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REVİEW ARTICLE

A Scientometric Study on Serious Games in Geriatric Care: Research Trends and Insights

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Abstract
The rising global aging population presents significant healthcare challenges, particularly in cognitive decline, physical rehabilitation, and social well-being. Serious games have emerged as an innovative intervention, offering interactive and engaging solutions to enhance cognitive function, mobility, and emotional health in older adults. However, a comprehensive understanding of research trends, key contributors, and thematic developments remains limited. This study conducts a bibliometric analysis of serious games in geriatric care using Web of Science (WoS) and Scopus, analyzing 95 unique publications with ScientoPy and VOSviewer. The results indicate a steady increase in research output, with a significant surge post-2020, reflecting growing recognition of serious games as effective geriatric interventions. European countries, particularly Italy, Spain, France, and Germany, lead in research contributions, while Qatar, Greece, and the United States host key institutions driving advancements in this field. A co-occurrence analysis of author keywords identified two primary thematic clusters: (1) Cognitive Health and Neurodegenerative Conditions, focusing on dementia, mild cognitive impairment, and cognitive training, and (2) Aging and Rehabilitation, emphasizing mobility, engagement strategies, and gamification. These findings highlight the interdisciplinary nature of serious games, integrating health sciences, psychology, and digital technologies. This study provides a strategic overview of the field, identifying research gaps, key trends, and emerging directions. The findings offer valuable insights for academics, healthcare professionals, and policymakers, guiding the future development of evidence-based serious game applications to enhance the quality of life for older adults.

Keywords
Serious Games, Geriatric Care, Cognitive Training, Rehabilitation, Digital Health

INTRODUCTION

The global aging population is rapidly increasing, leading to unprecedented challenges in healthcare, social engagement, and overall well-being among older adults. According to the United Nations Department of Economic and Social Affairs (UN DESA, 2017) the global population aged 65 and older is projected to reach 1.6 billion by 2050, nearly doubling from 771 million in 2022. With this demographic shift, age-related conditions such as cognitive decline, mobility impairments, and social isolation are becoming more prevalent, demanding innovative and technology-driven interventions (Rudnicka et al., 2020).

Serious games are interactive digital applications designed for purposes beyond mere entertainment, that might have gained increasing attention in geriatric care due to their potential to enhance cognitive functions, improve physical rehabilitation, and promote social inclusion (Baragash et al., 2022; Beltran-Alacreu et al., 2022).

Unlike traditional therapeutic approaches, serious games offer engaging, personalized, and adaptive medium that can improve cognitive stimulation, including memory, attention, and problem-solving, as well as physical activity and emotional well-being (Shahmoradi et al., 2022). Studies suggest that older adults who engage in digital game-based interventions demonstrate significant improvements in reaction time, memory retention, and motor coordination (ChePa et al., 2023; Zelinski & Reyes, 2009).

Despite the increasing body of research, the field remains fragmented, with varying levels of

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adoption, effectiveness, and accessibility across different regions. North America and Europe lead in serious games research and implementation, supported by strong government and institutional funding (Sillaots & Fiadotau, 2023). In contrast, Asia and Latin America are emerging contributors but face challenges such as limited infrastructure, digital literacy, and cultural barriers to technology adoption (Marston, 2013) While developed nations see higher adoption rates of serious games in clinical and home settings, low- and middle-income countries (LMICs) struggle with access to these interventions (Borda et al., 2023). This disparity underscores the need for a comprehensive understanding of the global research landscape to identify gaps, trends, and future directions in serious games for geriatric care.

To address these challenges, bibliometric analysis provides a robust method for evaluating the intellectual structure, collaboration networks, and thematic evolution of a field (Donthu et al., 2021). By analyzing scientific literature, bibliometric techniques can uncover publication trends, key contributors, influential journals, and emerging research themes. Applying this method to serious games in geriatric care will offer valuable insights into how the field has evolved over time, which regions and institutions are leading the research, and what key themes are shaping future advancements.

This study aims to conduct a bibliometric analysis of serious games research in geriatric care to explore global trends, identify major contributors, and highlight influential publications. Specifically, this research seeks to answer several critical questions:

RQ1: What are the annual publication trends in serious games research for geriatric care?

RQ2: Which are the top 10 countries and institutions contributing to research in this domain?

RQ3: Which are the top 10 journals publishing research on serious games in geriatric care, based on publication count and impact?

RQ4: What are the top 10 most cited articles in this field, and what are their major contributions?

RQ5: What are the most frequently occurring author keywords in serious games research for geriatric care, and how do they interconnect based on co-occurrence analysis to reveal emerging research themes?

Answering these questions will help map the intellectual landscape of serious games for geriatric care and guide future research efforts (Azizan, 2024). By synthesizing global research trends, this study will contribute to the existing body of knowledge in multiple ways. First, it will provide a quantitative overview of the research trajectory, helping scholars understand how the field has developed over time. Second, it will identify the leading countries, institutions, and scholars who are shaping the discourse on serious games for older adults. Third, it will highlight the most influential journals and landmark publications that have significantly contributed to the field. Finally, by mapping emerging themes and research gaps, this study will inform future innovation and policy-making in digital health interventions for aging populations. Through this bibliometric approach, researchers, healthcare professionals, policymakers, and game developers can gain valuable insights to enhance the quality of life for older adults through serious games.

MATERIALS AND METHODS

Data Source and Search Strategy

This study employed a bibliometric analysis to investigate research trends in serious games for geriatric care, utilizing two major academic databases: Web of Science (WoS) and Scopus. These databases were selected due to their broad coverage of high-impact, peer-reviewed literature and their frequent use in scientometric and bibliometric analyses (Azizan & Fadzil, 2024). The search was conducted on February 20, 2025, to ensure a comprehensive and up-to-date dataset for analysis.

To develop a robust search strategy, expert consultation and prior literature were used to determine the most relevant keywords. Boolean operators were applied to refine the query and retrieve only studies explicitly addressing serious games and geriatric care. The final search string was structured as follows:

"serious game" (Title) AND ("old" OR "elder" OR "geriatric*" OR "pension*" OR "age*") (Title) AND (Article OR Review Article) (Document Types) AND English (Languages)***

This query ensured that the dataset focused on serious games as an intervention, assessment tool, or research subject in the context of aging and geriatric populations. Only articles and review papers were considered, excluding conference proceedings, book chapters, and gray literature to maintain scientific rigor.

Although this study focused on high-quality peer-reviewed literature indexed in WoS and Scopus, we acknowledge that other databases such as Google Scholar and PubMed could offer additional insights, especially from non-English or region-specific publications. However, WoS and Scopus were selected for their rigorous indexing standards, structured metadata, and established use in bibliometric research, ensuring data consistency and scientific quality (Donthu et al., 2021; Ruiz-Rosero et al., 2019). Future studies are encouraged to integrate broader databases to capture a more diverse global research landscape.

Data Extraction and Processing

To ensure data quality and relevance, specific inclusion and exclusion criteria were applied. Studies were included if they:

Were published in any year to provide a historical perspective on the field.

Were classified as research articles or review articles.

Were written in English to ensure accessibility and comparability.

Studies were excluded if they were:

Conference proceedings, book chapters, editorials, or non-peer-reviewed literature.

Duplicates or irrelevant studies that did not align with the research focus.

A total of 166 publications were initially retrieved, with 79 from WoS and 87 from Scopus. To remove duplicate entries, ScientoPy, an open-source Python-based bibliometric analysis tool (Ruiz-Rosero et al., 2019), was employed. The duplicate removal process identified 71 redundant papers (42.8%), primarily from Scopus, where 81.6% of duplicate records were removed. In cases where duplicate records contained different citation counts, a harmonization process was applied, ensuring the most accurate citation data was retained.

Following this data refinement process, a final dataset of 95 unique publications was established, with 79 from WoS (83.2%) and 16 from Scopus (16.8%). A PRISMA-style flow diagram (Fig.1) illustrates the data selection process.

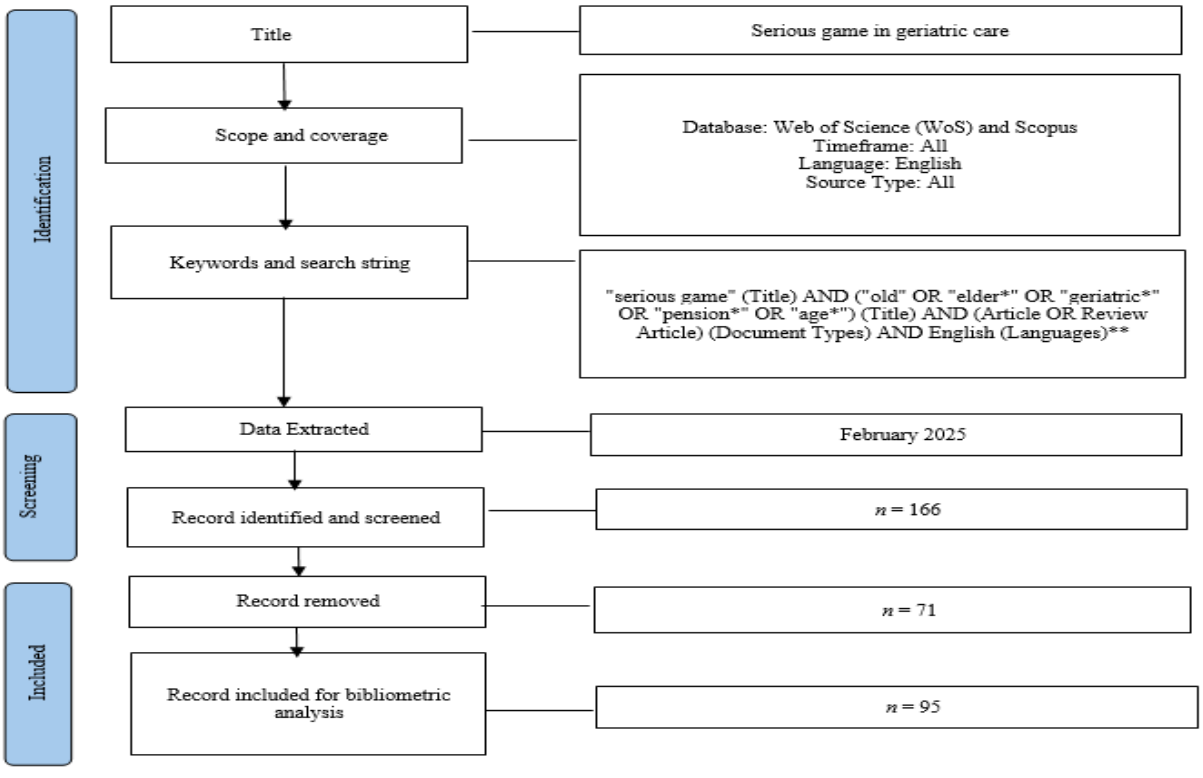

Figure 1. The modified preferred reporting items for systematics reviews and meta-analyses (PRISMA) guideline for the serious games in geriatric care

Bibliometric Analysis Framework

The bibliometric analysis was structured into three core components: performance analysis, science mapping, and network analysis. Performance analysis was conducted using ScientoPy to evaluate annual publication trends, leading countries and institutions, top publishing journals, and highly cited articles. These indicators provide insights into the growth and impact of research in this domain (Azizan et al., 2024).

Science mapping was performed using ScientoPy and VOSviewer to explore thematic structures within the dataset. Keyword co-occurrence analysis was conducted to identify frequently used author keywords, revealing emerging research themes in serious games for geriatric care. These analyses help illustrate shifting research priorities and areas of high scholarly activity (Narong & Hallinger, 2023).

Network analysis was conducted using VOSviewer, which enables the visualization of collaboration patterns among researchers, institutions, and countries. Co-authorship networks were examined to assess international research collaborations, while keyword mapping identified interconnections among core research topics. Citation network analysis was also performed to determine the most influential papers and their interconnected impact on the field. These techniques are essential for understanding knowledge diffusion and interdisciplinary linkages in serious games research (Van Eck & Waltman, 2018).

By integrating these bibliometric methods, the study provides a comprehensive overview of serious games research in geriatric care, highlighting key contributors, thematic developments, and future research directions. The use of ScientoPy and VOSviewer enhances the accuracy and visualization of bibliometric findings, offering valuable insights into the evolution of this research domain.

RESULTS

Fig. 2 presents the total number of publications (TP) and total citations (TC) for serious games in geriatric care demonstrate an increasing research interest over time, with variations in citation impact. From 2010 to 2014, publication output remained low, with only 9 publications in total. The highest citation count during this period was in 2012 (TC = 149), despite only two publications that year, indicating significant academic influence.

Between 2015 and 2019, the research output increased, with 20 publications recorded. The total citation count during this period was highest in 2016 (TC = 136), followed by 2015 (TC = 102) and 2017 (TC = 91). However, research activity remained relatively inconsistent, with some years (e.g., 2019) showing only a single publication. A surge in publications occurred from 2020 to 2024, with the highest number of papers published in 2024 (TP = 16). The peak in citations was observed in 2021 (TC = 157), followed by 2022 (TC = 146) and 2020 (TC = 109). Although 2024 had the highest publication count, its citation count (TC = 14) was relatively low, suggesting that recent publications had not yet accumulated significant citations.

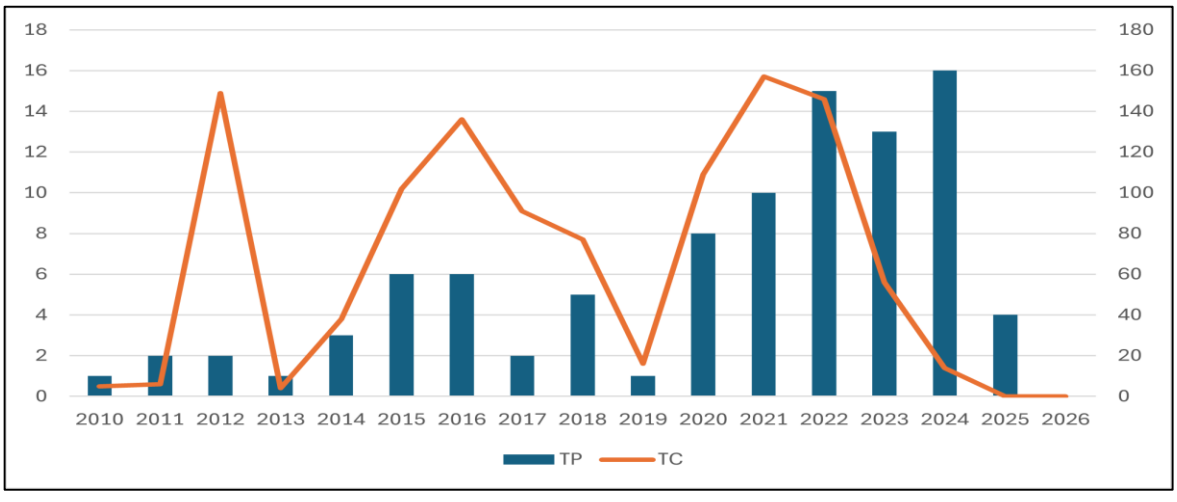

Figure 2. Annual publication trends in serious games research for geriatric care (2010-2025)

In 2025, the number of publications declined (TP = 4), with no citations recorded (TC = 0). This is primarily attributed to the early stage of data collection (conducted on February 20, 2025), during which many 2025 publications may not yet have been indexed or cited. It is common for recent publications to experience a lag before accumulating citations, reflecting the natural delay in academic dissemination and indexing processes.

Top Contributing Countries

The global research landscape on serious games in geriatric care demonstrates significant contributions from multiple countries. As illustrated in Fig.3, Italy leads with 10 publications, followed closely by Spain with 9 publications. Several other European nations, including France, Germany, the United Kingdom, and South Korea, each contribute 7 publications, indicating a strong regional focus on this research domain. Meanwhile, China, Qatar, and the United States each have 6 publications, highlighting growing interest beyond Europe. Colombia, with 5 publications, rounds out the top 10. These findings suggest that while European countries dominate the field, contributions from Asia and North America are expanding. The presence of countries like Qatar and China reflects the increasing global recognition of serious games as a potential tool for geriatric care interventions.

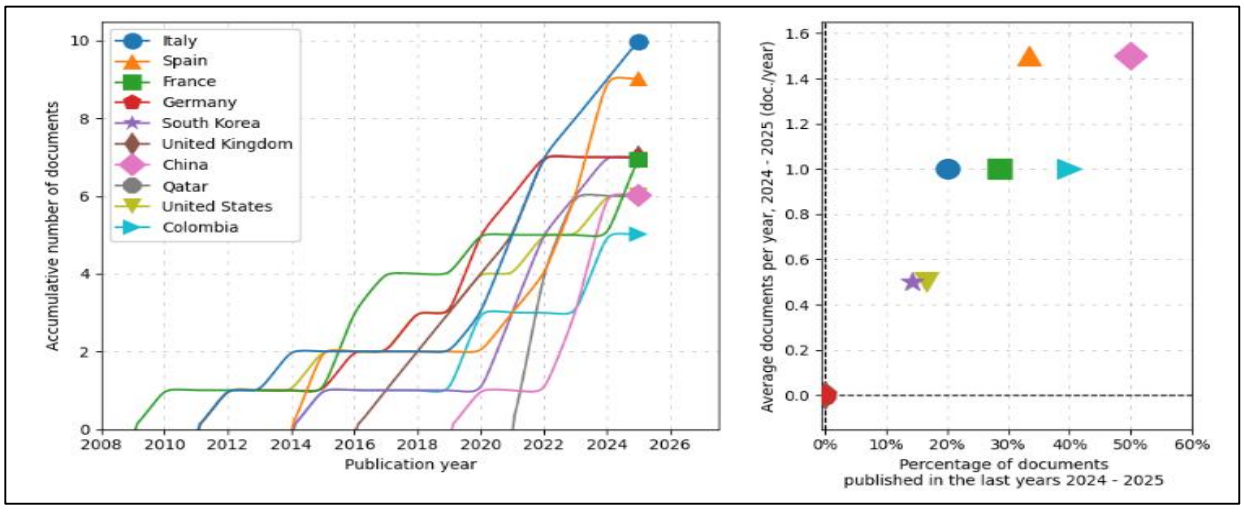

Figure 3. Top 10 contributing countries

Top Contributing Institutions

At the institutional level, Fig.4 presents the top 10 research institutions actively publishing in this field. Weill Cornell Medicine-Qatar emerges as the most prolific institution, contributing 5 publications. Aristotle University of Thessaloniki (Greece) and Hamad Bin Khalifa University (Qatar) follow, each with 4 publications. Other key contributors include the Centre for Research & Technology Hellas (Greece), Dasman Diabetes Institute (Kuwait), and Hamad Medical Corporation (Qatar), each with 3 publications. In addition, Heidelberg University (Germany), Kuwait University (Kuwait), and the University of Central Florida (United States) also contribute 3 publications, emphasizing a diverse institutional presence. Uppsala University (Sweden), with 2 publications, completes the list of top institutions.

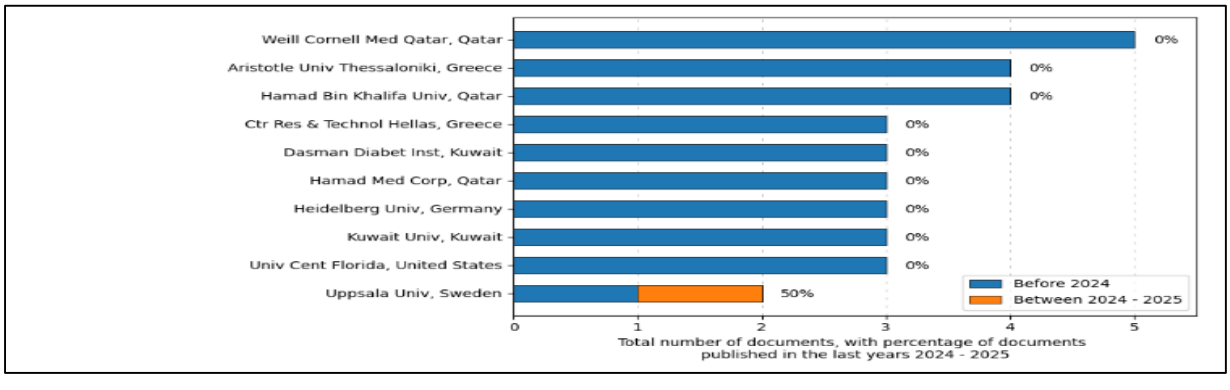

Figure 4. Top 10 contributing institutions

The distribution of research efforts across institutions highlights the collaborative and interdisciplinary nature of serious game studies in geriatric care. While European and Middle Eastern institutions dominate the rankings, notable contributions from North American universities underscore the field's expanding global reach.

Top 10 Journals

The publication landscape for serious games in geriatric care is distributed across various journals, with notable variations in publication count and impact. Table 1 presents the top 10 journals contributing to this field, ranked based on the total number of publications (TP) and impact indicators such as CiteScore, SCImago Journal Rank (SJR), and Source Normalized Impact per Paper (SNIP).

JMIR Serious Games leads as the most prolific journal, publishing 13 articles, significantly surpassing other journals in this domain. This journal, published by JMIR Publications Inc., has a CiteScore of 7.3, an SJR of 0.986, and a SNIP of 1.319, indicating its strong influence in the digital health and gaming research community.

Following at a distance, Applied Sciences (MDPI) has published 4 articles, with a CiteScore of 5.3, demonstrating moderate academic influence. The Journal of Clinical Nursing ranks third, contributing 3 publications and showcasing a relatively high SJR of 1.235 and SNIP of 1.582, reflecting its significant role in the nursing and healthcare domain.

Several journals have contributed 2 publications each, including Computers in Human Behavior (Elsevier), which has the highest CiteScore of 19.1, along with an SJR of 2.641 and a SNIP of 3.429, indicating substantial impact in human-computer interaction research. Other journals in this category include Frontiers in Aging Neuroscience, Frontiers in Psychology, Games for Health Journal, International Journal of Advanced Computer Science and Applications, Journal of Alzheimer's Disease, and Journal of Medical Internet Research.

Among these, Journal of Medical Internet Research (JMIR Publications Inc.) stands out with a CiteScore of 14.4 and an SJR of 2.020, reflecting its strong influence in digital health-related research. Journal of Alzheimer's Disease also shows a high impact, with a CiteScore of 9.2 and SJR of 2.438, indicating a specialized focus on neurodegenerative disorders. The distribution of publications across these journals reflects the interdisciplinary nature of serious games research in geriatric care, spanning fields such as health informatics, psychology, computer science, and nursing

Table 1. The top 10 journals and their related metrics

Ranks	Journals	TP	Publisher	CiteScore 2023	SJR 2023	SNIP 2023
1	*JMIR SERIOUS GAMES*	13	JMIR Publications Inc.	7.3	0.986	1.319
2	*APPLIED SCIENCES*	4	Multidisciplinary Digital Publishing Institute (MDPI)	5.3	0.508	0.924
3	*JOURNAL OF CLINICAL NURSING*	3	John Wiley & Sons	6.4	1.235	1.582
4	*COMPUTERS IN HUMAN BEHAVIOR*	2	Elsevier	19.1	2.641	3.429
5	*FRONTIERS IN AGING NEUROSCIENCE*	2	Frontiers Media S.A.	6.3	1.173	0.900
6	*FRONTIERS IN PSYCHOLOGY*	2	Frontiers Media S.A.	5.3	0.800	1.071
7	*GAMES FOR HEALTH JOURNAL*	2	Mary Ann Liebert	6.7	0.804	1.101
8	*INTERNATIONAL JOURNAL OF ADVANCED COMPUTER SCIENCE AND APPLICATIONS*	2	Science and Information Organization	2.3	0.278	0.523
9	*JOURNAL OF ALZHEIMERS DISEASE*	2	Serdi-Editions	9.2	2.438	1.567
10	*JOURNAL OF MEDICAL INTERNET RESEARCH*	2	JMIR Publications Inc.	14.4	2.020	1.961

Note: TP= total publication

Most Cited Articles

Table 2 presents the most cited articles in the field of serious games for geriatric care demonstrate significant contributions across various aspects of elderly well-being. The highest-cited study, published in 2012, has accumulated 149 citations, highlighting the comprehensive benefits of serious games beyond physical activity, encompassing

psychological, sensory-motor, and social interactions.

A 2017 study with 63 citations emphasizes the importance of user-centered design in exergames for seniors, based on long-term experience. Another 2021 publication with 54 citations explores the integration of humanoid robots in cognitive training, demonstrating the effectiveness of multimodal feedback in memory enhancement.

Serious games have also been applied in addressing fear of falling among the elderly. A 2016 study with 50 citations investigates virtual reality exposure therapy, reinforcing its role in psychological and physical rehabilitation. Similarly, cognitive health screening has been explored through a 2016 publication with 37 citations, which developed a predictive serious game for assessing cognitive function.

Other notable contributions include a 2015 study with 34 citations, which evaluates the impact of real-time feedback from pedagogical agents in serious games. A 2020 review with 33 citations discusses advancements in dementia care through serious games, proposing a multi-method evaluation model. Additionally, another 2015 publication, also with 33 citations, introduces an iPad-based serious game for multi-domain cognitive training, showcasing its potential for improving spatial navigation and visuomotor function. Overall, these findings indicate that serious games play a crucial role in cognitive training, rehabilitation, and psychological well-being for older adults.

Table 2. Most cited articles with minimum 30 citations

Ranks	Articles	Citations	Contributions
1	Serious games in prevention and rehabilitation-a new panacea for elderly people? (Wiemeyer & Kliem, 2012)	149	Serious games provide myriad benefits beyond mere physical activity, enhancing physiological, psychological, sensory-motor, and social interactions, thereby supporting a holistic approach to health and well-being in elderly individuals.
2	User-Centered Design of Serious Games for Older Adults Following 3 Years of Experience With Exergames for Seniors: A Study Design (Brox et al., 2017)	63	Lessons learned from 3 years of experience with exergames for seniors. Development of a user-centered design (UCD) protocol for exergames tailored to senior needs
3	The impact of serious games with humanoid robots on mild cognitive impairment older adults (Manca et al., 2021)	54	The design of a serious game to help older adults train their memory with versions for two different devices (tablet and humanoid robot). An analysis of the impact of the rich multimodal feedback provided by the humanoid robot version of the application on the older adults.
4	Fear of falling: efficacy of virtual reality associated with serious games in elderly people (Levy et al., 2016)	50	Virtual reality exposure therapy, combined with serious games, significantly reduces fear of falling in the elderly by addressing both psychological and practical aspects through virtual movement. The study frames fear of falling as an anxiety disorder, advocating for cognitive behavioral therapy and virtual reality exposure as essential alongside physical rehabilitation.
5	Smartkuber: A Serious Game for Cognitive Health Screening of Elderly Players (Boletsis & McCallum, 2016)	37	Smartkuber game predicts MoCA scores for cognitive health screening. Smartkuber enhances correlation with MoCA by adding textual elements.
6	Feedback source modality effects on training outcomes in a serious game: Pedagogical agents make a difference (Goldberg & Cannon-Bowers, 2015)	34	Real-time feedback, especially from pedagogical agents, enhances performance and retention in game-based learning. Embedding an EPA in a browser-based tutor interface (TUI) is as effective as placing it directly in the game environment.
7	A Review on Serious Games for Dementia Care in Ageing Societies (Ning et al., 2020)	33	Proposes a multi-method model combining questionnaires, expert reviews, game data, and physiological signals to improve the reliability of evaluating serious games for dementia care. Advocates for better game categorization, integration with therapies like music and reminiscence, and the creation of a "Serious Games Hospital" to enhance dementia treatment.
8	Multi-domain training in healthy old age: Hotel Plastisse as an iPad-based serious game to systematically compare multi-domain and single-domain training (Binder et al., 2015)	33	Introduces Hotel Plastisse, an iPad-based serious game that simultaneously trains spatial navigation, visuomotor function, and inhibition, allowing comparison with single-domain training. Highlights the benefits of tailored serious games with adaptive difficulty and feedback to enhance cognitive function in aging populations.

Co-Occurrence Analysis

A keyword co-occurrence analysis was conducted using VOSviewer to identify the most frequently occurring terms in serious games research for geriatric care. Out of 328 keywords, 12 met the threshold when a minimum occurrence of five was set. The term "serious game" and "serious games" were merged to maintain consistency.

The analysis revealed two distinct clusters, each representing a set of interconnected research themes. Cluster 1 (red) focuses on cognitive health and neurodegenerative conditions, encompassing terms such as “Alzheimer’s disease” (5 occurrences), “cognitive training” (9), “dementia” (10), “exergames” (6), “meta-analysis” (9), and “mild cognitive impairment” (12). This suggests a strong research focus on cognitive decline, interventions, and evidence-based analysis.

Cluster 2 (green) is more broadly centered on aging and rehabilitation, featuring terms like “aging” (8), “elderly” (7), “gamification” (5), “older adults” (14), “rehabilitation” (6), and “serious game” (68). This cluster highlights the broader application of serious games in geriatric care, addressing physical rehabilitation, engagement strategies, and game-based interventions for aging populations.

The co-occurrence network, illustrated in Fig.5 visually demonstrates how these keywords interconnect, revealing emerging research themes in the field. The findings indicate that while serious games are widely applied in both cognitive and physical health contexts, research is particularly concentrated on cognitive impairments, rehabilitation, and gamification techniques.

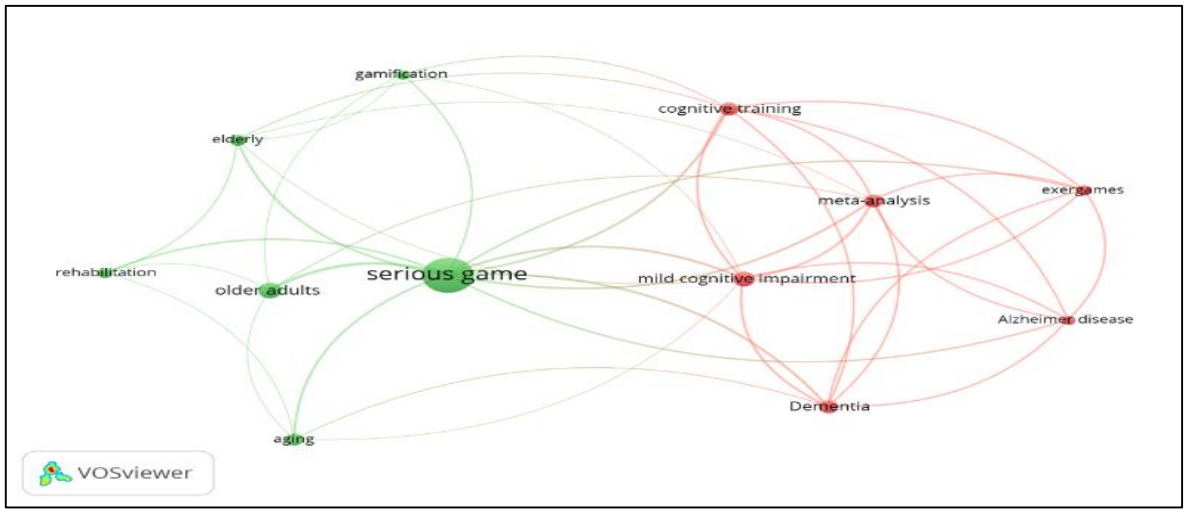

Figure 5. Co-occurrence analysis based on author’s keyword

DISCUSSION

The findings of this bibliometric analysis provide valuable insights into the growth, impact, and thematic evolution of serious games research in geriatric care. The increasing number of publications in this field suggests that serious games are gaining recognition as viable interventions for addressing cognitive, physical, and social challenges in older adults. The trends observed in this study align with broader global efforts to integrate digital health technologies into aging care, reflecting both the expanding research interest and the practical applications of serious games in healthcare settings. These patterns indicate a growing acknowledgment of the role of serious games in addressing aging-related health concerns.

The annual publication trends reveal a gradual but accelerating increase in serious games research related to geriatric care, with a notable surge in publications after 2020. This growth may be attributed to the increasing recognition of game-based interventions as tools for cognitive training, physical rehabilitation, and social engagement among older adults (Barbosa et al., 2017). The peak observed in 2024 suggests that serious games are becoming an established area of study within digital health and gerontology. However, the decline in publications in 2025 may indicate either a natural stabilization of research output or a delay in the indexing of recent publications. These fluctuations in research output highlight the dynamic nature of

this field, with shifts driven by funding availability, technological advancements, and emerging health priorities.

Despite the overall increase, the number of citations per year does not always correlate with publication output. Certain years, such as 2012 and 2016, had relatively low publication counts but high citation impact, suggesting that landmark studies published during these years significantly influenced subsequent research (Wiemeyer & Kliem, 2012). This indicates that while research volume is increasing, only a subset of studies has had a profound impact on shaping the field, highlighting the importance of quality over quantity in serious games research. Thus, while the field is expanding, its growth is also shaped by a few highly influential publications that set the foundation for future studies.

The results show that Italy, Spain, France, Germany, South Korea, and the United Kingdom are the most prolific contributors to serious games research in geriatric care. European countries dominate this field, likely due to their strong funding mechanisms, aging populations, and well-established research networks in digital health (Przybysz & Stanimir, 2023). The presence of China, Qatar, and the United States among the top contributors indicates a growing global interest, particularly in technologically advanced regions that invest in game-based rehabilitation and cognitive training for aging populations (Guo et al., 2023) The growing participation of non-European countries suggests a shift toward a more globally inclusive research landscape.

The dominance of European and other high-income countries in serious games research can be attributed to several interconnected factors. These regions typically benefit from stronger research funding mechanisms, robust digital infrastructure, and higher digital literacy rates among older adults, facilitating both the development and adoption of game-based interventions (Charness & Boot, 2022). In contrast, low- and middle-income countries (LMICs) face multiple barriers, including limited financial resources allocated for research, inadequate access to advanced digital technologies, and lower acceptance of digital health tools among elderly populations. Cultural perceptions regarding technology use in healthcare also play a significant role, where traditional rehabilitation methods are often preferred over digital interventions (Guo et al., 2022). Moreover, infrastructural deficits such as inconsistent internet access and the lack of specialized training programs for healthcare providers further constrain research activities in LMICs. Addressing these disparities requires targeted strategies, including the development of low-cost, culturally adaptable serious games and investments in digital literacy initiatives aimed at both healthcare providers and older adults.

At the institutional level, Weill Cornell Medicine-Qatar, Aristotle University of Thessaloniki (Greece), and Hamad Bin Khalifa University (Qatar) are among the leading research centers, with notable contributions from institutions in Kuwait, Germany, Sweden, and the United States. The strong representation of Middle Eastern institutions in the top 10 may reflect regional initiatives to enhance digital health solutions for aging populations, particularly in countries investing in artificial intelligence, robotics, and interactive health technologies (Charness & Boot, 2022). This institutional diversity underscores the increasing recognition of serious games as a viable healthcare intervention across different regions and cultural contexts.

However, there remains a disparity in research output between high-income countries and low- and middle-income countries. While developed nations have higher adoption rates of serious games in clinical and home settings, LMICs face barriers such as limited infrastructure, digital literacy, and cultural hesitance toward game-based interventions (Guo et al., 2022). Future research should explore how serious games can be adapted to resource-constrained environments, potentially through low-cost, mobile-based, or offline gaming interventions tailored for aging populations in LMICs. Bridging these gaps will be crucial for ensuring that serious games become a universally accessible tool for elderly care.

The distribution of publications across various journals reflects the interdisciplinary nature of serious games research in geriatric care, spanning fields such as health informatics, psychology, computer science, and nursing. JMIR Serious Games emerges as the most prolific journal, publishing the highest number of articles in this domain, followed by Applied Sciences, the Journal of Clinical Nursing, and Computers in Human Behavior. The high CiteScore and SCImago Journal Rank (SJR) of Computers in Human Behavior (CiteScore = 19.1) suggest that human-computer interaction research is playing a significant role in

shaping the development of serious games for older adults (Boletsis & McCallum, 2016). These publication trends reveal how the field is being shaped by multiple disciplines, contributing to its continued expansion.

Interestingly, journals with a focus on digital health (Journal of Medical Internet Research, Games for Health Journal) and neurodegenerative diseases (Journal of Alzheimer's Disease, Frontiers in Aging Neuroscience) also have a strong presence. This underscores the growing intersection between serious games and aging-related cognitive disorders, particularly in dementia care, Alzheimer's disease interventions, and mild cognitive impairment (Manca et al., 2021; Ning et al., 2020). This thematic shift suggests an increasing emphasis on using serious games not only for general aging interventions but also for targeted cognitive and neurological applications.

The analysis of the most cited articles further reinforces this theme. Wiemeyer & Kliem's (2012) study on serious games in prevention and rehabilitation remains the most influential publication in this field, with 149 citations. Other highly cited works emphasize the role of exergames in physical health (Brox et al., 2017), the integration of humanoid robots in cognitive training (Manca et al., 2021), and virtual reality exposure therapy for fear of falling (Levy et al., 2016). These findings suggest that serious games research has evolved from general cognitive training to more specialized interventions incorporating robotics, virtual reality, and adaptive learning systems. This evolution highlights how technological advancements are driving new frontiers in serious games research.

The co-occurrence analysis of author keywords reveals two distinct thematic clusters:

Cluster 1 : Cognitive Health and Neurodegenerative Conditions and Cluster 2 : Aging and Rehabilitation.

In Cluster 1, which includes terms such as Alzheimer's disease, dementia, mild cognitive impairment, and cognitive training, highlights the strong focus on game-based interventions for cognitive decline. The presence of meta-analysis in this cluster suggests that researchers are increasingly synthesizing findings from multiple studies to establish evidence-based guidelines for serious game interventions (Ning et al., 2020). These thematic clusters indicate that research is becoming more structured and specialized, reflecting growing maturity in the field.

While in Cluster 2, which includes terms such as aging, older adults, gamification, and rehabilitation, represents a broader application of serious games in geriatric care, focusing on physical therapy, engagement strategies, and the motivational aspects of gaming. The high frequency of the term "serious game" (68 occurrences) reflects the central role of this concept in geriatric research, reinforcing its growing significance as a digital health tool for aging populations. These findings suggest that while serious games remain a broad category, their applications are diversifying to address multiple facets of elderly care.

Beyond their potential as engaging interventions, serious games have demonstrated promising clinical applicability in geriatric care. Evidence from randomized controlled trials and longitudinal studies indicates that serious games can effectively improve cognitive functions, such as memory, attention, and executive function, as well as enhance physical rehabilitation outcomes like balance, gait, and motor coordination (Brox et al., 2017; Manca et al., 2021). In clinical environments, serious games offer a complementary tool that can augment conventional therapies by providing personalized, adaptive, and motivational experiences for older adults. However, several barriers remain to their widespread clinical adoption, including the lack of standardized protocols for implementation, limited regulatory oversight to ensure the safety and efficacy of game-based interventions, and a need for clinician training to integrate serious games effectively into rehabilitation programs. Addressing these challenges through interdisciplinary collaboration among healthcare providers, game developers, and regulatory agencies will be crucial for realizing the full clinical potential of serious games in aging populations.

To realize the full potential of serious games in geriatric care, their integration into healthcare policies is essential. Policymakers should consider formally recognizing serious games as validated digital health interventions within national geriatric care guidelines. Reimbursement frameworks that cover game-based therapies, similar to traditional rehabilitation services, could incentivize clinical adoption. Furthermore, government agencies and public health institutions could establish grant programs and public-private partnerships to support the development, evaluation, and scaling of serious games, ensuring accessibility across diverse

socioeconomic settings. Integrating serious games into policy frameworks would not only enhance the quality of care for older adults but also encourage innovation, standardization, and widespread adoption across clinical and community environments.

This study has several limitations. First, only articles written in English and indexed in WoS and Scopus were included. While this approach ensured quality and comparability, it potentially excluded valuable research published in other languages and regional databases. Second, the final sample size of 95 articles, though reflective of strict inclusion criteria, is relatively modest and may limit the generalizability of findings. Future research should consider incorporating additional databases such as Google Scholar, PubMed, and non-English language resources to broaden the scope and increase sample size, thereby providing a more comprehensive overview of serious games in geriatric care.

The findings of this study provide a comprehensive overview of the intellectual landscape of serious games research for geriatric care. The increasing research output, high citation impact of key studies, and emerging thematic clusters suggest that serious games are gaining widespread acceptance as an intervention for aging-related cognitive and physical health issues. However, challenges remain, including regional disparities, accessibility barriers, and the need for further validation of game-based interventions in clinical settings. Addressing these challenges will be essential for ensuring that serious games become an integral part of global geriatric care strategies.

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Conflict of Interest

There are no conflicting relations or activity.

Author Contribution

Study Design: AA; Data Collection: AA; Statistical Analysis: AA; Data Interpretation: AA; Manuscript Preparation: AA; Literature Review: AA. All authors have read and approved the published version of the manuscript.

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