

A Bibliometric Analysis of Technology for Aging Populations: Trends and Future Directions

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ABSTRACT

This study presents a bibliometric analysis of research on technology for aging populations from 1997 to 2024. We analyzed 552 documents from Scopus, focusing on publication trends, key research areas, and emerging topics. The field saw minimal activity until 2013, followed by fluctuations from 2014 to 2016, and a dramatic surge from 2017 to 2022, with publications increasing nearly fivefold. A slight decline was observed in recent years. The top research areas were Medicine, Computer Science, and Engineering. The most influential paper, “A Survey on Ambient-assisted Living Tools for Older Adults” (2013), received 919 citations. The most productive author, Demiris, G., published 16 documents, with his highest-cited article “Older adults’ attitudes towards and perceptions of ‘smart home’ technologies: A pilot study” (2004) receiving 548 citations. This review highlights trends in technological developments for aging populations, summarizes main research areas, and identifies topics requiring further investigation. Our findings can guide researchers, funding agencies, and policymakers in addressing the technological needs of aging populations.

Keywords: Aging populations, bibliometric analysis, gerontechnology, research trends, technological solutions

INTRODUCTION

Problem Statement

The rapid expansion of research on technology for aging populations across multiple disciplines has led to a diverse but potentially uncoordinated body of knowledge. This situation may result in the oversaturation of certain research areas while others remain underexplored, creating

ARTICLE INFO

Article history:

Received: 30 September 2025

Published: 28 November 2025

DOI: <https://doi.org/10.47836/pp.1.6.008>

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inefficiencies and potential gaps in addressing the comprehensive needs of the aging population. A systematic bibliometric analysis is therefore warranted to map the current research landscape, identify potential redundancies and overlooked areas, and provide strategic guidance for future research priorities. This study aims to synthesise and evaluate the existing literature to facilitate a more synchronised and targeted approach to research in gerontechnology, ultimately enhancing the field's ability to address the multifaceted challenges of an aging society.

Research Questions

For this study, there are three main research questions to address.

1. What are the predominant trends in publication volume, subject areas, and geographic distribution of research on technology for aging populations over the period of 1997-2024?
2. How have the key research themes and focus areas in gerontechnology evolved over time, and what emerging topics or underexplored areas can be identified?
3. Based on citation patterns and emerging keywords, what are the potential high-impact research directions in technology for aging populations for the next 5-10 years?

MATERIALS AND METHODS

Data Collection

This bibliometric analysis utilised the Scopus database, one of the largest abstract and citation databases of peer-reviewed literature. The search was conducted on 12th August 2024 using the following string of keywords: Search string used are ("Aging technology" OR "ageing technology" OR "Gerontechnology" OR "Assistive technology" OR "Smart home" OR "Robotics" OR telemedicine OR "Wearable technology" OR "Digital health" OR "Ambient assisted living" OR "Environmental gerontology" OR "Universal design" OR "Mobility aids" OR "Cognitive assistive technology" OR "Senior living technology" OR "Aging in place" AND (elderly OR aging OR ageing OR older) AND adults). The search was limited to articles published between 1997 to 2024, spanning over a 27-year trend in the field. Only English-language articles were included in the analysis.

Data Analysis

The initial dataset was exported from Scopus in CSV format for further processing and analysis. We employed several software tools for data cleaning, analysis, and visualization which include Microsoft Excel: used for initial data cleaning, basic statistical analysis, VOSviewer (version 1.6.20): for creating and visualising bibliometric networks, including

co-authorship, co-citation, and keyword co-occurrence networks and finally Harzing’s Publish or Perish for additional citation analysis and to verify publication metrics.

Inclusion and Exclusion Criteria

Our analysis encompassed all documents retrieved from the Scopus database search, including articles, conference papers, reviews, book chapters, letters, notes, editorials, and books. We excluded non-English publications.

RESULTS

The field of technology for aging populations experienced minimal growth from 1997 to 2016, followed by a surge from 2017 to 2022, with publications increasing nearly fivefold to peak at around 90 documents annually. However, a slight decline is observed from 2023 to 2025 (Figure 1).

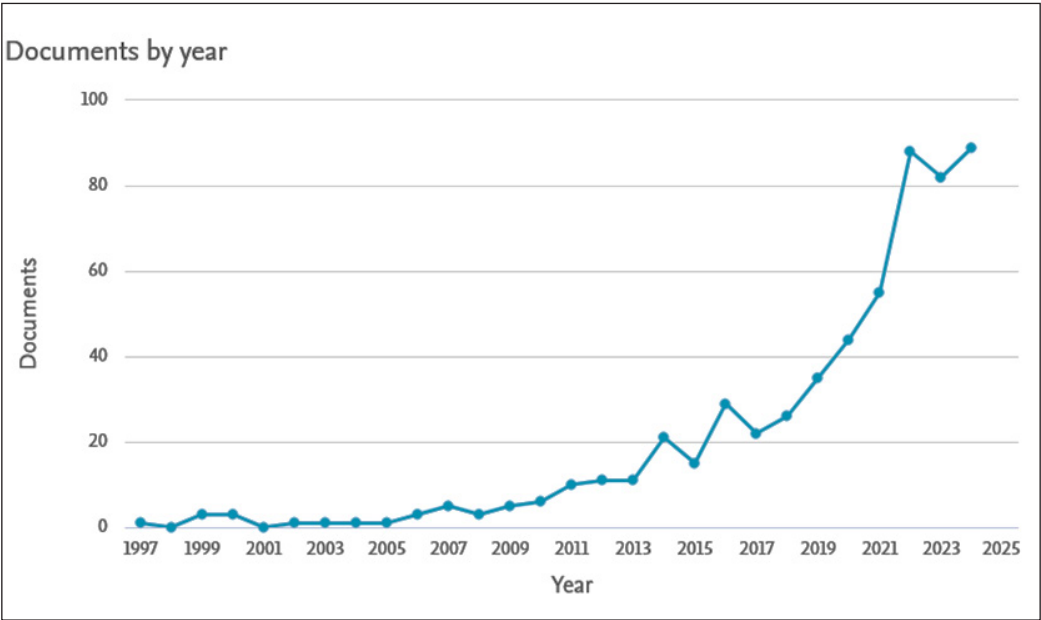


Figure 1. Annual publication trends in technology for aging populations (1997-2025)

Figure 2 shows the United States leads research output in technology for aging populations, followed by Canada and a diverse mix of European and Asia-Pacific countries, reflecting a global interest in this field with a concentration in developed nations.

Table 1 presents the top ten most cited publications in the field of technology for aging populations, with citation counts ranging from 922 to 153. The studies cover a diverse

range of topics including ambient-assisted living, smart homes, telemedicine, wearable technologies, and social networks for older adults, indicating the multifaceted nature of research in this field from 2004 to 2020.

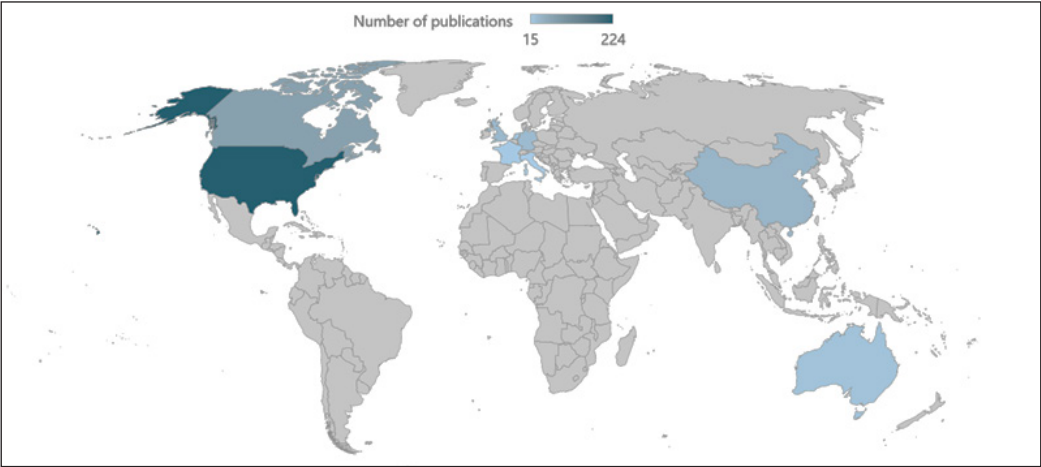


Figure 2. Top 10 countries/territories contributing to research on technology for aging populations

Table 1
Most cited publications on technology for ageing population

References	Title of the study	Year	Number of citations	Document type
Rashidi & Mihailidis (2012)	A survey on ambient-assisted living tools for older adults	2012	922	Article
Demiris et al. (2004)	Older adults' attitudes towards and perceptions of 'smart home' technologies: A pilot study	2004	552	Article
Liu et al. (2016)	Smart homes and home health monitoring technologies for older adults: A systematic review	2016	468	Review
Lam et al. (2020)	Assessing Telemedicine Unreadiness among Older Adults in the United States during the COVID-19 Pandemic	2020	433	Letter
Peek et al. (2016)	Older Adults' Reasons for Using Technology while Aging in Place	2016	347	Article
Gardner (2011)	Natural neighborhood networks - Important social networks in the lives of older adults aging in place	2011	295	Article
Li et al. (2019)	Health monitoring through wearable technologies for older adults: Smart wearables acceptance model	2019	279	Article
Looije (2010)	Persuasive robotic assistant for health self-management of older adults: Design and evaluation of social behaviors	2010	195	Article

Table 1 (continue)

References	Title of the study	Year	Number of citations	Document type
Wang et al. (2019)	Technology to support aging in place: older adults' perspectives	2019	185	Article
Courtney et al. (2008)	Needing smart home technologies: The perspectives of older adults in continuing care retirement communities	2008	153	Article

Figure 3 presents a network of interconnected keywords related to technology for aging populations from 2016 to 2022, with “human”, “older adults”, “aging”, and “quality of life” as the largest and most central terms. The map displays a color gradient from blue to

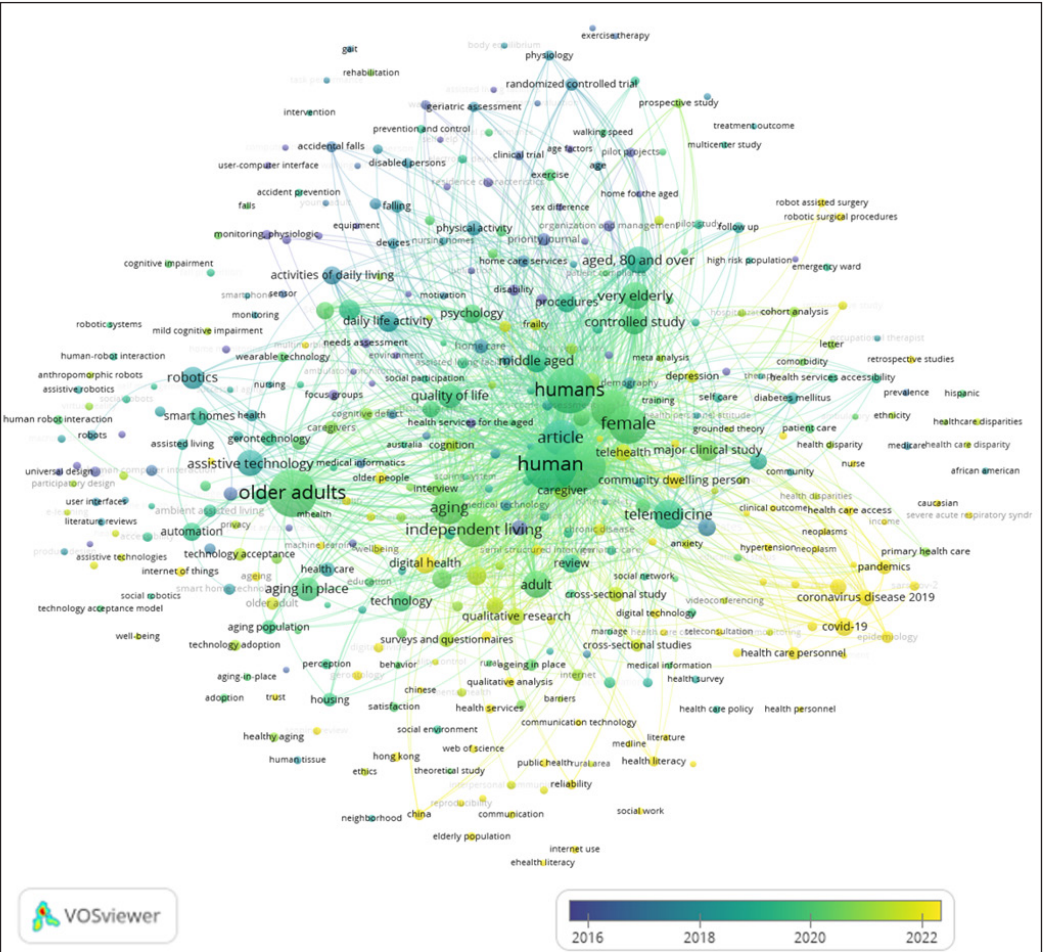


Figure 3. Overlay visualisation map of co-occurrence for all keywords on technology for aging population from 2016-2022

yellow, representing earlier to more recent years respectively, with terms like “covid-19”, “telemedicine”, and “digital health” appearing in yellow. The network shows distinct clusters of related topics, encompassing a diverse range of medical, technological, and social terms, with varying node sizes indicating different co-occurrence frequencies and interconnecting lines suggesting relationships between keywords.

DISCUSSION

The field of gerontechnology has an exponential growth since 2015, evolving from basic assistive technologies to encompassing cutting-edge concepts such as smart environments, digital health ecosystems, and AI-augmented care. This progression, accelerated by the COVID-19 pandemic, has led to high-impact research efforts in ambient-assisted living, advanced wearable technologies, and seamless AI integration in geriatric care. Current trends emphasize human-centric aging, quality of life, telemedicine, and digital health solutions, with key focus areas including assistive technologies, health monitoring, mental health support, and social connectivity for older adults. Future research is likely to prioritize AI integration, advanced telemedicine, personalized care technologies, and solutions addressing cognitive health, social connectedness, and sustainable aging in the context of global challenges like climate change.

CONCLUSION

Gerontechnology has rapidly evolved from basic assistive devices to sophisticated, AI-driven ecosystems, reflecting their growing importance in addressing the complex needs of aging populations worldwide. The field’s responsiveness to technological progress and societal changes, particularly accelerated by the COVID-19 pandemic, has led to expanding research in personalized care, cognitive health, and sustainable aging solutions. As gerontechnology advances, it is poised to revolutionize how societies support and empower their aging members while addressing broader healthcare system challenges.

ACKNOWLEDGEMENT

The author would like to express sincere gratitude to our institution for the support, and appreciation to colleagues and peers who provided valuable insights and feedback during the development of this manuscript. Special thanks to the anonymous reviewers. Finally, we acknowledge the broader research community working to advance technology for aging populations, whose collective efforts made this bibliometric analysis possible. Any errors or omissions remain solely the responsibility of the authors.

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