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Exploring the Global Trends and Hotspots About Role of Physiotherapy in Prevention of Falls in the Geriatric Population: A Bibliometric Study and Visualization Analysis

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ABSTRACT

Background: Falls are common in older adults, and physiotherapy plays a crucial role in preventing falls and minimizing their consequences. The purpose of the study was to forecast future directions in research on the role of physical therapy in preventing falls among older people, to thoroughly identify collaboration networks, to monitor research trends, and to highlight current hotspots.

Methods: Research about the role of physiotherapy in fall prevention in the geriatric population published in the PubMed Database from January 01, 2005, to June 02, 2025, was retrieved. The bibliometric analysis was conducted using RStudio version 4.5.0 (2025-04-11-ucrt) and the Bibliometric and VOSviewer software (version 1.6.20).

Results: Australia was found to be the highest productive country with 362 research articles, and the University of Sydney was the most productive institution, with 79 articles. The journal "BMC Geriatrics" (N=50) and Sherrington C (N=21) were the most productive journal and author respectively.

Conclusions: At present, "exercise", "independent living", "fear", "exercise therapy", "physical therapy modalities", "gait", "humans", "aged", and "accidental falls or prevention and control" are important research topics. Future research from other parts of the world may offer a diverse perspective.

Keywords: Elderly, falls, prevention, physiotherapy, trending topics, bibliometric analysis.

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INTRODUCTION

Falls are a common and serious problem among older adults, impacting both individuals and their caregivers. Strong evidence shows that physiotherapy interventions can effectively prevent falls [1, 2]. Falls are linked to increased mortality, morbidity, functional decline, and earlier nursing home placement. They typically result from a complex interplay of modifiable risk factors and environmental hazards, influenced by age, health conditions, and the surrounding environment [3, 4]. Several neural systems, including the brainstem, basal ganglia, systems regulating muscle tone, and sensory processing (hearing, vision, and body awareness), must coordinate to enable a person to walk normally. All these abilities deteriorate with age; moreover, the likelihood of developing health problems increases, and the frequency of medication use also increases. Therefore, the probability of falls increases as well. Falls have many causes, so prevention and management need a multi-faceted, team-based approach. This might include medication review, exercise, vitamin D supplements, and home assessments tailored to each older adult's needs. Evidence strongly supports exercise as a key component. Studies show that group and home-based exercise programs significantly reduce falls and the risk of falling [5]. Progressive resistance and functional training are safe and effective ways to build strength, improve function, and reduce fall-related anxiety and limitations during rehabilitation for frail, high-risk seniors with a history of falls [6]. Additional treatments, such as cataract therapy and home environment evaluation, may also be necessary. For patients who have fallen, both single- and multiple-intervention strategies have been explored [7]. However, considering the advantages of therapeutic exercise for fall prevention, it is essential to note that a rehabilitation or physiotherapy regimen plays a key role in preventing falls and their effects. As a result, a large number of publications in these areas are seen. Many clinical guidelines recommend exercise training programs as an effective measure for fall prevention in older people. As per Exercise and Sports Science Australia (ESSA) and numerous clinical guidelines, weight-bearing, muscle-strengthening activities are highly advised to maintain skeletal health, prevent falls and bone loss, enhance the components of balance, lower extremity strength, and mobility, and lessen falls and injuries related to falls, all of which contribute to an improved quality of life [8-12]. Nonetheless, the vast majority of the previously discussed studies have focused on specific, constrained elements. However, the majority of the studies discussed above have focused on specific and limited aspects. A general overview of this field about research on the role of physiotherapy and rehabilitation in the prevention of falls in the geriatric population is scarce.

Bibliometric visualization analysis is a quantitative methodology that combines mathematics and statistics and can help researchers understand how a field has developed over time [13]. Utilizing comprehensive indexes like journals, authors, nations, and institutions makes

it possible to conduct a detailed evaluation of research trends and the emphasis of a particular subject [13-14]. Authors with a high total citation count are acknowledged for their scientific accomplishments by their peers [15]. The findings of bibliometric evaluations might also offer recommendations for further investigation and judgment. Another scientometric tool for creating and visualizing network maps is VOS viewer. These knowledge maps can emphasize research trends within a specific region, showcase the work of authors and institutions, display geographical distribution, reveal collaboration links, and trace the genesis of research subjects.

Recent years have seen the application of RStudio with the biblioshiny package and VOSviewer across a variety of sectors, including medicine, machine learning, city or community research, agriculture, and environmental management [16-20]. Bibliometric methodologies have been used on subjects relevant to medicine [21-27]. The role of physical therapy in preventing falls among the elderly has been the subject of extensive research. Studies offering a bibliometric analysis or re-evaluating the literature on this subject are, nevertheless, scarce. Out of the existing literature on the topic from 2005 to 2025, 327 papers were considered for further study. The current study aimed to quantitatively analyze trends in publications on the role of physiotherapy in preventing falls in the geriatric population over the past 20 years, and to provide an overview of the global research base, hotspots, and frontiers of rehabilitation in geriatrics using bibliometric analysis.

MATERIALS AND METHODS

Data source and search strategy

The PubMed database (<https://pubmed.ncbi.nlm.nih.gov/>) provided the data used in this investigation on June 02, 2025. There are already around 38 million records at present in the biomedical and life sciences literature [28, 29]. The current study focused specifically on the period from 2005 to 2025.

Literature screening and data extraction

The analysis was restricted to "English" and only "clinical trials, comparative studies, meta-analysis, randomized controlled trials, reviews, or systematic reviews" involving human subjects that were available in full text (open access articles); non-English articles and other document types, including conference abstracts, letters, reviews, and news, were not included. The key terms for this bibliometric analysis were "physiotherapy in fall prevention in geriatric rehabilitation" OR "physical therapy in fall prevention in the elderly". The Boolean operator "OR" was used. The search returned 378 documents from the PubMed database. The information was exported as a comma-separated values Excel file. The data underwent rigorous cleaning and verification to exclude duplicate or redundant records, ensuring the accuracy of the retrieved articles on fall prevention in geriatric rehabilitation. To determine whether the chosen item was appropriate, systematic searches were carried out. After being marked, the chosen

articles were exported as a PubMed file.

Data analysis tool and statistical methods

The VOSviewer program, version 1.6.20, created by the Center for Science and Technology Studies at Leiden University in the Netherlands, was used to assess keyword co-occurrences and co-authorship between authors and institutions. With the help of Bibliometrix, a software tool developed by the Department of Economics and Statistics at the University of Naples Federico II in Italy, the data analysis was carried out using the RStudio program version 4.5.0 (2025-04-11-ucrt) [30]. The current study examined publication trends, covering a range of topics, including authors, publications, sources, and contributing institutions.

RESULTS AND DISCUSSION

Data searches

The PubMed search engine yielded 378 articles when the keywords “physical therapy in fall prevention in the elderly” or “physiotherapy in fall prevention in geriatric rehabilitation” were entered. A maximum of 51 articles were eliminated from the study due to irrelevant or duplicate data. By restricting the study to 327 relevant articles, it becomes more contextualized. Adding unnecessary articles will also introduce data noise, potentially making interpretation more difficult. By highlighting relevant articles throughout the analytical process, the conclusions and findings produced gain greater legitimacy and are more likely to be accepted by the scientific community. For the bibliometric analysis, 327 articles were used.

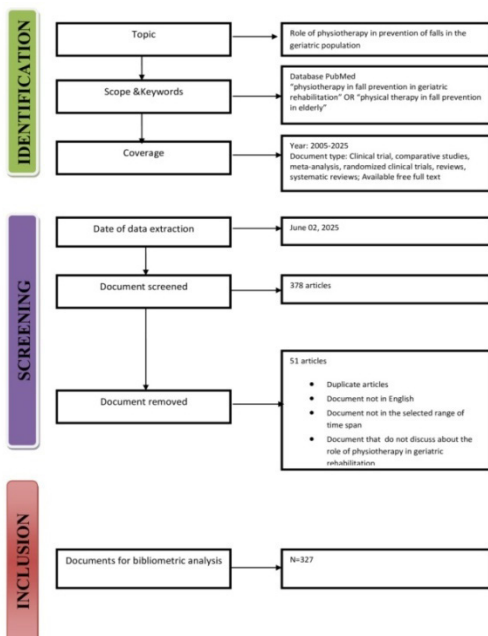


Figure 1:

Article search procedure.

The successive stages involved in performing an article search are depicted in the flowchart in Figure 1. To identify and classify knowledge concepts related to the

role of physical therapy in preventing falls in older people, the analysis involved searching the PubMed database. According to Dede and Ozdemir, bibliometric analysis comprises two parts: science mapping and performance analysis [31]. Productivity of the articles is increased through performance analysis, which assesses the contributions of researchers from different countries, institutions, sources, and authors [32]. In scientific research, mapping is a visual representation of the complex structure of knowledge and its development within the field of study. Furthermore, the study clarifies the complex relationships and interactions between the different research components as well as the strength of their correlations [32].

Trends of annual publications

The time span covered in this bibliometric analysis was from 2005 to 2025. Three hundred twenty-seven documents included in the analysis were retrieved from 112 English-language sources, authored by 1734 authors. The annual growth rate of the documents was 16.44 percent. 2024 had the most articles, with 35, followed by 2019 and 2022, with 33 each. A total of 27 articles were generated in 2021, followed by 21 in 2025, 20 in 2017, and 19 in each of 2018 and 2016. As only 6 months were included in 2025, the numbers were lower than in 2024. The rate at which articles are generated has been steady and uninterrupted since 2005.

Research hotspots by contributing authors

A total of 1734 authors contributed to publications discussing the role of physical therapy in preventing falls among older people. Spanning 2005-2025, Sherrington C, affiliated with the Sydney School of Public Health, University of Sydney, Australia, has disseminated 21 scholarly articles about the role of physiotherapy in the prevention of falls in geriatric rehabilitation. Notably, Sherrington C possesses an overall “h index of 99,” and since 2020, the h index is 67. The h-index is a number intended to represent both the productivity and the impact of a particular scientist or scholar. The acquisition of a high h-index and the publication of a large number of research articles indicate a significant impact on the scientific community.

The second individual researcher identified is Lord SR, affiliated with NeuRA, University of New South Wales, Sydney, Australia, who has contributed to the scientific community by authoring 15 scholarly papers from 2005 to 2025. Notably, Lord SR possesses an overall “h index of 151,” and since 2020, his h index is 88. The scholarly output of Clemson L, an esteemed researcher affiliated with the University of Sydney, Australia, encompasses 14 publications spanning 2005-2025. In the same time span, Tiedemann A from the Sydney School of Public Health, University of Sydney, Australia, produced 12 scholarly research works in the same field.

Sherrington C was most productive in 2016, with four scholarly publications, followed by two publications each in 2009, 2014, 2019, and 2024. Lord SR was most productive in 2014 and 2021, with three publications, followed by two publications each in 2009, 2015, and 2016.

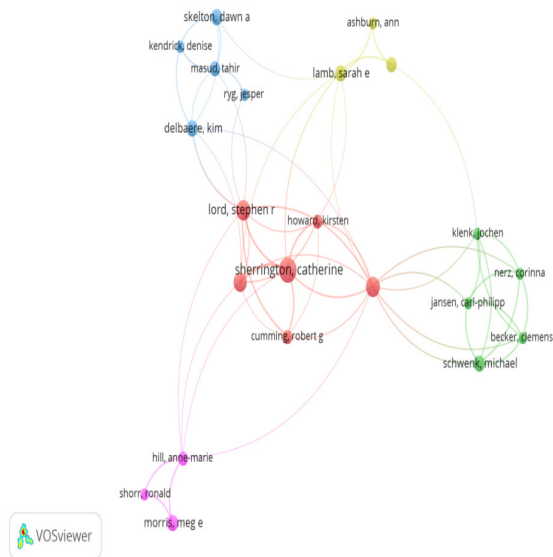


Figure 2: Collaborations between various authors conducting research related to the role of physiotherapy in the prevention of falls in geriatrics.

During network analysis of co-authorship (Figure 2), the minimum number of documents per author required by VOSviewer was set to 5. Of the 1800 authors, 25 met the threshold, and 22 were identified as co-authors. After completing the VOSviewer analysis, five distinct clusters were observed. Each cluster effectively demonstrates the interrelationship between individual authors. The network's visual representation is shown in Figure 2. The authors were depicted as circles of varying colors, with their sizes directly corresponding to their co-authorship frequencies. A common chromatic attribute signifies their interconnectedness and cohesive categorization. It can be observed that specifically, “Sherrington C” has collaborated in 19 documents with a total link strength of 34, “Clemson L” has co-authored 12 documents with a total link strength of 32, “Lord SR” has co-authored 13 documents with a total link strength of 27, “Becker C” has collaborated in 5 documents with a total link strength of 22, and “Jansen CP” and “Nerz C” has co-authored five documents with a total link strength of 22.

Cluster 1 = Red: The authors in this cluster have worked on multidisciplinary and multidomain interventions to prevent falls in older people [33, 34].

Cluster 2 = Green: The authors in this cluster have researched lifestyle-integrated functional exercise to prevent falls and promote physical activity in older people, as well as to assess the cost-effectiveness of such programs [35, 36].

Cluster 3 = Blue: This cluster of researchers focused on identifying health system challenges, tasked with reducing the rate and risk of falls in older adults; complex and multiple health system challenges related to the adoption and implementation of fall management exercise programmes, etc. [37, 38].

Cluster 4 = Pink: These researchers focused on studies examining the feasibility of multifactorial interventions and

the use of allied health assistants to deliver fall prevention education after hospitalization [39, 40].

Cluster 5 = Yellow: These researchers confined their studies to physiotherapy interventions for the prevention of falls in patients who have Parkinson’s disease [41, 42].

Research hotspots by journals/ contributing sources

Based on the data provided by RStudio, 327 scholarly articles were collected from 112 distinct sources or journals, of which the primary source of utmost relevance is “BMC Geriatrics,” with 50 scholarly articles. “BMC Geriatrics” is an open-access journal publishing original, peer-reviewed research articles on all aspects of the health and healthcare of older people, followed by the “International Journal of Environmental Research and Public Health,” which features 18 notable articles (Figure 3).

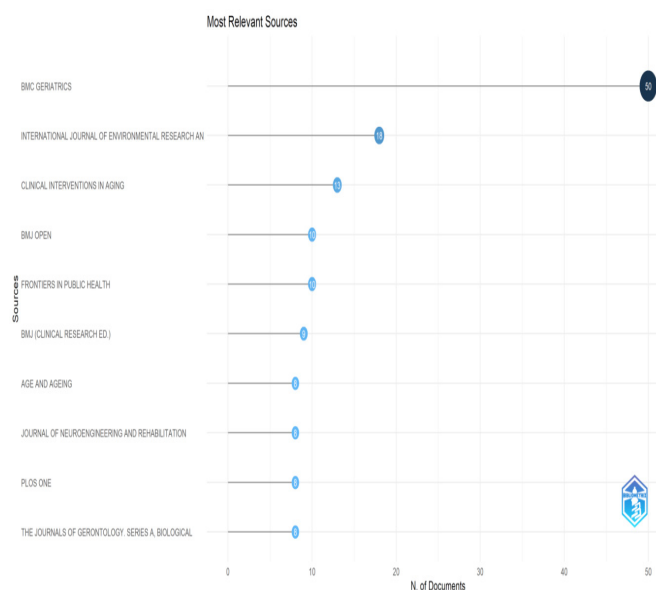


Figure 3: Highest impact source for publication of research related to the prevention of falls in geriatric rehabilitation using the RStudio application.

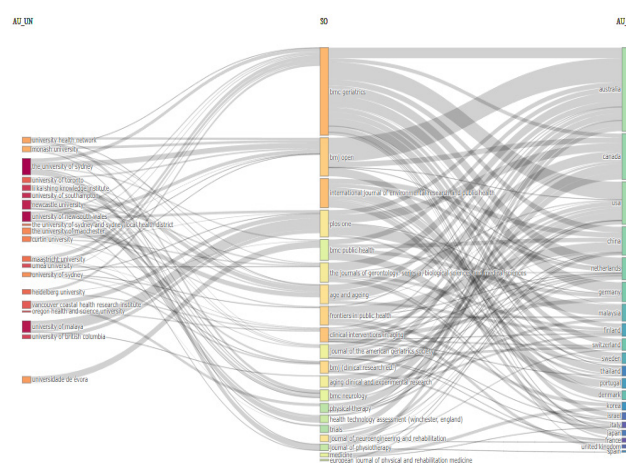


Figure 4: Three-field plot between author affiliations (AU_UN), Source (SO), and author country (AU_CO) using the RStudio application.

Figure 4 illustrates the observed correlation among author affiliation (AU_UN), sources/journals (SO), and the country of the author (AU_CO). Gray lines interconnect the three regions. The longitudinal dimension of the

rectangular shape serves as a quantitative representation of the number of entities associated with each compartment. The data presented in Figures 3 and 4 support the notion that the journal “BMC Geriatrics” has the most significant influence in the field of research on the role of physiotherapy in fall prevention among the geriatric population. The scholarly institutions, namely Maastricht University (N=12), the University of Sydney (N=11), the Umea University (N=10), Heidelberg University (N=8), the University of New South Wales (N=5), among nine incoming flow count towards the journal “BMC Geriatrics” have chosen this reputed platform for disseminating their research findings. Based on an analysis of the outgoing flow count of this journal, it is revealed that this journal has disseminated scholarly articles from diverse nations like the USA (N=55), Germany (N=35), Australia (N=33), the Netherlands (N=32), Sweden (N=25), to name a few, among authors from 16 different countries.

Research hotspots by institutions

A link clarification procedure was implemented to ascertain the most pertinent links. The primary entities engaged in research on this subject are enumerated using the document co-authoring index presented by Abafe et al. [42]. According to the data presented in Figure 5, the University of Sydney, University of New South Wales, University of Malaya, Newcastle University, and University of Southampton are the primary institutions associated with the production of scholarly articles about the role of physiotherapy in the prevention of falls in the geriatric population. After tracking affiliations’ output over time, Figure 5 shows which institution has published the most academic articles on the role of physical therapy in preventing falls among older people. It’s noteworthy that the University of Sydney has become the most productive university, producing 79 articles on this topic. The second-most-productive institution is the University of New South Wales, with 39 documents; the third-most-productive is the University of Malaya, with 38 documents. Newcastle University ranked fourth with 37 scholarly articles, and the University of Southampton ranked fifth with 34 scholarly articles. Asian countries were underrepresented among the top 10 institutions for research on the prevention of falls in the geriatric population, which could impede the development of this field. Asian nations are not seen in the top 10 research institutions. Therefore, it is recommended that European, American, and Asian research institutes strengthen their collaboration networks to advance the field.

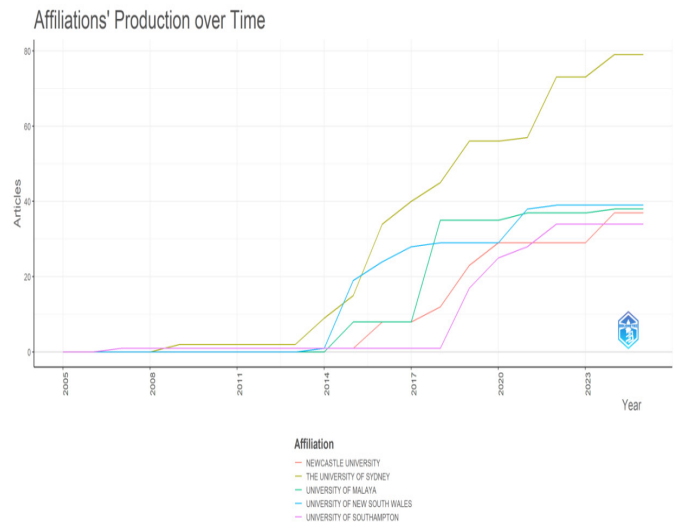


Figure 5: Affiliations’ production over time. Research hotspots by countries/ regions.

Figure 6 shows that the highest number of scientific research articles on the role of physiotherapy in the prevention of falls in the geriatric population was published in Australia (N=362), followed by the USA (N=274), Canada (N=234), China (N=131), and the Netherlands (N=109). It is also evident from Figure 6 that China is placing greater emphasis on developments in this field. Canada and the Netherlands are among the world’s most developed nations. This is because they have been well-represented and consolidated within the World Confederation for Physical Therapy, which supports and encourages physical therapy-related research. Additionally, the USA is the primary collaborator among nations, as it has the highest degree of centrality. Globally, the highest level of collaboration is between Australia and the Netherlands (N=6) in research on the role of physiotherapy in the prevention of falls in the geriatric population. This is followed by collaboration between Australia and Germany (N=5), then Australia and the USA (N=5), the Netherlands and Belgium (N=5), the Netherlands and Switzerland (N=4), Switzerland and France (N=4), and the USA and China (N=4), as the highest worldwide collaborators.

Country Collaboration Map

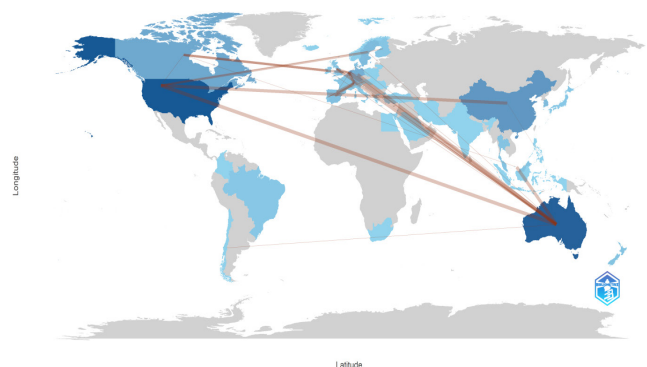


Figure 6: Scientific research articles on the role of physiotherapy in the prevention of falls in the geriatric population were produced by various countries and by collaborations across different countries on the world map.

Trends based on author keywords

Figure 7 depicts a trend topics plot based on the author's keywords. The time span considered was 2005-2025. When creating trend topic graphs, the "number of words per year" and "word minimum frequency" parameters were set to 3 and 5, respectively. It is seen that "exercise" (f=63), "independent living" (f=56), "fear" (f=24), "exercise therapy" (f=63), "physical therapy modalities" (f=26), and "gait" (f=22) have been the popular topics in recent years, as per the author's keywords. It correlates with the fact that

exercise therapy and other physical therapy modalities play an essential role in helping the elderly population to live independently and overcome the fear of falling. Exercises and a balance retraining program reduce subsequent falls among older adults with a history of falls and slow gait speed [43]. This provides the rationale for these trending keywords. This explains the reasoning behind these popular terms. Among the top few author keywords, "humans" (f=327), "old" (f=308), and "accidental falls or prevention and control" (f=217) were the most frequently used.

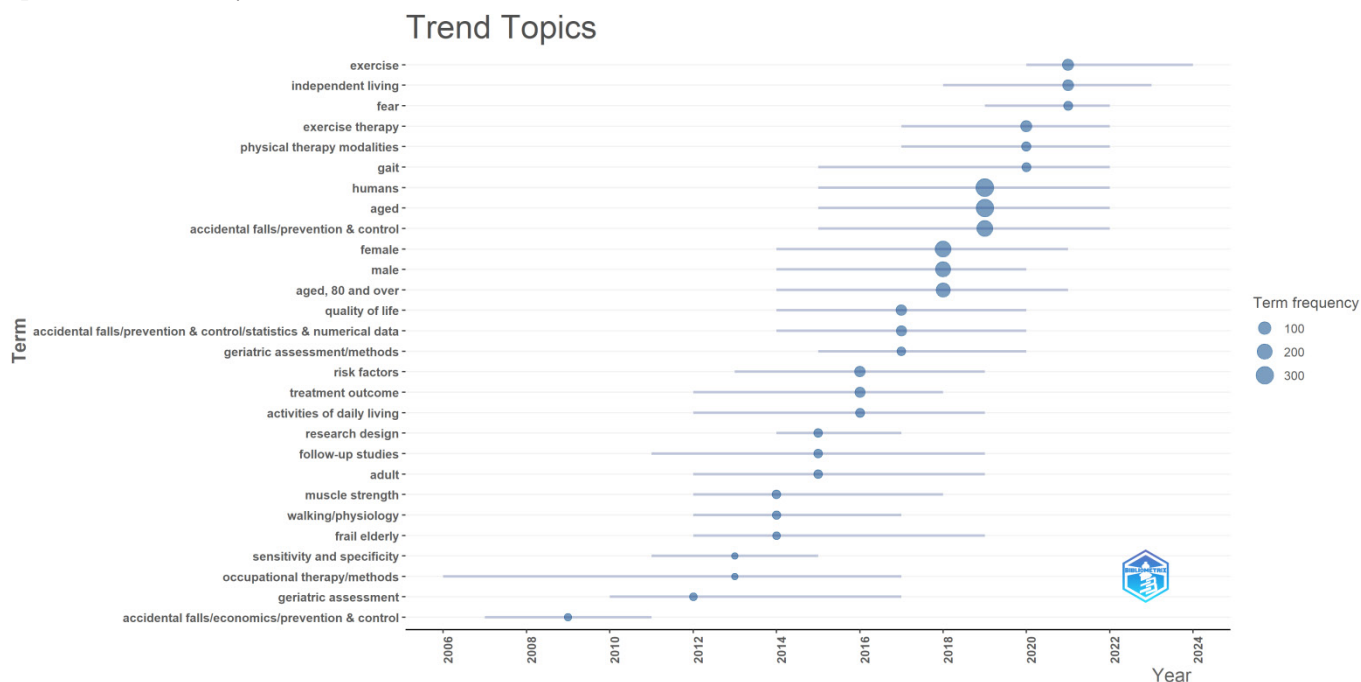


Figure 7: Trend topics according to the author's keywords.

Analysis of keyword co-occurrence

For VOSviewer use, the minimum number of times an author keyword appeared was set at 2. The threshold conditions were met by 124 out of the 531 keywords. After the VOSviewer study was completed, 12 distinct clusters were identified. Every cluster successfully illustrates how different topics relate to one another. The software offers three different methods for visualizing bibliometric mapping. The network's visual representation is shown in Figure 8. The visual representation of the keywords consisted of circles of different colors, each with a size proportional to the frequency of the keywords in the abstracts and titles.

The sizes of the letters and circles were therefore established by their respective occurrence rates. When the letter and circle sizes are raised, the observed phenomenon indicates a higher frequency of recurrence for a particular keyword. To identify 124 keywords, a corpus of 327 related publications was consulted. The empirical data from papers on osteoarthritis rehabilitation were the primary focus. Figure 8 shows the clusters found in each of the problem areas examined. Their consistent hue indicates a strong association between the keywords. A shared color scheme indicates their compatibility and unified classification. It is evident from the data in Figure 8 that the keywords "falls," "exercise," "older adults," "balance," "fall prevention," and

"accidental falls" show different frequencies and total link strengths. In particular, the terms "falls" recur 51 times with a total link strength of 159, "exercise" 43 times with a total link strength of 153, "older adults" 43 times with a total link strength of 150, "balance" 33 times with a total link strength of 111, "fall prevention" 40 times with a total link strength of 110, and "accidental falls" 25 times with a total link strength of 83. It is evident that older adults are prone to falls, and exercise and balance training play a pivotal role in preventing accidental falls in the geriatric population, as demonstrated by the results.

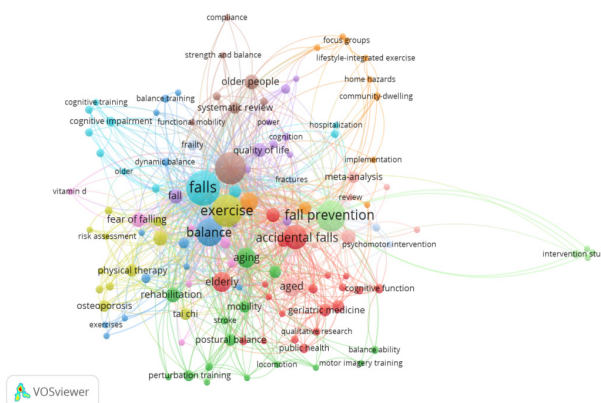


Figure 8: Co-occurrence of author keywords by VOSviewer using network visualization.

Limitations

Using a bibliometric tool, this study examined advancements and patterns in international scientific research, providing a quantitative and comprehensive picture of research focus, trends, and collaborations. It also offered insights into how fall prevention in the geriatric population will develop in the future and the function of physical therapy in this area. However, it should be noted that only publications in the PubMed database were included, and non-English publications and those without free full texts were excluded, which could lead to publication bias; Notwithstanding these drawbacks, the study's conclusions offer a more thorough analysis of the literature on role of physiotherapy in fall prevention in older people, which may provide insightful information for present and upcoming studies in this area. Moreover, the study excluded articles published before 2005 and focused on those published between 2005 and 2025. Other datasets (e.g., Web of Science or Scopus) warrant further investigation. It should be mentioned, last but not least, that bibliometric research will direct researchers and highlight knowledge shortages.

CONCLUSION

Overall, the number of papers on the role of physiotherapy in fall prevention in geriatrics has been rapidly increasing. Australia is home to the majority of the top publishing institutions, making it the pioneer and most influential country in this industry, along with the United States. Canada is rapidly rising to become the third most powerful nation. A journal analysis found that "BMC Geriatrics" and the "International Journal of Environmental Research" are the most prominent sources for rehabilitation research in the field during 2005–2025, publishing articles of notable significance. These timely analytical results offer a fresh perspective on the subject of study, assist researchers in selecting suitable journals for publication, identify potential collaborators, and help them understand hotspots and frontiers, thereby advancing the field's growth. There were, however, several limitations on the scope of this study. In particular, this analysis only included English-language papers published between 2005 and 2025. Future research from other parts of the world, e.g., the Indian population, may bring a diverse perspective to various aspects of this field. Upcoming studies may focus on novel developments such as the integration of telerehabilitation, virtual reality, EMG biofeedback, and sensor-based insole applications, as well as sensor-based home exercise programs, which are trending areas. In conclusion, the study's findings may provide academicians with insight into the current status and direction of research on the subject at hand, as well as references and ideas for further study.

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