

Digital games technologies for the elderly with dementia: A bibliometric analysis (2005-2025)

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ABSTRACT

Background: The global and national increase in the elderly population has led to a rising prevalence of dementia, negatively impacting quality of life and imposing socio-economic burdens on families and healthcare systems. Recently, non-pharmacological interventions, particularly digital games, have gained traction as innovative tools to support cognitive function and well-being in older adults with dementia.

Objective: This study conducts a bibliometric analysis of global research on digital game technologies for elderly individuals with dementia from 2005 to 2025, aiming to identify trends, key contributors, research themes, collaboration networks, and influential publications.

Methods: A bibliometric analysis was performed using Scopus-indexed data collected in May 2025. A total of 413 open-access articles published between 2005 and 2025 were analyzed. Data screening and extraction were conducted independently by two researchers. Tools used included R Studio (Biblioshiny) and VOSviewer, focusing on authorship, institutional and national productivity, keyword frequency, and collaboration patterns.

Results: Research output has grown significantly over the last seven years, peaking at 64 publications in 2024, though the average remains below 40 articles annually. The United States, the United Kingdom, and China were the most prolific contributors. Top institutions included University College London and the University of California. Dominant keywords were digital games, elderly, aged, dementia, and virtual reality, reflecting a growing interest in exergames and technology-driven cognitive stimulation. HEYN P (2004) authored the most cited work with 1,019 citations.

Conclusion: *This study reveals a growing yet emerging field focused on digital games for dementia care. It highlights established areas and critical gaps, offering a strategic roadmap for future research. The findings are valuable for researchers, clinicians, and policymakers working to optimize digital game interventions for enhancing the lives of older adults with dementia.*

KEYWORDS: *biometric analysis; cognitive stimulation; dementia; digital games; elderly*

Article info : Received 24 May 2025; 1st revision 13 May 2026; 2nd revision 19 June 2026; accepted 07 September 2026; available online 22 September 2026; published 30 September 2026

INTRODUCTION

The significant increase in the global elderly population, mirrored by national trends in Indonesia, has profound implications for the prevalence of neurodegenerative diseases, particularly dementia (1,2). Dementia, characterized by a progressive decline in cognitive function, not only deteriorates the quality of life of those affected but also imposes a substantial socio-economic burden on families and healthcare systems (3). This situation underscores the urgency of developing and evaluating accessible and effective interventions, both pharmacological and non-pharmacological, to support the cognitive function and overall well-being of older adults living with dementia (4,5).

In recent decades, non-pharmacological interventions have garnered growing attention as vital complementary approaches. Previous studies on non-pharmacological interventions for people with dementia have reported promising benefits, especially for

cognitive stimulation, psychosocial activation, physical activity, and technology-based approaches, yet the overall evidence remains limited by small samples, heterogeneous intervention types, and methodological weaknesses (7,8). Recent reviews also emphasize that many interventions are still tested in isolated contexts, with insufficient attention to feasibility, implementation challenges, and the lived needs of people with dementia and their caregivers. In particular, although game-based interventions and digital games have shown potential to improve cognition, coordination, behavioral symptoms, and quality of life, existing findings are still inconsistent and often rely on weak study designs, making it difficult to determine which format works best and for whom.

Based on this gap, health games are scientifically justified as the variable of interest because they combine cognitive stimulation, engagement, and enjoyment in a single non-pharmacological platform, which may improve adherence and

acceptability among older adults with dementia. Unlike passive interventions, health games can actively involve participants through structured tasks, social interaction, and repeated mental exercise, all of which are relevant to maintaining cognitive and psychosocial functioning in dementia care. Therefore, selecting health games allows the study to respond to an important research gap: the need for feasible, acceptable, and potentially scalable interventions that are grounded in both evidence and user needs (6,9).

As scholarly interest in this topic has grown, the volume of scientific publications addressing the use of digital games for elderly individuals with dementia has increased substantially over time. While this surge in literature reflects the vibrancy and dynamism of the field, it has also resulted in a research landscape that is both complex and fragmented. This fragmentation can pose challenges for researchers, practitioners, and policymakers attempting to identify key trends, dominant research areas, critical collaboration networks, and existing research gaps that require immediate attention (10,11). Therefore, a comprehensive and systematic review is necessary to map the intellectual structure of this rapidly evolving field of study.

Bibliometric analysis offers a quantitative approach to examining large volumes of bibliographic data, uncovering hidden patterns in the development of a specific discipline or research topic (12,13).

This method enables the identification of the most prolific authors, institutions, and countries; the analysis of collaborative networks; keyword co-occurrence mapping; and the identification of the most influential publications through citation analysis (14,15). To date, comprehensive and targeted bibliometric reviews focusing on global research surrounding digital game technologies for elderly individuals with dementia remain limited. This gap is critical, as a thorough understanding of the current research landscape is essential for shaping future research agendas more strategically and effectively.

The present study aims to conduct a bibliometric analysis of global scholarly literature on digital game technologies for elderly individuals with dementia, covering a defined time period (e.g., 2005-2025). Specifically, this study will identify annual publication trends; highlight key contributors (authors, institutions, countries); examine collaborative networks; map central and emerging research themes; and identify the most influential publications in this field. The results of this bibliometric analysis are expected to provide a clear roadmap of the field's development, highlighting mature research areas as well as those requiring further exploration. These insights will be valuable for researchers, technology developers, clinical practitioners, and policymakers in optimizing the potential of digital games to enhance the quality of life for elderly individuals with dementia, both

globally and within the Indonesian context. Research Questions is; Who are the top 10 contributing authors (in terms of publications and citations), and what are the collaboration patterns in studies on digital game technologies for the elderly with dementia? Which ten countries and institutions are the most productive in this research domain? What are the most frequently used keywords, and what emerging topics are currently trending in this area of study? In which preferred sources (journals or conference proceedings) are researchers publishing studies related to digital game technologies for the elderly with dementia?

MATERIALS AND METHODS

Key Elements of the Novel Method: Bibliometric Analysis: This approach reviews existing literature to identify established knowledge and emerging trends in global publications. **Tools Used:** R Studio (Biblioshiny): Analyzed publication volume and citation metrics to find the most productive authors, countries, and organizations. VOSviewer: Visualized co-authorship networks and keyword co-occurrence, enhancing the understanding of collaborative efforts and research themes. A bibliometric analysis was conducted to review the literature describing established knowledge and emerging trends in global publications (e.g., keyword occurrences, citation counts, publication years, and authorship). The analysis employed R

Studio (Biblioshiny) to identify the most productive authors, countries, and organizations based on publication volume and citation metrics. Additionally, VOSviewer (version 1.6.18) was used to visualize co-authorship networks and keyword co-occurrence. Both Biblioshiny and VOSviewer are widely recognized tools and have been applied in previous bibliometric studies (16,17).

Data for this study were retrieved from the Scopus database on May 10, 2025, covering the publication period from 2005 to 2025. Scopus is one of the most comprehensive abstract and citation databases for peer-reviewed literature across various scientific disciplines (18). While other platforms such as Web of Science (WoS), PubMed, and Google Scholar are also widely used, Scopus was selected for this study because it provides broader coverage for topics that may not be fully indexed in other databases (19).

The dataset comprised international publications extracted from the Scopus website (<https://www.scopus.com/>). Keywords were formulated based on Medical Subject Headings (MeSH) terms. Data collection was performed in May 2025, using the following search terms: Games* OR activity* OR exergames* OR “serious games” AND dementia OR “memory loss” OR “Neurocognitive Disorder” OR “Neurocognitive Disorder” OR “Cognitive Decline” AND elderly OR “older people” OR aging” AND digital OR Computerized

OR virtual OR electronic OR “Health Technologies” The search was limited to publications between 2005 and 2025. These terms were entered in the Scopus search field as keywords. The retrieved document information was exported in CSV format, including author names, titles, affiliations, keywords, citation counts, journal types, language, and publication years. The analysis was further refined by filtering for document type: Article, language: English, and source type: Journal. A data cleaning process was conducted using Open Refine to ensure consistency and accuracy in the extracted terms.

The inclusion criteria for database searches were limited to open-access journal articles. A total of 413 journal articles were selected from the Scopus database for final analysis. These articles were examined for annual publication volume, publication year, keyword trends, authorship, citation metrics, contributing organizations, and countries (**Figure 1**). To ensure the reliability and consistency of the screening process, two authors independently reviewed the articles. Their results were then compared, and any

discrepancies were resolved through discussion and consensus (16,20). A descriptive statistical analysis was conducted to illustrate publications' temporal distribution and frequency over the selected time. No ethical approval was required, as this study did not involve human participants. This research has obtained ethical approval from the Ethics Committee of the Universitas Negeri Semarang and was declared ethically sound on May 26, 2025 (No. B/7192/UN37.1.9/KM.07/2025).

RESULTS AND DISCUSSION

The study-selection process is presented in **Figure 1**. A total of 630 records were initially identified through the Scopus database search. After the initial screening and removal of records that did not meet the eligibility requirements, 580 records remained for further assessment. Of these, 180 reports could not be retrieved. The remaining 480 records were assessed for eligibility, and review articles, conference papers, and editorials were excluded. Finally, 413 journal articles met the inclusion criteria and were included in the bibliometric analysis.

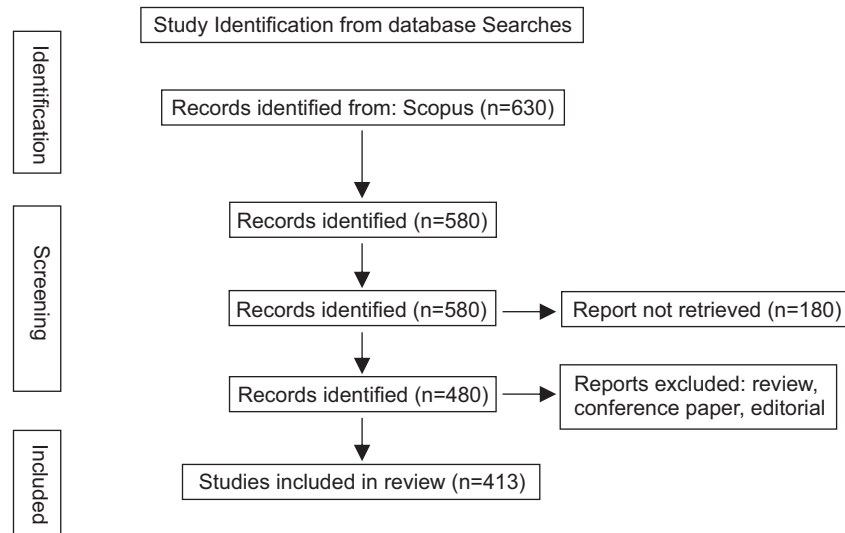


Figure 1. Bibliometric screening strategy

From the initial 580 articles retrieved from the Scopus database using the predefined keywords, a total of 167 articles were excluded based on the inclusion criteria. This resulted in 413 articles being included in the final dataset. **Figure 2** illustrates the yearly distribution of publications indexed in Scopus between 2005 and 2025. The publication trend appears fluctuating, but a notable increase has been observed in the last seven years, particularly from 2019 onward. The year 2024 recorded the highest number of publications, with 64 articles. The average number of publications per year remains below 40. The bibliometric analysis reveals that, despite recent growth, the overall volume of research on Digital Game Technologies for the Elderly with Dementia remains relatively low. This highlights a substantial opportunity for further investigation and development in this emerging field.

The bibliometric analysis conducted in this study reveals a noticeable increase in publications addressing digital game interventions for the elderly with dementia over the past seven years, with a marked surge since 2019 and a peak of 64 articles published in 2024. Nevertheless, the annual average remains below 40 publications, indicating that this field is still in its early stages of development and holds substantial room for future exploration. This trend is consistent with observations by Manseer (2023) (29), who noted that rapid growth in scientific literature can lead to increased complexity and fragmentation, thereby highlighting the need for systematic research mapping to identify prevailing trends and critical knowledge gaps. Several mechanisms may explain the post-2019 increase. First, the ageing population and rising dementia burden have intensified demand for interventions that can support cognition, engagement, and quality of life

without adding drug-related side effects. Second, the rapid expansion of tablets, smartphones, serious games, and user-friendly interfaces has made digital game interventions more feasible for older adults

than before. Third, the pandemic era likely shifted research priorities toward remote, socially distanced, and technology-enabled care, which made digital games especially appealing.

Table 1. Top 10 most productive authors

Author Ratings	T.P.
LI Y	6
DE BOER B	5
NEF T	5
BEERENS HC	4
BHERER L	4
HAMERS JPH	4
KRAMER AF	4
MONTERO-ODASSO M	4
NAJAFI B	4

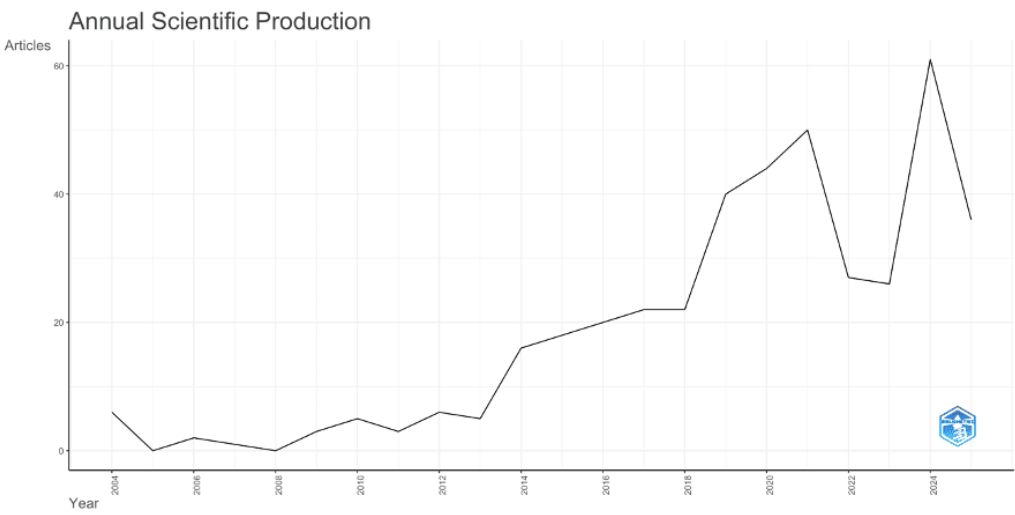


Figure 2. Annual distribution of publications (2005–2025)

Bibliometric Analysis of Authors and Citations

Researchers play a critical role in shaping and advancing academic fields, as evidenced by the publications indexed in various scientific databases (16,21). In this study, both individual authors and co-authorship patterns were analyzed to

identify those with strong publication records and significant contributions to the field. The total number of publications and citations was examined to assess the influence of authors within the domain of digital game technologies for the elderly with dementia. The top ten contributing authors are presented in **Table 1**, indicating

that these individuals have a substantial volume of publications. Authorship patterns suggest a high degree of collaboration, with many articles authored by teams of three or more researchers. Notably, the three most frequently cited articles were published in Archives of Physical Medicine and Rehabilitation, Neurology, and The Lancet. **Figure 3** highlights the most globally cited

article in this field: a seminal work by Heyn P. (2004), which has received 1,019 citations. This article is distinctly positioned at the far right of the citation distribution graph, signifying its exceptional impact relative to other publications. In comparison, the citation counts for other highly referenced works range from approximately 219 to 321.

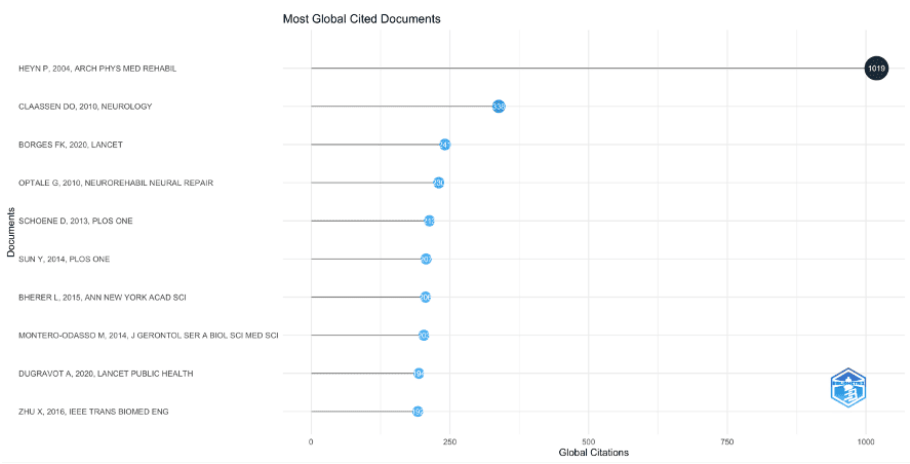


Figure 3. Most globally cited articles in the field

The figure presents the ten most globally cited documents in the dataset. Heyn et al. (2004), published in *Archives of Physical Medicine and Rehabilitation*, was the most influential publication, with 1,019 citations, followed by Claassen et al. (2010) in *Neurology* with 338 citations. The

remaining highly cited documents received between 192 and 241 citations, indicating that the literature is strongly influenced by a small number of foundational studies, particularly in rehabilitation, neurology, neuroscience, gerontology, and public health.

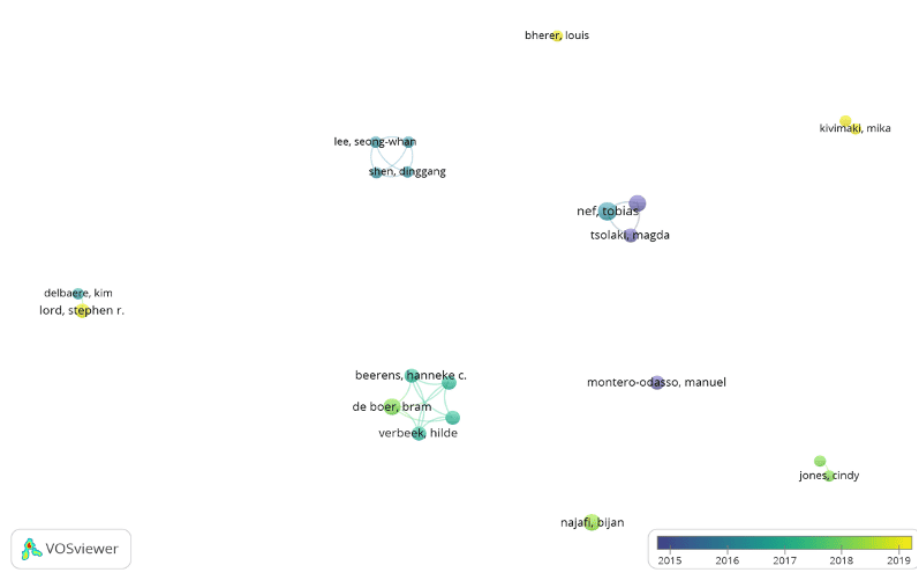


Figure 4. Visualization of author distribution by publication year (2004–2025)

Figure 4 presents the temporal distribution of authors who contributed to research on digital game technologies for older adults with dementia. The overlay colors represent the average publication year, ranging from 2015 (blue) to 2019 (yellow). The map shows several distinct author groups, including collaborations among Beerens, de Boer, and Verbeek, as well as smaller clusters involving Lee and Shen and Nef and Tsolaki. More recent publication activity is indicated by yellow-green nodes, particularly for Bherer, Kivimäki, Lord, and Delbaere. The limited connections between clusters suggest that collaboration within this research field remains relatively fragmented.

The bibliometric analysis revealed that the top ten contributing authors, including Jones, Kindy, Najafi, Bijan, and Kivimäki, Mika, have made significant scholarly contributions to the field, often

collaborating in multi-author teams consisting of more than three researchers per article. This pattern of multidisciplinary collaboration is essential for enhancing the quality and impact of research, a point also emphasized by Guo et al. (2023) and Yu et al. (2020). The most influential work in the field remains the study by Heyn P (2004), which has been cited over 1,000 times, highlighting its foundational role in the literature. The prominence of leading authors in this bibliometric landscape reflects more than publication productivity; it indicates their central role in shaping the conceptual and methodological direction of digital game research for dementia care. Their frequent participation in multi-author teams suggests that progress in this field depends on multidisciplinary collaboration, integrating clinical, technological, and behavioral expertise to develop interventions that are both scientifically

rigorous and practically usable. The enduring influence of highly cited foundational work further shows that the field remains anchored to a small set of seminal studies, highlighting the need for broader replication, cross-site validation, and collaborative innovation to strengthen the evidence base and support translation into practice.

Most Productive Countries and Institutions

Figure 5 illustrates the distribution of authors by country. The United States emerges as the most dominant contributor, exhibiting a large node size and numerous connections to other countries, highlighting its central role in global research collaboration with a total of 115 articles. Other highly active countries include the United Kingdom (63 articles), China (33

articles), and Germany, all of which also show strong centrality and extensive international collaborations. The author distribution map indicates that contributions are not evenly spread across all nations. Despite the fact that dementia among the elderly is a global health concern (22), only 55 countries worldwide have participated in research on this topic. Furthermore, the number of publications from many of these countries remains relatively low. Based on the analyzed data, several productive authors are affiliated with nations where individual publication counts do not exceed 10 articles. This finding underscores the importance of promoting broader international engagement in this field. Given that dementia is one of the most prevalent health issues affecting the elderly globally, increased global participation in related research is both necessary and urgent.

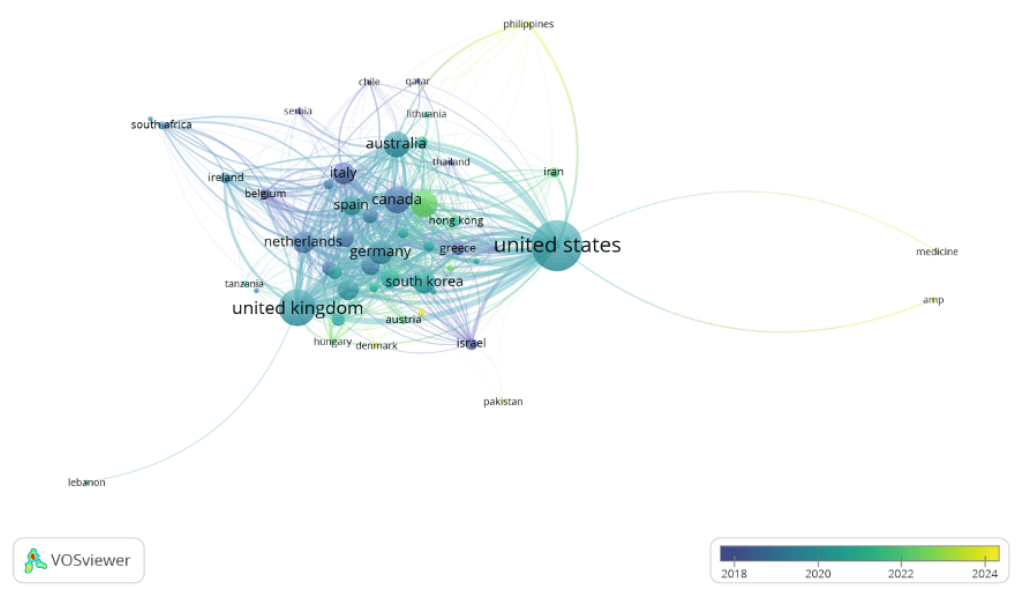


Figure 5. Visualization of country distribution by number of publications and year of publication

Country Collaboration Map

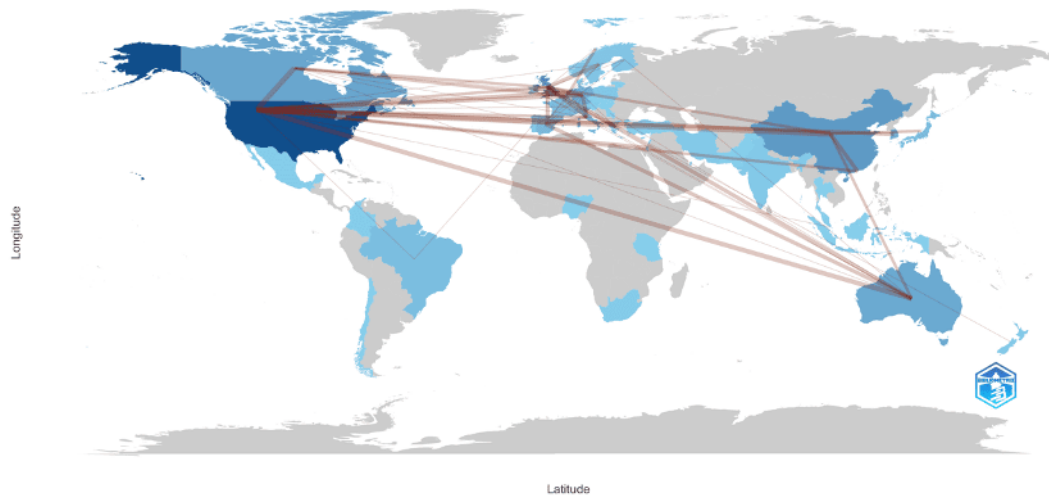


Figure 6. Visualization of country-level collaboration networks

Figure 6 presents a visualization of global research collaboration networks based on the frequency of international co-authorship. The United States again leads as the country with the most extensive collaboration network, followed closely by the United Kingdom and Australia.

Figure 7 highlights the top ten most productive institutions in this field. University College London ranks highest with 47 publications, followed by the University of California with 37, and Maastricht University with 32.

From a geographical perspective, the United States leads in research output, contributing 115 articles, followed by the United Kingdom (63 articles), China (33 articles), and Germany. Despite these

leading contributors, most other countries have published only a limited number of studies on this topic. This underscores the importance of strengthening international collaboration to broaden the research scope and address fragmentation in the global knowledge base (14,22). High-income countries dominate because they have deeper and sustained investments in research systems, larger and better-resourced institutions, and stronger international networks; this concentration reduces visibility and capacity-building in low- and middle-income countries (LMICs) and makes targeted efforts for capacity strengthening and equitable collaboration necessary to broaden the global evidence base.

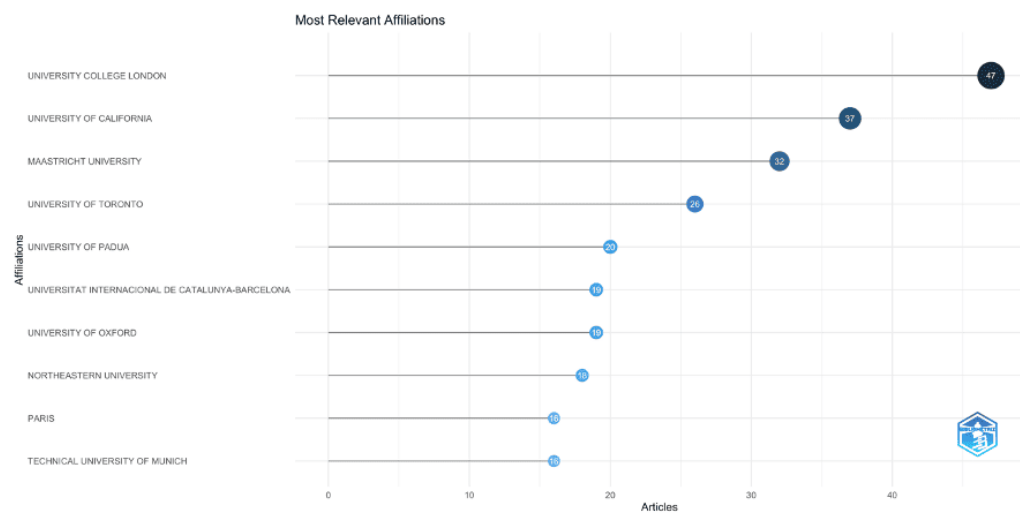


Figure 7. Distribution of the most relevant affiliates

Bibliometric Analysis of Themes and Trending Topics

Figure 8 presents an overlay visualization of keyword co-occurrence in research on digital game technologies for older adults with dementia. The map is dominated by the central terms “aged,” “dementia,” “female,” “male,” “cognition,” and “physical activity,” indicating that research in this field primarily focuses on cognitive function, demographic characteristics, physical activity, and dementia-related outcomes. The network also includes several interconnected intervention-related themes, such as video games, serious games, virtual reality, cognitive training, cognitive rehabilitation,

exercise therapy, digital health, and telemedicine. These terms indicate the integration of technology-based interventions with cognitive, physical, and rehabilitative approaches.

The overlay colour scale ranges from 2018 to 2022. Blue and purple nodes represent relatively earlier research themes, whereas green and yellow nodes indicate more recent topics. Recent research appears to emphasize machine learning, electronic health records, digital health, physical activity, caregiver support, outcome assessment, and home care, suggesting a shift toward data-driven, digitally integrated, and community-based dementia interventions.

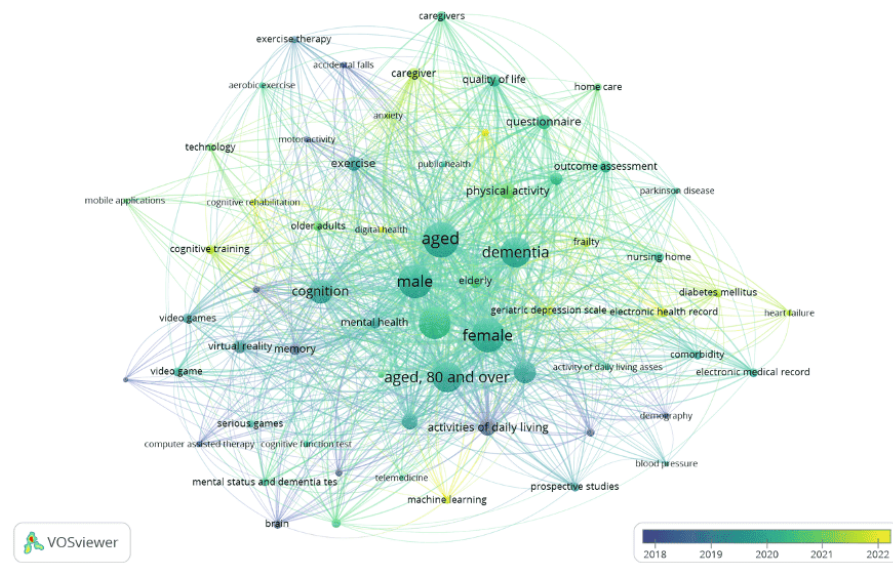


Figure 8. Distribution of Author Keywords (2018–2022)

In recent years, technology-based non-pharmacological interventions, particularly digital games, have attracted increasing attention as innovative complementary approaches (6,25).

Digital games, including serious games and exergames, offer avenues for cognitive stimulation, enhanced physical activity, and social interaction, all of which have been associated with improved quality of life for older adults with dementia (7,26). Emerging studies further highlight the potential of digital games to alleviate symptoms of apathy and enhance specific cognitive domains in elderly individuals with

cognitive impairment (27,28).

Despite the growth in publications over recent years, contributions from most authors and countries remain limited. A significant number of productive authors have published fewer than ten articles, underscoring the need to strengthen research networks and promote international collaboration. This is particularly crucial for addressing knowledge gaps related to the effectiveness, implementation, and cultural and health system adaptability of digital games for elderly individuals with dementia (13,29).

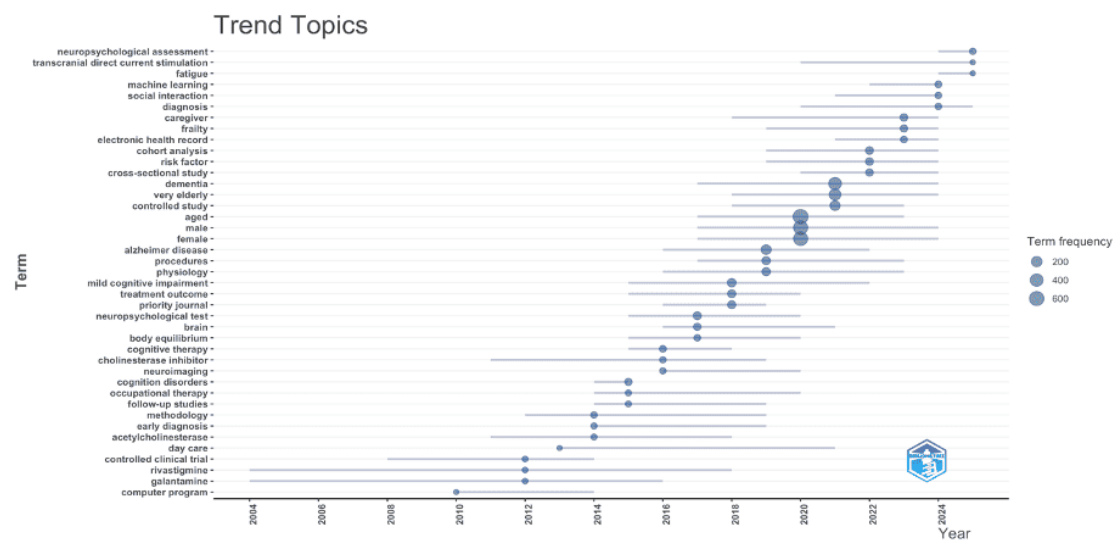


Figure 9. Trending Topics in Publications (2004-2025)

Figure 9 presents the temporal evolution of research topics related to digital game technologies for older adults with dementia. The horizontal axis represents the publication year, while the vertical axis lists the identified terms. The size of each bubble indicates term frequency, with larger bubbles representing more frequently occurring topics; the horizontal lines indicate the period during which each term appeared in the literature.

The earlier research period, approximately 2010–2014, was characterized by topics related to computer programs, galantamine, rivastigmine, acetylcholinesterase, controlled clinical trials, day care, and methodology, suggesting an initial emphasis on pharmacological treatment, clinical evaluation, and conventional care. Between approximately 2015 and 2019, the focus

expanded to cognitive disorders, neuroimaging, cognitive therapy, neuropsychological testing, brain function, and mild cognitive impairment, reflecting increasing interest in cognitive assessment and rehabilitation.

From approximately 2018 onward, more prominent topics included dementia, Alzheimer's disease, older adults, physical activity, treatment outcomes, and quality-of-life-related assessment. The most recent research period, particularly 2022–2025, shows growing attention to caregivers, social interaction, machine learning, electronic health records, frailty, neuropsychological assessment, and transcranial direct current stimulation. These emerging themes indicate a shift toward personalized, technology-assisted, socially integrated, and multidisciplinary approaches to dementia care.

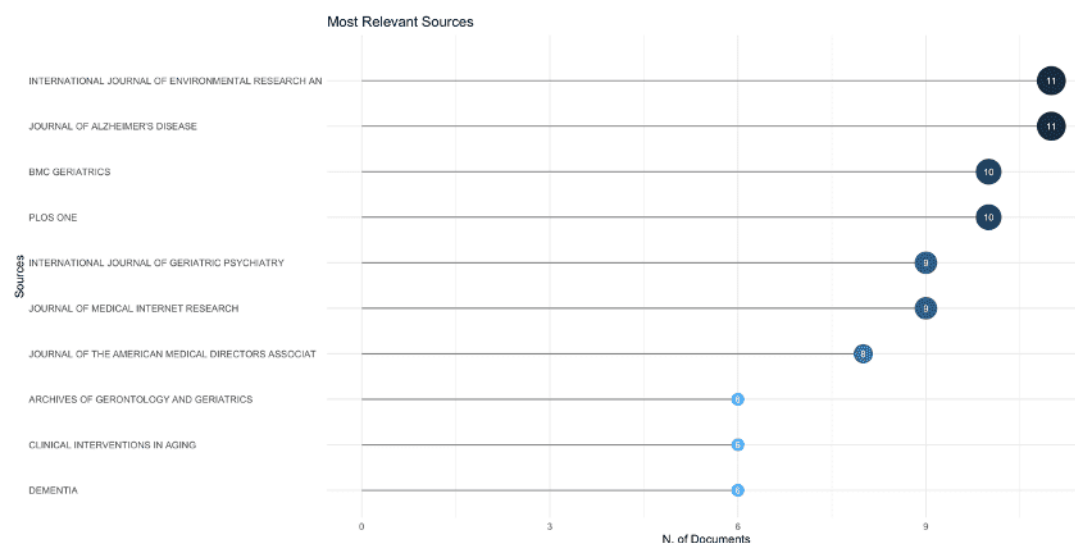


Figure 10. Top 10 most relevant journals by number of publications

Bibliometric Analysis of Most Relevant Sources

Figure 10 presents the most relevant publication sources in the dataset, ranked by the number of documents published on digital game technologies for older adults with dementia. The International Journal of Environmental Research and Public Health and the Journal of Alzheimer's Disease were the most productive sources, each contributing 11 documents. They were followed by BMC Geriatrics and PLOS ONE, with 10 documents each. The International Journal of Geriatric Psychiatry and the Journal of Medical Internet Research each contributed 9 documents, while the Journal of the American Medical Directors Association contributed 8. Archives of Gerontology and Geriatrics, Clinical Interventions in Aging, and Dementia each published 6 documents.

Measurable research that fills identified gaps: (1) intervention efficacy with

standardized outcomes; (2) culturally and contextually adapted technology development and evaluation; (3) implementation and scalability studies in LMIC settings; (4) interdisciplinary mechanism and dose-response research; and (5) equity-focused collaboration and capacity-building studies to decentralize knowledge production.

CONCLUSION AND RECOMMENDATION

The volume of publications focusing on digital games for elderly individuals with dementia has shown an upward trend, particularly over the past seven years, with the highest number of articles published in 2024 (64 articles). However, the average number of publications per year remains relatively low (fewer than 40 articles), suggesting this is still a nascent yet rapidly growing field. This dynamic indicates a wealth of opportunities for future research, particularly in areas involving clinical

validation, cross-cultural implementation, and integrative approaches to digital health interventions for aging populations.

Although publications on digital games for older adults with dementia have increased in recent years, the field remains relatively nascent, with a low average annual publication volume and substantial methodological heterogeneity. Existing studies vary widely in intervention type, outcome measures, and study design, which limits comparability and the strength of evidence. Moreover, most studies are concentrated in a limited number of countries and settings, indicating the need for more clinically robust, cross-cultural, and implementation-focused research. Future investigations should emphasize standardized outcomes, longer follow-up, and integrative digital health strategies to support broader clinical translation.

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