Humanoid robots in clinical care: a scoping review protocol

Robôs humanoides nos cuidados assistenciais: protocolo de revisão de escopo

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ABSTRACT

Objective: To map scientific evidence on types of care provided by humanoid robots.
Method: A scoping review was conducted guided by the Joanna Briggs Institute's guidelines to answer the question: What type of care is performed by humanoid robots? The search will be carried out in six databases and the grey literature. The citations will be collated in Rayyan software, and duplicates will be removed. The selection of articles will be carried out in two stages, title and abstract screening, followed by full-text evaluation by two independent reviewers, and a third one will be activated in situations of divergence. The extracted data will be synthesized descriptively. A narrative summary will accompany the tabulated and mapped results and describe how the results relate to the review's purpose and question. The final article will use the Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR).
Descriptors: Scoping Reviews; Humanoid Robots; Patient Care; Nursing Care.

RESUMO

Objetivo: Mapear as evidências científicas dos tipos de cuidados assistenciais desempenhados por robôs humanoides. **Método:** Revisão de escopo direcionada pelas diretrizes do Joanna Briggs Institute para responder à pergunta: quais os cuidados assistenciais desempenhados por robôs humanoides? A busca será realizada em seis bases de dados e na literatura cinzenta. As citações serão agrupadas no *software* Rayyan e as duplicatas removidas. A seleção dos artigos será realizada em duas etapas, leitura de títulos e resumos, seguida da avaliação do texto completo por dois revisores independentes, sendo acionado um terceiro em situações de divergência. Os dados extraídos serão sintetizados de forma descritiva. Um resumo narrativo acompanhará os resultados tabulados e mapeados e descreverá como os resultados se relacionam com o objetivo e a questão da revisão. O artigo final utilizará o *Preferred Reporting Items for Systematic Reviews and Meta Analysis extension for Scoping Reviews* (PRISMA-ScR).
Descritores: Revisão de Escopo; Robôs Humanoides; Assistência ao paciente; Cuidado de Enfermagem.

INTRODUCTION

Since the industrial revolution, there have been increasing changes in all areas of knowledge, such as education, management, and assistance. Since then, there has been a growing and permanent technological innovation, which began with the expansion of information technology and various sophisticated equipment[1].

Technology is present in several fields of daily life, and the health area could not fail to follow the advances resulting from it. However, in parallel, this acceleration leads to the miscegenation of feelings such as admiration, fear, curiosity, and, at times, an abomination. This causes concern among health professionals, making this topic the target of many debates and research[2,3]. Studies indicate that technology would advance rapidly in the health sector with modern equipment and innovative treatments. In Brazil, in 2008, robotics reached surgical procedures in the private network, reaching the Unified Health System (SUS) around 2011, and since then, growth in this area has

been on the rise. This technology is mainly used as exoskeletons for rehabilitation and ergonomic use, as well as in direct healthcare, such as diagnoses, surgeries, and special care for the elderly[4].

The incorporation of new technologies in healthcare requires adaptation at the structural and behavioral levels since, by adopting these strategies, the health professional must update himself in technical-scientific functions and interpersonal relationships[2].

Dealing with technology in the health environment requires an evaluation of aspects such as safety, ethics, social impact, cost-effectiveness, and, above all, adequate use, avoiding the abandonment of the humanization during the provision of healthcare[1,5].

In addition to these aspects, implementing new technologies has other financial issues, considering that the health sector usually needs to allocate resources in areas of greater priority and not in sectors that still do not have well-defined cost-effectiveness[6].

Given the above, Artificial Intelligence (AI) advances in the health sector, showing that humanoid robots can perform various care activities and even socially interact with humans[4]. In this scenario, humanoid robots stand out, a type of technology with increasing advances, being used in large health centers, such as the Romeo and Pepper robots, in Paris, and Telenoid, Asimo, Aiko Chihara, and Twenty-One, in Japan, which provide direct care to patients, either with assistance in daily activities, social interaction or emergencies[7].

AI can be used in several fields because, once performed safely, it will certainly have a more agile and better quality service as a final product, including the population's health management; prediction, intervention, and guidance, according to health risks; medical advice and screening; integration between devices used by the population; digital coaching; clinical documentation; diagnoses and clinical decision-making[5].

The current health scenario in 2021 is challenging, as along with the COVID-19 pandemic, there have been insertions and technological advances. Therefore, AI and robotics have corroborated this moment by deploying humanoid robots that perform the assistance and social activities. In this innovative process, barriers such as technical problems and prejudices must be faced, but several facilitators encourage investments in this matter[8].

In order to understand the theme, a systematic review record on this topic was searched in the Joanna Briggs Institute (JBI) database, and a record from October 2021 was found related to the use of humanoid robots for the treatment of pain in children[9]. In the International Prospective Register of Systematic Reviews (PROSPERO), there are six records of systematic review protocols, two in 2017, one completed and the other ongoing; three from 2020; and one from 2021, in progress. The study completed and registered in 2017 refers to social robots in health and education[10]; the one that is still in progress addresses the same theme, however, it approaches the health of the elderly[11]. One of the protocols registered in 2020 aims to research humanoid robots as a therapeutic practice[12], and the most current one seeks an effect on elderly people with dementia[13].

Given the above, several issues permeate this type of action and must be thoroughly analyzed, especially in their insertion in the various healthcare modalities, which justifies this study's importance.

Given the topic's relevance, a scoping review of care provided by humanoid robots may corroborate the approach to the theme and identify gaps in knowledge and studies on this issue.

The research question of this review is: What type of care is performed by humanoid robots? Moreover, the review has the following sub-questions: What is the most prevalent population (children, adults, or elderly) that receives care provided by humanoid robots? In which contexts (geographical, environmental, and clinical) does this type of care take place?

The protocol was registered on the Open Science Framework (OSF) platform with the number osf.io/6ur93.

METHOD

The scoping review is also known as a mapping review, as it intends to explore the literature concerning a chosen theme without intending to assess the methodological quality of the studies, only to identify how they were performed[14].

This study is a protocol for a scoping reviews that will be developed based on the JBI® guidelines, following the steps determined by the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)[15].

Research question

The mnemonic PCC (Population, Concept, Context) was used to construct the research question. Therefore:

Population

The study population will be composed of human beings, regardless of age group, who have received care provided by humanoid robots, regardless of the care scenario.

Concept

This review will include studies addressing the practice of care provided by a humanoid robot, understood as any robot with structures and characteristics based on human ones, being able to move and interact with man and the environment.

Care encompasses any practice beyond disease care, including activities that promote assistance to the individual in several dimensions in which there is vulnerability, encompassing the physical, social and cognitive domains[16,17].

Context

The context will be broad and can be any environment where care is practiced, such as public and private hospitals, clinics, nursing homes, homes, and others.

Study designs

Experimental, quasi-experimental (randomized and non-randomized clinical trials), observational (cohort, case-control, and cross-sectional), and qualitative studies will be included. The review will also include case reports, protocols, clinical practice guidelines, all types of evidence synthesis, theses, dissertations, and term papers. Letters, editorials, articles with incomplete data, and studies that, after three consecutive attempts to contact the authors, cannot be access in full format, will be excluded.

Databases

In order to reach different types of study, in all languages, without a time frame, the following electronic databases will be used: Pubmed®, Excerpta Medical dataBASE (EMBASE®), Latin American and Caribbean Health Sciences Literature (LILACS), Web of Science, Scopus® and CINAHL Complete.

ProQuest Open and Google Scholar will be used as sources of grey literature.

Authors will contact a certified translator if they find studies published in languages that are not their domain.

Search strategy

The search strategy will be adapted for each database according to the recommended search descriptors. There will also be a search to examine the reference lists of the included studies. An initial search will be carried out using the terms combined with the Boolean operators "AND" AND "OR" in the Pubmed® and Scopus® databases to identify search terms related to the research theme through the studies considered relevant (Figure 1). After this pre-analysis, the authors will define the definitive search strategy used in all selected databases. A librarian will assist with this step.

The initial strategy will consist of the following search query: ("Artificial intelligence" OR robotics OR robot OR ai) AND ("humanoid robot") AND ("Ambulatory Care" OR "Ambulatory Care" OR "Patient Care" OR "Long--Term Care" OR "Home Nursing" OR "Hospital Care" OR "Personal Health Services" OR "Comprehensive Health Care" OR "Delivery of Health Care" OR "Continuity of Patient Care" OR "Hospital Care" OR "Personal Health Services" OR "Comprehensive Health Care" OR "Delivery of health care").

Selection of studies

In order to guarantee the quality of the review, two reviewers will participate in the study selection, and, in case of disagreements, a third reviewer will participate. The selection of studies will be carried out according to previously defined criteria.

For the selection of studies, first, two reviewers will read the titles and abstracts to verify whether the studies respond to the proposed research objectives. After this step, the studies selected for final selection will be read in full. There will also be a manual search for studies through the reference lists of the studies included in the review. The Rayyan® reference management software will be used in this step to organize and structure the references and remove duplicate studies.

As a result of the selection of studies, a flowchart of all steps and the individual results will be presented.

Data extraction

The reviewers will extract data from the studies selected for the scoping reviews using an instru-

Mnemonic	DeCS	Entry terms
P	Artificial intelligence AI Robot Robotics	humanoid robot
C	Ambulatory Care Long Term Care Home Nursing Patient Care Continuity of patient care	Comprehensive Health Care Delivery of healthcare Personal Health Services Hospital care
C	-	-

Figure 1– Terms selected for the initial search strategy to be used in Pubmed®, and Excerpta Medical dataBASE (EMBASE®). Londrina, PR, Brazil, 2022

Source: Prepared by the authors, 2022.

ment prepared by the authors using the Excel® software. The instrument will address detailed information on each study, such as title, authors, country, location, journal name, year of publication, objectives, study design, and size and age of sample participants.

Data analysis and presentation

The included studies will be described using the recommendations of the PRISMA-ScR checklist and the JBI® manual for scoping reviews.

The results will be presented using tables and graphs for visibility of the evidence found, and the following information will be grouped: year and country of publication, study design, population (sample size and age), study objectives, results, study location (type of institution), and type of care provided.

Together with the tabulations of the results, there will be a narrative description to highlight the relevant situations and the similarity between the findings, in addition to directing the correlations between the findings and the review's objective and question.

CONFLICT OF INTERESTS

The authors have declared that there is no conflict of interests.

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