologies in health and education in human care innovation” approved by the Research Ethics Committee (REC) of the State University of Amazonas under the n°3.574.288 and CAAE n° 15924919.6.0000.5016.

2. METHOD

Methodological study, defined as the investigation of methods, involving production-construction, validation and evaluation, with a focus on the development of new instrument-products.^[9] Conducted in two stages: integrative literature review and elaboration of educational technology. The technology was the product of the project developed in the Postgraduation Program of Technology and innovation in health of the State University of Amazonas, developed within the Laboratory of Technology in health and education-LABTECS, held in the period from August 2020 to April 2021, with the participation of four professionals with university degree.

2.1 Step 1-Integrative literature review

An integrative literature review was carried out, which began with the definition of a problem and the formulation of the research question using for the elaboration of the problem/question the PICO strategy, acronym for Population, Interest, Context.

Thus, the question is: what health information do pacemaker users need to know after implantation?

To answer the guiding question of the review, the bibliographic search of publications indexed in the

PubMed/MEDLINE, LILACS database was performed, using the uncontrolled descriptors of Medical Subject Headings (MeSH): “Pacemaker, health education, and quality of life”, we chose to include in the search the keywords: artificial Cardiac Pacemaker, artificial cardiac stimulation, health education and quality of life. The boolean operators AND and OR were adopted.

The criteria included in the studies were: original articles, case reports, pre-print articles, manuals, and society portals related to cardiac electrophysiology in both English and Portuguese; all materials available in full text. The exclusion criteria considered were review articles, duplicate articles and those that did not answer the guiding question. All studies identified through the search strategy were initially evaluated through titer analysis.

The selection of the articles was conducted in flowchart format with details according to the preferred reporting Items for Systematic Review and Meta-Analyses (PRISMA) methodology, through this scheme it is possible to better visualize how the data collection of the articles was carried out. In this step, 2,063 articles were found for analysis, of which, after reading the abstracts, 13 articles were selected in full. Figure 1 presents the synthesis of the results obtained in each step.

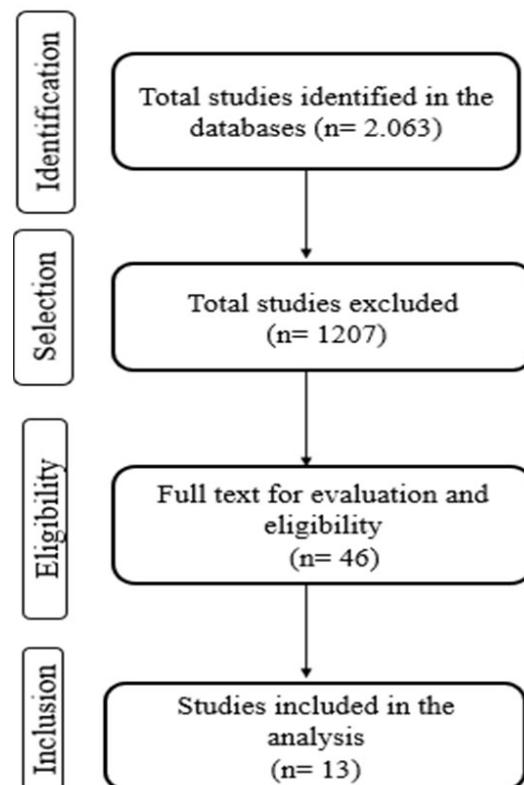


Figure 1. Flowchart of the selection of articles for the study of Integrative literature review by PRISMA. Manaus, I have 2021

2.2 Technology development, editing and diagramming

Based on the exhaustive reading, the generating themes directly related to artificial Cardiac Pacemaker were listed, they were organized according to the frequency of citation in the articles and it was found that it was convergent with the themes that emerged in the first phase. The themes were developed and organized to select illustrations for each of the themes that helped in the construction of Educational Technology according to the guidelines of the Brazilian Association of Cardiology with emphasis on Cardiac Electrophysiology. It was built into an educational technology called “pacemaker Alphabet”, the development of the technology was idealized with audio recording that featured a room reserved for recording, a mobile device and headset. Several recording tests were performed, the team was composed

of two researchers where one of them performed the audio recording. After recording, the audio was sent to the designer for editing and diagramming the cover with the appropriate guidelines. The final version of the technology after editing contains 06: 01 minutes.

2.3 Result

A total of 2,063 articles were selected, after careful reading there were 13 studies left for the research. Table 1 shows the data included in the research and the data on authors, year of publication, title of the study and the type of material.

Table 2 shows the categories that emerged from the research and the results selected in the final sample of the Integrative literature review related to the topic addressed in this work.

Table 1. Description of publications second year of publication, authors, objective and results. Manaus-AM, 2021

Year	Author	Item type	Study title
2020	Pavlović a, et al.	Original Article	Management of patients with cardiac implantable electronic devices undergoing magnetic resonance imaging – proposal for unified hospital protocol: Croatian working group on arrhythmias and cardiac pacing.
2020	Gonçalo s dos S, et al.	Original Article	Quality of life related to the health of patients with definitive cardiac pacemaker.
2020	Mlynarski R, et al.	Original Article	The impact of cardiac pacemaker implantation on male sexual function.
2019	Silva LDC, Caminha EL de C, Ferreira NS	Original Article	Quality of life of individuals with implantable electronic cardiac device
2019	Han D, et al.	Original Article	Experiences of magnetic resonance imaging scanning in patients with pacemakers or implantable cardioverter-defibrillators.
2018	Haugaa, KH, et al.	Original Article	Patient’s knowledge and attitudes regarding living with implantable electronic devices: results of amulticentre, multinational patient survey conducted by the European Heart Rhythm Association.
2018	Fleur VYT, et al.	Original Article	Health-related quality of life impact of a transcatheter pacing system.
2017	Santos JeM dos, et al.	Original Article	Readability of facilitator leaflet and health literacy of individuals with pacemaker.
2014	Hayes K. et al.	Original Article	Utilization of YouTube as a Tool to Assess Patient Perception Regarding Implanted Cardiac Devices.
2014	Vianna MS, et al.	Original Article	Patient guidance plan after implantation of implantable electronic cardiac devices.
2020	Almeida SM, et al.	Manual	Guidance Manual for implantable cardiac devices
2017	ABEC/DECA	Manual	Pacemaker spelling book
2012	Fenelon G, et al.	Guidelines	Brazilian recommendations for driving in patients with implantable electronic cardiac devices (IEDs) and cardiac arrhythmias.

Table 2. Description of the publications with the categories and results of the study Manaus-AM, 2021

Category	Results found in the studies
Pacemaker user perception	The highest scores achieved were in social aspects and Mental Health and those of lower physical aspects and functional capacity.
	Attention is drawn to the sedentary lifestyle of the research sample. The lowest scores were in the domains physical aspects.
	The information that the patient most wanted were: battery capacity of the device and limitations in physical activity, because they were attend.
	The result of the evaluation of the educational material aimed at the patient with pacemaker, indicated that about half of the individuals have an adequate understanding of how the device works.
	The most frequent doubts were about the proper position to sleep after surgery, care of the surgical scar, use of large speakers or microwaves and restrictions with the arm.
Pacemaker user education	In all patients, the cardiac pacemaker implant had a positive effect on sexual functioning.
	None of the patients had complications related to MRI. During the follow-up period, no generator/electrode failure or battery problems occurred.
	The scale of the physical component remained below average, except in one case, as the implantation physician evaluated the patient’s activity restrictions.
	If MRI is planned for a patient with compatible devices, it is advisable to follow all the manufacturer's instructions, patients with pacemakers should be programmed.
	The reviewed videos were intended to educate patients about the indications for therapy with the device, what to expect on the day of the procedure, and how to care for the device after the procedure.
	Guidance Manual for implantable cardiac devices, pacemaker ABC.
	ABC pacemaker spelling book, A - Z tips, quick for those who are pacemaker carriers or family members.
According to Abramet’s current recommendations, patients undergoing pacemaker implantation should remain away from driving for a period of two weeks in case of private driving, and six weeks in case of professional driving.	

3. DEVELOPMENT: MAKING AND DIAGRAMMING

The so-called construction of the technology “pacemaker Alphabet” corresponds to the cover of the developed technology, to the design and corresponds to a pacemaker apparatus inside a heart. The pacemaker Alphabet emerged from the information acquired from the results of the studies, both from the patient perception category and from health education and was adapted according to the letters of the Brazilian Alphabet and the main information corresponding to the letters.

Table 3 presents the roadmap of the developed technology “pacemaker Alphabet”, which are orientations from A to Z that the pacemaker user needs to know after the implantation of the device. Each letter contains information for day-to-day care.

4. DISCUSSION

In the category perception of the pacemaker user, 5 studies were listed, as significant similarity was identified between the authors about the limited knowledge of pacemaker users about the device.

In the pacemaker user education category, 8 studies were identified with similarity between the authors on the most relevant information that the user needs to know.



Source: The authors.

Figure 2. Educational Technology cover design diagram, Manaus – AM, 2021

Table 3. Description of the pacemaker Alphabet-educational technology content, Manaus-AM, 2021

Letter	Informative Content
A	Household Appliances: in general, they can be used without restrictions, provided they are in perfect working condition and properly grounded.
B	Pacemaker battery: it has an average durability or service life of 8 years, but each case is different from the other and the battery life can vary from 6 to 15 years.
C	Cell phones: do not produce interference to the pacemaker wearer, but it is good that it is worn on the side opposite the device and not put in the top pocket of the shirt.
D	Communication devices: such as <i>wi-fi</i> and smart routers are risk-free.
E	Electric shock: equipment in the home and work environment must be grounded. The pacemaker wearer must not repair equipment connected to the mains and must keep distance from electric fences.
F	Physical Exercise: the pacemaker alone does not prevent you from exercising physical activity unless the carrier has another limiting heart disease.
G	Pacemaker generator: it consists of a battery and electrodes that provide electrical pulse to the heart.
H	Sanitization of the operating wound: the operating wound should be kept clean and dry, being sanitized only with soap and water
I	Indications of the use of pacemaker: it is indicated for those patients who have slow heart, the so-called bradycardia, the device increases the heart rate.
J	Correspond to The Sound Amplifiers: and large speaker can interfere, the recommendation is to avoid close contact with them.
K	Correspond to magnetic mattresses: it should be avoided.
L	Site of surgery: regularly examine the site and if you see bruising, bleeding, swelling, pain, purulent discharge, redness and increased temperature at the site let your doctor know.
M	Metals: metal detectors in airports and revolving doors of banks should be avoided. The pacemaker holder must present the pacemaker card to gain access to another entrance.
N	Swimming: walking, running, fishing and traveling by plane, bus, train, ship etc. they are also allowed to the pacemaker wearer, unless there are other limiting heart diseases.
O	Outpatient follow-up: The first evaluation should be carried out until the first 30 days after the implant; then the revisions will be made usually every 3 months or every 6 months. But each case may have special needs, which only your doctor can indicate.
P	Medical procedures: such as radiotherapy, radiofrequency ablation, lithotripsy, should follow specific medical recommendations.
Q	Quality of life: the pacemaker promotes health benefits for patients with heart disease by prolonging life and improving the symptoms caused by the disease.
R	Magnetic Resonance Imaging: there are pacemaker devices compatible with resonance imaging devices, these must be programmed before use and after their realization. There are absolute restrictions, but they will be evaluated by your doctor.
S	Sexual activity: the pacemaker implant does not restrict it, ask the doctor when you will be released.
T	Pacemaker change: generator change will be requested by your cardiologist when identifying battery depletion during outpatient evaluations. The surgery lasts from 1 to 2 hours.
U	Use of microwave: the current recommendation is that the patient maintain a distance of at least 2 meters from the appliance during its operation
V	Vehicles: according to abramet's current recommendations, patients undergoing pacemaker implantation should remain away from driving for a period of two weeks in case of private driving, and six weeks in case of professional driving.
W	Store anti-theft systems: are released, pacemaker holders should avoid prolonged exposure for more than 2 minutes in front of the device. Hand-held detectors should not be applied over the pacemaker.
X	Portable music systems: (MP3 / MP4 / iPod): keep distance of 15 cm and do not use during evaluations.
Y	Care in the 1st month after the implant: the patient should be careful with the movement of the arm from the side on which the pacemaker was implanted, it is not advised to jump, nor to drive bicycles, nor to carry or push weights
Z	Within the possible: avoid sleeping on the side of the pacemaker implanted mainly in the first 30 days.

Studies identified that patients presented lower scores in physical aspects and functional capacity, whose sedentary lifestyle drew attention. Similar results were found in the literature, with lower scores in physical aspects, and low numerical scores reflect poor health perception.^[10]

Another study identified questions that were not answered by the health team, where patients underwent surgery, such as: battery capacity of the device and limitations in physical activity. It was not found in the current literature studies related to pacemaker battery, but when comparing with the studies of the review itself we found the guidelines of ABEC/DECA (2017) that the average battery life is 8 years.

In this study, about half of the participants have knowledge of how the device works. The inefficiency of information transmitted by health professionals can present as a barrier to care with the electronic device and the consequences are physical limitations caused by insecurity and fear that disadvantages self-care and delays the return to Daily activities.^[11]

There is emphasis on the proper sleeping position after implantation of the device, care of the operative wound, use of large speakers or microwaves and restrictions with the arm. The guidelines of the ABEC/DECA spelling book. Found in this review says that one should avoid sleeping on the side of the implant in the first 30 days and maintain distance from the microwave during its operation.

In the pacemaker user education category, the results are consistent with the doubts of the studies found in the previously discussed category.

The studies conducted identified positive effect on sexual functioning. The resumption of sexual activity should be well clarified, since patients end up not returning to exercise it because they believe it is risk.^[12]

The MRI in pacemaker user identified that no patient presented complications during the MRI examination, and that

there are pacemaker devices compatible with the MRI. The manufacturers of the devices have worked in the last decade on the development of devices compatible with magnetic resonance Images.^[13]

Another study identified that the scale of physical components remained below average in all patients except the patient whose implanted physician evaluated the restrictions of physical activities. The greater the knowledge deficit, the greater the difficulty of returning to life before the disease, which has a negative impact on the quality of life.^[14]

The reviewed videos were intended to educate patients about the indications for therapy with the device, what to expect on the day of the procedure, and how to care for the device after the procedure. Educational technologies aimed at pacemaker patients were not found in the literature, becoming a challenge for this study.

The guidance materials from A to Z for pacemaker carriers. The materials found in the literature addressed the same guidelines of the ABEC/DECA and no studies were found that addressed different items.

A guideline that addresses on vehicular driving for pacemakers. Studies that corroborate this finding were not found in the literature, and this topic was left for future studies.

5. CONCLUSION

The understanding of pacemaker users about health care after device deployment is unsatisfactory. Health education strategies are necessary for this population.

In view of this, a podcast called “pacemaker Alphabet” was developed, developed from this literature review, containing all the letters of the Brazilian Alphabet and the information contained in the studies of the review.

CONFLICTS OF INTEREST DISCLOSURE

The authors declare that there is no conflict of interest.

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