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Robotics in occupational therapy: Protocol for a scoping review

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Abstract

Introduction: Although the utilization of social robots to support interventions on occupations holds promise due to the shortage of human resources, no synthesis of knowledge on this topic has been conducted in the field of occupational therapy.

Objective: Synthesize knowledge of occupational therapy interventions using robotics to foster occupations published since 2004.

Inclusion/Exclusion
Criteria: Based on the following inclusion and exclusion criteria, studies were selected if: (1) original empirical research published in English or French in a peer-review scientific journal, (2) involved a robot as previously defined and (3) reported an intervention directly on occupations that had been carried out within occupational therapy practice and involving an OT. As exoskeletons, prothesis and upper limb training robots are mainly used to exercise (training with repetitive motions) and not specifically to support occupations, these robots were excluded. Also, only articles were included.

Method: To synthesize this knowledge, the methodological framework for scoping studies (Arksey & O'Malley, 2005; Levac, Colquhoun & O'Brien, 2010) and PRISMA standards (Moher, Liberati, Tetzlaff, Altman & PRISMA Group, 2009) will be followed. The search will be conducted across seven databases (PUBMED, SocIndex, CINAHL, MedLine, AgeLine, Abstracts in Gerontology, and OTDBase) using keywords related to occupational therapy and robotics, with the search period ending on April 15st 2025. Eligibility screening (title/abstract and full-text) and data extraction will be performed by at least two independent reviewers, and any conflicts will be resolved by the team.

Introduction

1 Occupational therapists play a crucial role in enhancing individuals' quality of life by supporting their participation in meaningful occupation "as an activity in which one engages" (Merriam-Webster, 2025). This is achieved through interventions that develop functional skills, provide assistive devices, and teach coping strategies. Various health conditions or events can create challenges in daily living (Maresova et al., 2019). As a result, healthcare professionals, including occupational therapists, are reevaluating how to deliver effective interventions (Richards & Vallée, 2020). In parallel with fields such as nursing (Krick et al., 2019), social work (Shin & Lee, 2024), and surgical medicine (Alip et al., 2022), robotics has emerged as a tool to address daily life challenges and support occupational therapy interventions. The International Federation of Robotics (2016; p. 9 defines robots as *"an actuated mechanism programmable in two or more axes with a degree of autonomy, enabling them to perform intended tasks based on their current state and sensory input."* While literature on robotics in occupational therapy remains limited, robots have been utilized in specific therapeutic contexts, such as biomechanical interventions like exoskeletons for individuals with mobility impairments (Stampacchia et al., 2022) and bionic prostheses for amputees (Schweitzer, Thali, & Egger, 2018). Moreover, robots have assisted in interventions for conditions such as hand therapy following a stroke (Singh et al., 2021), rehabilitation after accidents or trauma (Chien et al., 2020; Mekki et al., 2018; Pundik et al., 2022), dementia progression (Ma et al., 2023), and social interaction with children on the autism spectrum (Saleh et al., 2021). Considering ongoing health crises, labor shortages, and the need for physical distancing, robots present an opportunity for occupational therapists to conduct remote interventions or home visits, minimizing human proximity and reducing the need for physical manipulation of objects (Ranjan, Gandhi & Sivakumar, 2023). Additionally, during the pandemic, as isolation increased and in-person visits were restricted in settings like nursing homes (Sayin & Karaman, 2021), robots have served as an alternative to support rehabilitation and social engagement (Liao et al., 2021). Beyond improving the efficiency and quality of healthcare services, robots can optimize the time and energy of caregivers while promoting the autonomy of community-dwelling clients (Hong et al., 2024). Some robots, such as the JACO robotic arm (Beaudoin et al., 2019), can perform tasks independently, without the need for human intervention, and can carry out repetitive tasks continuously (Malik et al., 2022). While their initial cost may be high, robots could be cost-effective over time by assisting therapists over several years (Cano-de-la-Cuerda et al., 2024) and performing other tasks that optimize their time (Lo et al., 2019). In the literature, no scientific articles perform knowledge integration on robotics used in occupational therapy interventions. This study thus aims to synthesize the body of knowledge on robotics used in occupational therapy interventions designed to directly support occupational engagement.

Research question

2 The main research question was the following: how robotics is used in occupational therapy interventions to directly foster occupations?

Search strategy

3 1 AND 2

	A	B
	Occupational therapy	" Occupational therap* " OR OT
	Robotics	Robot* OR " virtual agent*" OR " computer agent*"

Concept

4 This review will include studies that report on the utilization of social robots to support interventions on occupation. The review will explore how robots can serve as a modality in occupational therapy interventions. Key factors to be examined include the intervention's purpose, the target population's age, health condition, intervention duration, user satisfaction, and the robot's functionalities and characteristics. The intervention purpose refers to the rationale for using the robot in therapy, while the population describes the group of people targeted by the intervention. The health condition will be considered if the intervention is designed for specific conditions such as dementia or stroke. The duration refers to the number of sessions involving the robot, and satisfaction reflects the occupational therapist's approval of the robotic intervention. Finally, the review will include the robot's functionalities and characteristics to determine what is needed from the robot to effectively deliver the intervention.

Context

5 To describe specific occupational therapy interventions, McColl and Law taxonomy for occupational therapy interventions (McColl & Law, 2013) will be used. This taxonomy categorizes interventions into the eight following areas: training, skills development, education, task adaptation, occupation development, environmental modifications, support provision, and support enhancement.

Studies identification

6 The first author, a master's student in occupational therapy (MC), will search seven databases (Figure 1) until April 15th, 2025, to identify relevant articles using five predefined keywords related to occupational therapy and robotics (Table 1). These keywords were selected by the research team with the assistance of a scientific librarian from the *Université de Sherbrooke*. Given the broad use of the term 'robot' in scientific literature, keywords unrelated to the scope of this study will be excluded, such as artificial intelligence (AI), virtual reality, mobile applications, and cellphone technologies. To ensure the focus is on recent advancements in the field, articles published before 2004 will also be excluded.

Studies selection

7 The result of the search will be uploaded into Zotero 7.0.11. After removing duplicates in Zotero, the selection process will begin with an initial screening based on article titles. A second screening will focus on abstracts. This process will be carried out independently by two of the four master's students in occupational therapy (MC, LC-T, AG-L, or NG), under the supervision of the primary investigator (ML), who will resolve any conflicts. Finally, the full text of the remaining articles will be reviewed to complete the selection.

Studies extraction

8 Data will be extracted using an Excel file adapted from prior work by the primary investigator. The following information will be recorded: first author and their country of residence, publication date, study aims, design, population and diagnoses, sample size, duration of the intervention, and satisfaction with the intervention. Additionally, the characteristics, strengths, limitations of the robots and interventions, as well as the study results, will be documented. Data extraction will be performed independently by two master's students in occupational therapy (MC, NG). In cases of ambiguity, the final decision will be made by the primary investigator (ML). Furthermore, the Human Development Model – Disability Creation Process (HDM-DCP) (Fougeyrollas et al., 2019) will be used to categorize information based on

personal and environmental factors, as well as social participation, that influence the use of robots in occupational therapy interventions.

Studies analyze

9 The analysis will be conducted by the same two master’s students in occupational therapy (MC, NG) who performed the data extraction. To ensure all relevant findings are accurately captured, the analysis will be reviewed by all team members. Extracted characteristics will be analyzed in terms of frequencies and percentages. The Oxford Centre for Evidence-Based Medicine (Centre for Evidence-Based Medicine, 2009) classification will be used to assess the level of evidence for each study based on its design: 1a (systematic review with homogeneity of randomized clinical trials), 2b (individual cohort study), 3b (individual case-control study), 4 (case series), and 5 (expert opinion). Interventions will be appraised as satisfactory if most participants expressed a willingness to continue using the robot, and positive outcomes were reported. A neutral appraisal will be given if the authors identified both advantages and disadvantages and concluded that the intervention may be a promising solution for the future. An unsatisfactory appraisal will be given if the article predominantly reports negative feedback regarding the robot's use.

Anticipated outcome

10 This scoping review aims to compile existing research on occupational therapy interventions that use robotics to support occupations. The information summarizing various interventions such as the type of robot, health conditions, age groups, and user satisfaction will guide future occupational therapy practice. Additionally, the review will also inform on how personal factors, the individual, the environment, and the robot itself influence occupational outcome.

Conflicts of interest

11 The authors have no conflict of interest to declare.

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