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Educational avatars for patients with cardiovascular diseases: a scoping review

Avatares educacionais para pacientes com doenças cardiovasculares: revisão de escopo

Avatares educativos para pacientes con enfermedades cardiovasculares: revisión del alcance

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ABSTRACT

Objective: to map the scientific evidence on the use of educational avatars for patients with cardiovascular diseases.

Methods: a scoping review was conducted according to the Joanna Briggs Institute guidelines, with no time limit. The search was conducted in eight databases, in the gray literature, and reverse citation searching. Data extraction and description followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews.

Results: a total of 1,405 publications were identified, of which 14 studies were included, all published in English. The studies pointed to good acceptance of avatars by patients for self-management of their health condition, understanding, treatment adherence, promotion of self-care, and improvement in health literacy levels. Methodological diversity was observed, along with important gaps, such as the lack of description of avatar development processes and the scarcity of information on the profile and selection criteria of experts involved in the validation process.

Conclusion: educational avatars have the potential to complement clinical practice and the promotion of cardiovascular health. Further studies are needed in different contexts to ensure effective, accessible, and patient-centered tools.

Descriptors: Cardiovascular diseases. Humanoid avatar. Educational technology. Digital health. Health education.

RESUMO

Objetivo: mapear as evidências científicas sobre o uso de avatares educacionais para pacientes com doenças cardiovasculares.

Método: revisão de escopo conduzida conforme as diretrizes do Joanna Briggs Institute, sem delimitação temporal. A busca foi realizada em oito bases de dados, na literatura cinzenta e por meio de busca reversa por citações. A extração e descrição dos dados seguiram o Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews.

Resultados: foram identificadas 1.405 produções, das quais 14 estudos foram incluídos, todos publicados no idioma inglês. Os estudos apontaram boa aceitação dos avatares pelos pacientes para a autogestão da condição de saúde, a compreensão, a adesão ao tratamento, a promoção do autocuidado e a melhoria dos níveis de letramento em saúde. Observou-se diversidade metodológica, acompanhada de lacunas importantes, como a falta de descrição dos processos de desenvolvimento dos avatares e a escassez de informações sobre o perfil e os critérios de seleção dos especialistas envolvidos no processo de validação.

Conclusão: os avatares educacionais apresentam potencial complementar à prática clínica e à promoção da saúde cardiovascular. São necessários mais estudos, em diferentes contextos, para garantir ferramentas eficazes, acessíveis e centradas nas necessidades do paciente.

Descritores: Doenças cardiovasculares. Avatar humanoide. Tecnologia educacional. Saúde digital. Educação em saúde.

RESUMEN

Objetivo: mapear las pruebas científicas sobre el uso de avatares educativos para pacientes con enfermedades cardiovasculares.

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Método: revisión de alcance realizada según las directrices del Joanna Briggs Institute, sin delimitación temporal. La búsqueda se realizó en ocho bases de datos, en literatura gris y mediante búsqueda inversa por citas. La extracción y descripción de los datos se realizó siguiendo el Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews.
Resultados: se identificaron 1405 publicaciones, de las cuales se incluyeron 14 estudios, todos publicados en inglés. Los estudios señalaron una buena aceptación de los avatares por parte de los pacientes para el autocontrol de su estado de salud, la comprensión, la adherencia al tratamiento, la promoción del autocuidado y la mejora de los niveles de alfabetización en salud. Se observó diversidad metodológica, acompañada de importantes lagunas, como la falta de descripción de los procesos de desarrollo de los avatares y la escasez de información sobre el perfil y los criterios de selección de los especialistas involucrados en el proceso de validación.
Conclusión: los avatares educativos presentan un potencial complementario a la práctica clínica y a la promoción de la salud cardiovascular. Se necesitan más estudios, en diferentes contextos, para garantizar herramientas eficaces, accesibles y centradas en las necesidades del paciente.
Descriptores: Enfermedades cardiovasculares. Avatar humanoide. Tecnología educacional. Salud digital. Educación en salud.

INTRODUCTION

Cardiovascular diseases (CVDs) are the leading cause of mortality around the world and contribute substantially to the high number of hospitalizations, disabilities, premature deaths, and high financial costs for health systems[1]. In 2021, there were 20.5 million deaths from CVDs worldwide, of which 395,000 occurred in Brazil. Among the main conditions related to CVDs are acute myocardial infarction, stroke, heart failure, and cardiac arrhythmias[2].

The impacts of CVDs represent challenges for health systems, resulting in high economic costs and significant impacts on healthcare[3]. Hospitalization, invasive procedures, continuous medication use, and the need for cardiac rehabilitation increase the demand for financial resources. In addition to direct costs, CVDs also lead to indirect impacts, such as loss of productivity due to work disability and reduced quality of life[4].

When individuals understand the nature of their disease, the associated risk factors, the signs and symptoms of worsening, as well as treatment options, they tend to actively engage in their self-care. This process includes consistent adherence to medication regimens, lifestyle changes, and early recognition of signs and symptoms of decompensation that require intervention[5].

The therapeutic management of CVDs is directly influenced by the patient's level of knowledge. Educational guidance provided immediately after clinical diagnosis and/or hospital discharge is often excessive and difficult to assimilate. This may result in forgetfulness or low adherence to therapeutic recommendations. When such guidance is not provided adequately, it leaves important gaps in patient knowledge[6].

With the current technological revolution, several digital health tools have been developed to support the promotion of self-care behaviors and improve therapeutic adherence among people with CVDs. These technologies enhance access to information about health conditions, enable continuous monitoring, encourage lifestyle changes, promote self-management of disease, and support more assertive decision-making[7-8].

Digital health has been consolidated as a strategy to strengthen health systems by expanding access to qualified information and optimizing the quality of care provided. The World Health Organization (WHO) developed the Global Strategy on Digital Health 2020–2025, which highlights the need for technological innovation to address global challenges[9]. The Digital Health Strategy for Brazil 2020-2028 follows this guideline, promoting and supporting the use of digital technologies through the informatization of health services, the integration between services, telehealth and telemedicine, as well as the development of digital solutions, such as applications and platforms, to expand the reach and efficiency of health care in the country[10].

Educational avatars in healthcare are emerging as innovative tools capable of transforming how patients engage with their own self-care and treatment. Avatars are virtual representations of human beings that seek to realistically reproduce physical characteristics, facial expressions, body movements, and appearance details through an interactive experience[11]. Therefore, avatars can be incorporated into the ecosystem of digital innovations, which includes methodologies, models, and software aimed at engaging users in health education and supporting user empowerment in managing their clinical condition[10,12].

A previous study analyzed the effectiveness of using educational avatars by patients with chronic diseases and identified improvements in knowledge, self-care, and self-efficacy. However, little evidence was found regarding the impact on quality of life, medication adherence, and hospital readmission[13].

No publications were identified from searches conducted in January 2026 in scientific databases indexed in Web of Science, PubMed, and Scopus, as well as in research protocol repositories such as the Open Science Framework (OSF), that have systematically mapped the process of creating avatars, including design stages, their characteristics, implementation, and evaluation of these tools aimed at people with CVDs. In this sense, this study seeks to contribute to filling this knowledge gap and to support nurses and other professionals in the development and implementation of digital educational strategies aimed at improving treatment adherence, self-care, communication with patients, and potential interventions to improve health outcomes. Therefore, this study aims to map the scientific evidence on the use of educational avatars for patients with cardiovascular diseases.

METHOD

This is a scoping review, defined as the process of mapping and synthesizing the scientific evidence available in the literature from a broad perspective on the object of investigation. The development of this review followed the methodological guidelines of the Joanna Briggs Institute (JBI)[14].

The study protocol was previously registered with the OSF in October 2024, under the registration: osf.io/2sxhe/. The review follows the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-SCR)[15].

The research question was developed based on the Population, Concept, and Context (PCC) mnemonic, where P (population): patients with cardiovascular diseases; C (concept): avatar; and C (context): educational interventions. Based on these elements, the following guiding question was formulated: "What evidence is available in the literature on the use of educational avatars for patients with cardiovascular diseases?".

The review included empirical studies, regardless of methodological design, that addressed the use of educational avatars in contexts aimed at patients diagnosed with CVDs, focusing on the development, implementation, evaluation, or impact of these interventions. Original research articles, systematic or scoping reviews, dissertations, and theses published in any language and time period were considered. Publications unavailable in full text, whose complete version could not be accessed even after attempts through the Coordination for the Improvement of Higher Education Personnel Journal Portal (*Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* - CAPES), conference abstracts, research protocols, expert opinions, and studies directed at health professionals or students were excluded.

The search strategy was developed based on controlled vocabularies from the Health Sciences Descriptors (DeCS), Medical Subject Headings (MeSH), and Embase Subject Headings (EMTREE), combined using the Boolean operators AND and OR to maximize search sensitivity and specificity.

Initially, a pilot test was conducted in the Medical Literature Analysis and Retrieval System Online (MEDLINE), via PubMed®, to identify relevant descriptors and validate the search terms. Two reviewers fully retrieved all potentially relevant documents. Based on the results, the strategy was refined and adapted to the specificities of each database.

studies was conducted in the following databases: Medical Literature Analysis and Retrieval System Online (MEDLINE) / PubMed® (via the National Library of Medicine), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Scopus (Elsevier), Excerpta Medica Database (Embase), Cochrane Library, Web of Science, Latin American and Caribbean Health Sciences Literature (LILACS), ACM Digital Library, and IEEE Xplore. These were accessed through the CAPES Journal Portal via the Federated Academic Community (*Comunidade Acadêmica Federada* - CAFe). Additionally, gray literature was explored through the Electronic Theses Online Service (EThOS) and Google Scholar (limited to the first 100 results, as recommended in the literature [16]). The searches were conducted by one of the researchers between December 2024 and January 2025, using the specific search strategies detailed in Chart 1.

The references were exported to the Zotero® (version 7.0.3), manager (version 7.0.3), which assisted in identifying and removing duplicates and organizing the references. Subsequently, two reviewers independently and double-blindly screened the studies using the Rayyan Qatar Computing Research Institute platform (Rayyan®).

Chart 1 – Search strategies applied to each database. João Pessoa, Paraíba, Brazil, 2025

Database	Search strategy	Results
MEDLINE / Pubmed	("avatar"[Mesh Terms] OR "avatar"[All Fields] OR "Humanoid Avatar"[All Fields]) AND ("cardiology"[Mesh Terms] OR "cardiology"[All Fields] OR "Heart Diseases"[Mesh Terms] OR "Heart Diseases"[All Fields] OR "Cardiac Diseases"[All Fields] OR "Cardiac Disorders"[All Fields] OR "Heart Disorders"[All Fields] OR "Cardiovascular Diseases"[Mesh Terms] OR "Cardiovascular Diseases"[All Fields]) AND ("Learning"[Mesh Terms] OR "Learning"[All Fields] OR "Health Education"[Mesh Terms] OR "Health Education"[All Fields] OR "Education, Health"[All Fields] OR "Health Literacy"[Mesh Terms] OR "Health Literacy"[All Fields] OR "Consumer Health Information"[Mesh Terms] OR "Consumer Health Information"[All Fields] OR "Health Information, Consumer"[All Fields] OR "Health Promotion"[Mesh Terms] OR "Health Promotion"[All Fields] OR "Promotion of Health"[All Fields] OR "Patient Education as Topic"[Mesh Terms] OR "Patient Education as Topic"[All Fields] OR "Education of Patients"[All Fields] OR "Education, Patient"[All Fields] OR "Digital health"[Mesh terms] OR "Digital health"[All Fields] OR "Digital Health Technology"[All Fields])	18
Embase	('avatar'/exp OR 'avatar' OR 'humanoid avatar') AND ('cardiology'/exp OR 'cardiology' OR 'heart disease'/exp OR 'heart diseases' OR 'cardiac diseases' OR 'cardiac disorders' OR 'heart disorders' OR 'cardiovascular disease'/exp OR 'cardiovascular diseases') AND ('learning'/exp OR 'learning' OR 'health education'/exp OR 'health education' OR 'education, health' OR 'health literacy'/exp OR 'health literacy' OR 'consumer health information'/exp OR 'consumer health information' OR 'health information, consumer' OR 'health promotion'/exp OR 'health promotion' OR 'promotion of health' OR 'patient education'/exp OR 'patient education as topic' OR 'education of patients' OR 'education, patient' OR 'digital health'/exp OR 'digital health' OR 'digital health technology')	37
Scopus	TITLE-ABS-KEY(avatar OR "Humanoid Avatar") AND TITLE-ABS-KEY(Cardiology OR "Heart Diseases" OR "Cardiac Diseases" OR "Cardiac Disorders" OR "Cardiovascular Diseases" OR "Heart Disorders") AND TITLE-ABS-KEY("Learning" OR "Health Education" OR "Health Literacy" OR "Education, Health" OR "Consumer Health Information" OR "Health Information, Consumer" OR "Health Promotion" OR "Promotion of Health" OR "Patient Education as Topic" OR "Education of Patients" OR "Digital health" OR "Digital Health Technology")	9
Cochrane Library	(Avatar OR "Humanoid Avatar") AND (Cardiology OR "Heart Diseases" OR "Cardiac Diseases" OR "Cardiac Disorders" OR "Heart Disorders" OR "Cardiovascular Diseases") AND (Learning OR "Health Education" OR "Health Literacy" OR "Consumer Health Information" OR "Health Promotion" OR "Promotion of Health" OR "Patient Education as Topic" OR "Education of Patients" OR "Digital health" OR "Digital Health Technology")	7
ACM Digital Library	Abstract:(avatar) OR Abstract:("humanoid avatar") AND Abstract:(cardiology) OR Abstract:("heart diseases") OR Abstract:("cardiovascular diseases") OR Abstract:("Cardiac Disorders") OR Abstract:("Cardiovascular Diseases") OR Abstract:("Heart Disorders") AND Abstract:(Learning) OR Abstract:("Health Education") OR Abstract:("Health Literacy") OR Abstract:("Education, Health") OR Abstract:("Consumer Health Information") OR Abstract:("Health Information, Consumer") OR Abstract:("Health Promotion") OR Abstract:("Promotion of Health") OR Abstract:("Patient Education as Topic") OR Abstract:("Education of Patients") OR Abstract:("Education, Patient") OR Abstract:("Digital health") OR Abstract:("Digital Health Technology")	537

Chart 1 – Cont.

Database	Search strategy	Results
IEEE Xplore	("Abstract":Avatar) OR ("Abstract":"Humanoid Avatar") AND ("Abstract":cardiology) OR ("Abstract":"Heart Diseases") OR ("Abstract":"Cardiovascular Diseases") AND ("Abstract":Learning) OR ("Abstract":"Health Education") OR ("Abstract":"Health Literacy")	628
Google Scholar	Avatar OR "Humanoid Avatar") AND (Cardiology OR "Heart Diseases" OR "Cardiovascular Diseases") AND (Learning OR "Health Education" OR "Health Literacy")	10,500 Selected 100
ETHOS	avatar AND cardiology	49
Web of Science	TS=(Avatar OR "Humanoid Avatar") AND TS=(Cardiology OR "Heart Diseases" OR "Cardiac Diseases" OR "Cardiac Disorders" OR "Cardiovascular Diseases" OR "Heart Disorders") AND TS=("Learning" OR "Health Education" OR "Health Literacy" OR "Education, Health" OR "Consumer Health Information" OR "Health Information, Consumer" OR "Health Promotion" OR "Promotion of Health" OR "Patient Education as Topic" OR "Education of Patients" OR "Education, Patient" OR "Digital health" OR "Digital Health Technology")	1
CINAHL	(Avatar OR "Humanoid Avatar") AND (Cardiology OR "Heart Diseases" OR "Cardiac Diseases" OR "Cardiac Disorders" OR "Cardiovascular Diseases" OR "Heart Disorders") AND ("Learning" OR "Health Education" OR "Health Literacy" OR "Education, Health" OR "Consumer Health Information" OR "Health Information, Consumer" OR "Health Promotion" OR "Promotion of Health" OR "Patient Education as Topic" OR "Education of Patients" OR "Education, Patient" OR "Digital health" OR "Digital Health Technology")	19
LILACS	(Avatar OR "Humanoid Avatar" OR "*avatar humanoide*") AND (cardiology OR *cardiologia* OR *Cardiología* OR "Heart Diseases" OR *Cardiopatias* OR "*Doenças Cardíacas*" OR "*Doenças do coração*" OR *Cardiopatías* OR "Cardiovascular Diseases" OR "*Doenças Cardiovasculares*" OR "*Enfermedades Cardiovasculares*") AND (Learning OR *Aprendizagem* OR *Aprendizaje* OR "Health Education" OR "*Educação em Saúde*" OR "*Educación en Salud*" OR "Health Literacy" OR "*Letramento em Saúde*" OR "*Alfabetización en Salud*" OR "Consumer Health Information" OR "*Informação de Saúde ao Consumidor*" OR "*Información de Salud al Consumidor*" OR "Health Promotion" OR "*Promoção da Saúde*" OR "*Promoción de la Salud*" OR "Patient Education as Topic" OR "Educação de Pacientes como Assunto" OR "*Educación del Paciente como Asunto*" OR "*Educação do Paciente*" OR "Digital health" OR "*Saúde Digital*" OR "*Tecnologia de Saúde Digital*" OR "*Tecnologia Digital para Saúde*")	00

Source: research data, 2025.

The study selection process followed four main steps: initially, the titles and abstracts were read for the preliminary identification of potentially eligible publications; next, any disagreements between the reviewers were resolved by consensus, without the need for a third evaluator; subsequently, full-text reading of the pre-selected articles was conducted to assess their eligibility according to the inclusion criteria; finally, a manual search of citations in the reference lists of the included studies was performed to identify additional evidence not captured in the electronic searches.

Data extraction was performed by completing a form developed by the authors with the following information: title, author(s), country of origin, database, year of publication, objective(s) and methodological design, specific characteristics of educational avatars,

development stages, main results and outcomes, identified benefits and limitations. The data were organized based on the categorization of the variables in the developed form and subsequently subjected to a descriptive synthesis.

Before the final data collection, a pilot test was conducted to validate and adjust the instrument, ensuring standardization, consistency, and quality in data extraction, without requiring further adjustments. The results were presented in charts and figures to highlight the distribution of studies, their methodological characteristics, and the main findings.

RESULTS

The search in the databases resulted in the identification of 1,405 records, of which 11 publications were included in the data corpus. Additionally, a manual search of the references of the selected studies allowed the inclusion of three new publications, totaling 14 studies in the review. The selection process is detailed in the flowchart (Figure 1).

Figure 2 presents a world map illustrating the geographic distribution of the selected studies.

Regarding temporality, the studies covered the period from 2016 to 2024, with a significant number in the last five years, showing the following distribution: 2024[17-18], 2023[19-20], 2021[21-22], 2020[23-27], 2018[28], 2017[29] and 2016[30]. Regarding the origin of the studies, seven (50%) were conducted in Australia[20,22-23,25-28], five (35.7%) in the United States[17,21,24,29-30], one (7.1%) in Hong Kong[18] and one (7.1%) in the Netherlands [19]. All studies were published in English.

The indexing sources were CINAHL, with three[19,22,25] (21,4%) studies, *MEDLINE/PubMed*[26,28], *Embase*[27,30] and *Scopus*[20-21], with two publications each (14.3%), followed by the Cochrane Library[18] and Google Scholar[23], with one research each (7.1%). In addition, the citation search resulted in the inclusion of three studies[17,24,29] (21.4%). Regarding methodological designs, randomized clinical trials stood out[17,20-22,24-25,27], followed by methodological studies[23,30], and, with equal distribution, qualitative studies[18], descriptive[19], pilot[26], participatory action research[28] and cohort studies[29].

The characterization of the included studies is presented in Chart 2, including author(s), objective(s), and main results and outcomes.

It was observed that some studies describe the stages for avatar development, while others present partial information or do not detail all phases of the process. The development stages, as identified in the analyzed studies, are systematized in Chart 3.

DISCUSSION

This scoping review analyzed studies on the use of educational avatars for patients with CVD, identifying growing academic interest and potential application in educational and clinical contexts focused on cardiovascular health. In addition, methodological heterogeneity was observed among the included studies, as well as a recurring gap in the description of the development and validation processes of these technologies.

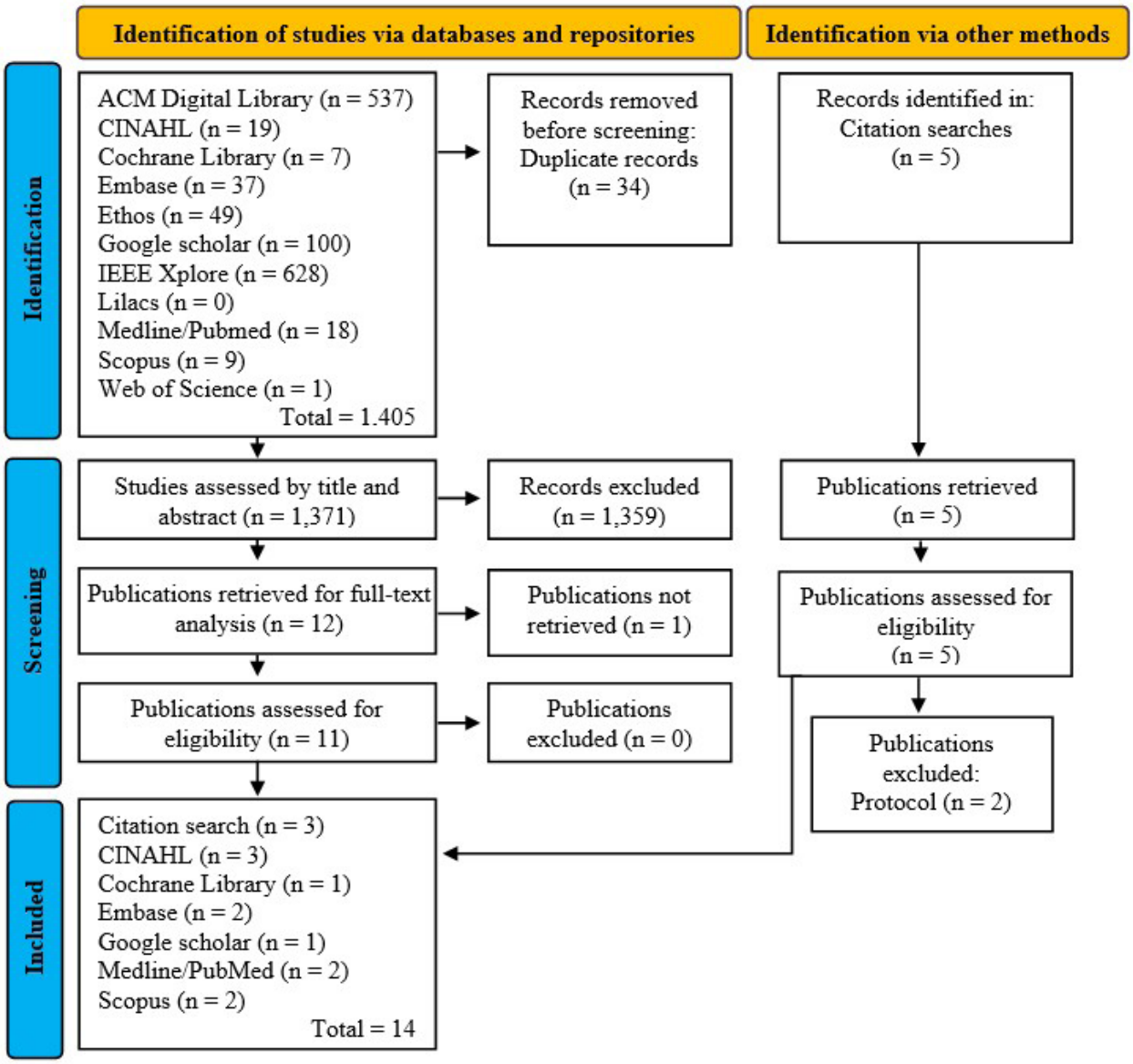
The studies were published between 2016 and 2024, with an emphasis on randomized clinical trials, considered the gold standard in the production of robust evidence due to their high rigor and lower susceptibility to bias[31]. The geographical analysis of the studies revealed a concentration in developed countries, particularly in Australia, highlighting an important gap in regions such as Latin America and other developing countries. This disparity reinforces the need to expand research across different economic and sociocultural contexts to ensure greater representativeness and global applicability of educational technologies.

Heart failure and atrial fibrillation were the main cardiovascular clinical conditions identified in the sample of studies. Both conditions require lifestyle changes and involve complex therapeutic regimens, the use of multiple classes of medications, and continuous monitoring of signs and symptoms for decision-making[32].

Patients with heart failure often have low levels of self-care, a multifaceted phenomenon that, when unsatisfactory, potentiates clinical decompensation, morbidity and mortality, and negatively affects quality of life. Factors such as health literacy level, social support, polypharmacy, multiple comorbidities, and cognitive or functional limitations of patients contribute to an unfavorable prognosis[33-35].

Currently, there is an increase in smartphone use and internet access, expanding mHealth interventions, which include mobile applications, text messaging (SMS), and telemonitoring systems aimed at primary and secondary prevention of CVD and the promotion

Figure 1 – Flowchart of the study selection process, adapted from the PRISMA 2020 recommendation. João Pessoa, Paraíba, Brazil, 2025



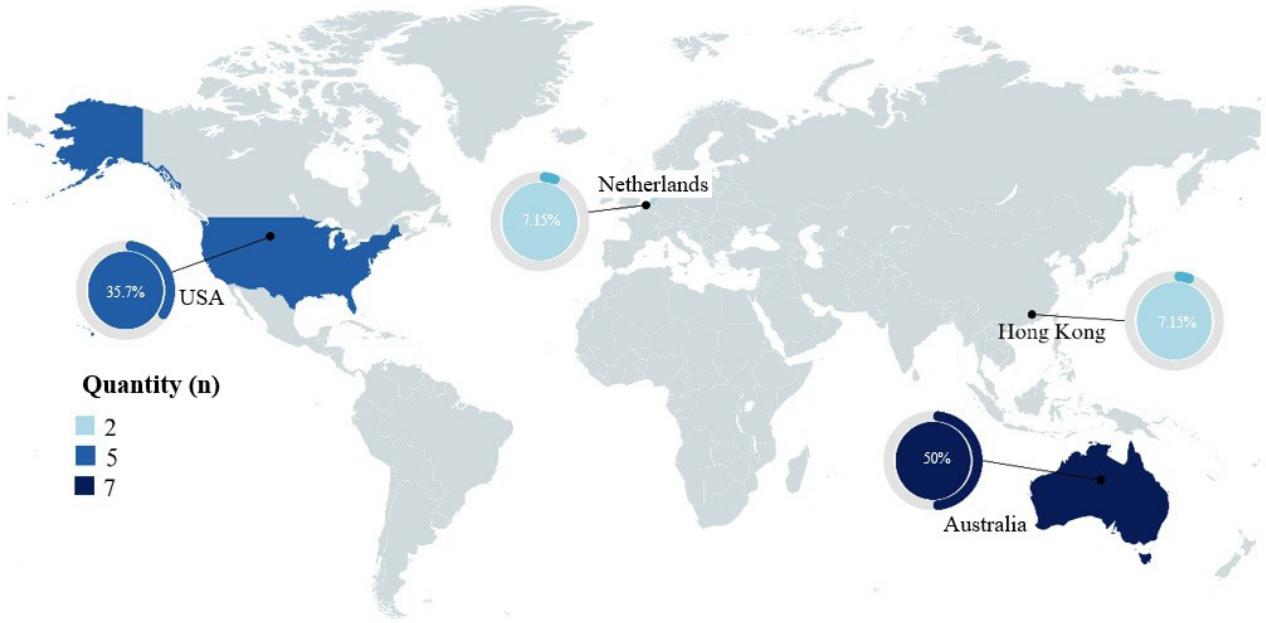
Source: research data, 2025.

of self-care behaviors[36]. In this context, educational avatars have gained prominence due to their educational and motivational potential in health-oriented applications and software. These resources can be used as support tools in the self-care process, promoting increased knowledge about the disease, levels of health literacy, and patient engagement in decisions related to their treatment[37].

In this review, heterogeneity was observed in the methodological approaches adopted for avatar development. Although some steps have been commonly described – such as content selection based on clinical guidelines, consultation with experts and users, technical development, and preliminary testing – few studies[20,23,24,28–30] reported these phases in a detailed and standardized manner, which compromises reproducibility and hinders the consolidation of good scientific practices.

The participation of multidisciplinary teams, along with the direct involvement of the target audience,

Figure 2 – Geographic distribution of the selected studies. João Pessoa, Paraíba, Brazil, 2025



Source: prepared by the authors using the Canva tool, 2025.

has proven to be an essential strategy to ensure the quality, validity, and applicability of the technologies developed. Validation by experts is relevant to ensure the accuracy of the content and its compliance with clinical guidelines[38]. However, the lack of information regarding the profile and selection criteria of experts limits comparisons between studies and the replication of their results. Furthermore, the active involvement of the target population during the development and validation processes contributes to aligning technology with real needs and expectations, enhancing the acceptability and effectiveness of educational interventions in clinical practice[39].

Regarding technical aspects, the best-rated avatars were those with anthropomorphic characteristics, realistic facial expressions, body gestures, and intuitive interfaces, which enhance user engagement – especially among older adults. Features such as icons, vibrant colors, and enlarged text were also considered important facilitators of the user experience[28]. Studies suggest that avatars that simulate human communication may be better received by patients due to their greater interactivity and anthropomorphic characteristics[40-41].

Usability and acceptability testing was described in some studies, contributing to adjustments in the design, language, and interactivity of the avatars. Acceptability is understood as the extent to which an intervention is considered appropriate by users based on their cognitive and emotional responses and is directly related to adherence and the effectiveness of interventions[42]. Similarly, usability testing – whether formative or summative – are essential to identify navigation flaws, clarity of information, accessibility and overall user satisfaction[43]. These strategies made it possible to identify practical problems and make significant improvements before final implementation, strengthening the adherence and experience of end users[44].

Through customized communication and interactivity, educational avatars have the potential to reduce barriers to accessing knowledge, especially for populations with low health literacy[45]. Self-management of chronic diseases is complex, especially for patients with limited health literacy, as it encompasses understanding health information and adhering to therapeutic regimens, which can often be considered complex, in addition to daily decision-making about their own health[46].

Studies have pointed to significant challenges, especially regarding digital inclusion. Older users or those with low technological familiarity reported difficulties in interaction, which can compromise the continuity and engagement in use[22]. A systematic review study aimed at evaluating the use of conversational agents

Chart 2 – Characterization of the studies selected for the scoping review. João Pessoa, Paraíba, Brazil, 2025

Author(s)	Objective(s)	Main results and outcomes of the study
Fallah M et al.[17]	To explore the use of a virtual avatar via smartphone to assist patients with atrial fibrillation in health management, encouraging the use of an integrated heart rhythm sensor.	Participants in the intervention group positively evaluated the virtual coach in terms of trust, likability, and knowledge. The number of sessions (average of 76.7 over 4 months) was associated with more positive attitudes. There was a sense of closeness to the avatar and a desire to include it in the care routine.
Zhu Y et al.[18]	(1) To explore attitudes toward visual cues for self-management in hypertensive patients; (2) To investigate the association between avatar appearance and healthy behavior; (3) To propose guidelines for design.	After two weeks of use, participants reported understanding the relationship between the avatar's appearance and their own health status, which motivated them to adopt healthy habits and modify the avatar's appearance. Design guidelines were described, highlighting that task structuring with specific goals facilitated engagement, with interest in expanding goals, such as including sleep and emotions in self-management.
Gingele AJ et al.[19]	To clarify the role of the avatar in telemedicine and heart failure care.	Most patients considered communication with the telemedicine avatar (similar to a nurse) to be satisfactory and easy. Suggestions for improvement included a preference for weekly contacts, voice recognition, and the need for the avatar to avoid reading punctuation marks in its speech.
Gallagher R et al.[20]	To assess the impact of the gamified application MyHeartMate on lifestyle changes in patients with cardiovascular risk and coronary artery disease (CAD).	The use of the application for six months did not result in significant lifestyle changes or a reduction in risk factors, although it contributed to a reduction in triglyceride levels and an increase in physical activity. The tool was considered useful, with high acceptability for tracking behaviors and encouraging self-care, but with limited effects for lasting lifestyle changes.
Hickman RL, Clochesy JM, Alaamri M.[21]	(1) To examine the effects of the electronic hypertension self-management intervention (eSMART-HTN) and attention control on patient-professional interaction over time; (2) To assess the effects on functional health literacy in adults with hypertension.	Participants interacted with an avatar in communication simulations (expressing needs and preferences) and in education on hypertension self-management. After three months, there was improvement in communication with healthcare professionals and a modest increase in health literacy compared to the control group.

Chart 2 – Cont.

Author(s)	Objective(s)	Main results and outcomes of the study
Zisis G et al.[22]	To determine whether an avatar-based application can improve outcomes in heart failure by promoting knowledge, quality of life, and self-care behavior.	Of the 36 participants, only 10 used the application and only two engaged for eight weeks. These showed improvement in self-care, with greater adherence among younger individuals and those with higher educational levels. In contrast, older adults and individuals without technological experience discontinued use after the first session. None of the engaged users were readmitted, suggesting potential benefits of the application, while six of the non-engaged participants were rehospitalized.
Du H et al.[23]	(1) To develop an avatar application with experts, developers, and patients with heart failure; (2) To evaluate the feasibility of the application to improve knowledge and self-care behaviors; (3) To assess patient satisfaction.	The intervention was divided into sections, consisting of 8 to 10 minutes for reviewing educational content (total average time of 50 to 60 minutes), through feasibility and acceptability testing. There was a significant improvement in knowledge, as well as in self-care maintenance and confidence, but not in self-management. Satisfaction was high (89.2%), with praise for ease of use, clarity, font size, accessible language, and usability. The application helped in understanding health, learning about nutrition, and monitoring weight.
Guhl E et al.[24]	To evaluate the acceptability, adherence, and effectiveness of an avatar-based application for patients with atrial fibrillation.	There was moderate adherence to the intervention, with 61 participants allocated to the intervention group. After 30 days of use, there was an improvement in quality of life and medication adherence. The avatar was considered useful, reliable, and informative.
Wonggom P et al.[25]	To evaluate the effectiveness of an educational avatar-based application to improve knowledge and self-care behaviors in patients with heart failure.	After 90 days of use, there was a significant improvement in knowledge and self-care management in the intervention group, but no increase in confidence between groups. Participants reported high satisfaction with the application, highlighting clarity and adequacy of the information.
Zisis G et al.[26]	To evaluate the feasibility of a nurse-led management program with patients with heart failure selected as high risk for short-term hospital readmission, using ultrasound-guided diuretic management and artificial intelligence to improve heart failure knowledge in an outpatient setting.	Feasibility study with 21 patients over 75 years old, hospitalized due to decompensated heart failure. After 52 days of use, improvements were observed in quality of life, self-care behaviors, and specific knowledge about heart failure.
Tongpeth J, et al.[27]	To evaluate the effectiveness of an avatar-based application for the education of individuals with acute coronary syndrome.	There were significant improvements in the intervention group, as well as changes in attitudes, beliefs, and intentions to act in response to a heart attack, after one and six months.

Chart 2 – Cont.

Author(s)	Objective(s)	Main results and outcomes of the study
Tongpeth J, Du HY, Clark R[28]	To develop and evaluate an interactive avatar-based educational application to improve patient knowledge and response to symptoms of acute coronary syndrome.	The avatar-based educational application, focused on heart attack symptoms, was presented to 10 patients who completed a pre- and post-test. The results indicated an increase in knowledge about heart attack symptoms, as well as high levels of satisfaction and engagement reported by users.
Magnani JW et al.[29]	To test a smartphone application avatar as preparation for a randomized clinical trial, the Atrial Fibrillation Health Literacy Information Technology Trial (AF-LITT).	After 30 days of use, along with phone contacts during the first 7, 14, and 21 days to discuss any difficulties, 31 participants reported significant improvement in quality of life and a slight increase in medication adherence. The avatar was considered useful and reliable.
Athilingam P et al.[30]	To design interactive educational modules on a smartphone platform specifically for patients with congestive heart failure.	Based on free use for up to two hours or until participants felt ready to provide feedback, most participants trusted the use of the application for heart failure, praising its intuitive design and relevant content. Participants reported learning new information and considered it useful for newly diagnosed patients.

Source: research data, 2025.

in the self-management of chronic diseases highlights that the exclusion of populations that could significantly benefit from these technologies, such as older adults or people with physical limitations, in design and usability studies, may exacerbate existing disparities[47]. Therefore, it is important to develop and adapt technologies to different user profiles, prioritizing accessible interfaces, usability features, and continuous support[48].

As technology increasingly influences nearly all aspects of life in contemporary society, health education and promotion are also being transformed by the digital era. Telehealth, as a technological resource that enables interaction between patients and healthcare professionals, has the potential to transform the model of care, particularly by offering support for remote monitoring and health education for individuals with CVD[49].

Although limited public investment in digital solutions is still observed, there has been growth in the development of new technologies, which has progressively impacted the clinical care of populations with CVD. In a context of reduced production costs and increased access to digital technologies, including in low- and middle-income countries, health education strategies and avatar-mediated digital consultations are becoming feasible[50].

These resources not only broaden the reach of health information but also contribute to overcoming barriers to access to services, especially in contexts marked by geographical, social and economic inequalities. The possibility of integration into digital platforms contributes to a more inclusive, connected, and patient-centered health ecosystem, reinforcing the digital transformation of services and equity in access to health knowledge[9,10].

This review revealed some important limitations: most studies used small samples with short follow-up periods, which limits the generalization of findings and benefits of use in the medium and long term. Additionally, the concentration of studies conducted in developed countries limits the understanding of the applicability of avatars in contexts with less technological infrastructure, as well as different socioeconomic and cultural realities, considering specific challenges

Chart 3 – Stages of the avatar development process. João Pessoa, Paraíba, Brazil, 2025

Author(s)	Stages for avatar development
Fallah M et al.[17]	Not reported.
Zhu Y et al.[18]	The content was defined based on three types of behaviors aimed at controlling hypertension: practice of moderate physical activities, adoption of healthy diets, and continuous monitoring of blood pressure; two versions of a mobile application were developed, one of which included an avatar in the form of a virtual plant as an additional visual suggestion, exclusive to the intervention group; both versions of the application were tested and evaluated by 15 participants from the target audience, divided between an intervention group and a control group, over two weeks.
Gingele AJ et al.[19]	Not reported.
Gallagher R et al.[20]	Development based on the guidelines of the National Heart Foundation of Australia; review by a multidisciplinary panel of experts (physicians, nurses, physiotherapists, nutritionists, exercise science researchers); creation of the avatar's appearance and animation in consultation with older adults with CAD; testing and evaluation of the beta version of the application with 18 individuals from the target population over two weeks.
Hickman RL, Clochesy JM, Alaamri M.[21]	Not reported.
Zisis G et al.[22]	Not reported.
Du H et al.[23]	Content development based on the guidelines of the National Heart Foundation of Australia; discussion with 15 heart failure specialists; application development; validation of appearance by five individuals from the target population and one family member; avatar modification based on feedback; further review by specialists; feasibility and acceptability evaluation of the application with 13 patients from the target population.
Guhl E et al.[24]	Content based on a literature review and qualitative interviews with users, organized into three modules: atrial fibrillation education, symptoms, and adherence.
Wonggom P et al.[25]	Not reported.

Chart 3 – Cont.

Author(s)	Stages for avatar development
Zisis G et al.[26]	Not reported.
Tongpeth J, et al.[27]	Not reported.
Tongpeth J, Du HY, Clark R[28]	A multidisciplinary panel of experts (cardiologist, nurse, and cardiovascular researchers) developed the storyboard based on the National Heart Foundation of Australia Heart Attack Action Plan; information technology specialists developed the application; cardiology experts and the target population validated the first draft through focus groups; the application was revised by an information technology specialist based on feedback; final review by cardiovascular experts.
Magnani JW et al.[29]	Development based on a literature review and qualitative interviews with patients with atrial fibrillation.
Athilingam P et al.[30]	Content based on the guidelines of the Heart Failure Society of America; alpha testing with six individuals from the target population to evaluate program appearance, style, and functionality; beta testing with ten individuals from the target population to assess patient self-efficacy and confidence in using the mobile application; evaluation of the application by eight experts in the field.

Source: research data, 2025

such as barriers to technology access, digital literacy, and inequalities in access to the healthcare system.

CONCLUSION

Educational avatars are promising technologies in promoting health literacy, self-care, and therapeutic adherence in patients with cardiovascular diseases. Improvements in health literacy were observed as avatars facilitated the understanding of clinical information through accessible explanations and visual representations for users. In terms of self-care, avatars have demonstrated potential to support the organization of disease management routines, promoting the understanding of knowledge necessary for self-management and the development of skills to monitor clinical conditions more effectively.

The synthesis presented in this review provides a framework for expanding the use of digital educational technologies in nursing care by highlighting the integration of these technologies into care pathways, increasing the potential for innovation and impact on professional practice. Robust methodological studies, with greater sample and geographic diversity, feasibility and usability testing, and validation processes with experts and end-users are needed. Furthermore, the applicability of educational interventions in diverse clinical and sociocultural settings is opportune to ensure that these tools are accessible, effective, and aligned with patient-centered needs. The scarcity of studies in Brazil reinforces the need for investment in research exploring the potential of these tools in the therapeutic management of patients with CVD.

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Data and material availability

Access to the dataset is available upon request from the corresponding author.

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