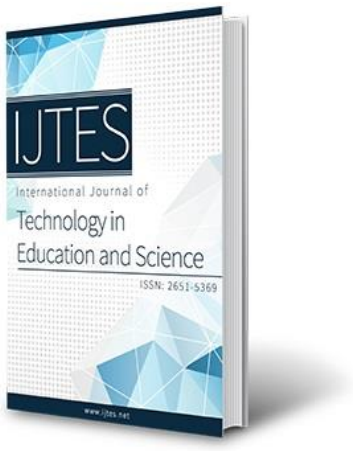

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College Mapping the Research Landscape of Falls in Older Adults: A Bibliometric Analysis

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College Mapping the Research Landscape of Falls in Older Adults: A Bibliometric Analysis

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Abstract

Aging poses a significant public health concern due to the high incidence of falls among older adults. This study conducted a bibliometric analysis of 6815 studies from 1842 to 2022 to identify key areas and interactions in falls research among older adults and propose future research directions. The United States was found to be actively contributing to this field, with the Hinda and Arthur Marcus Institute for Aging Research, Boston, MA being a prominent institution. Notable authors included Lord SR, Kenny RA, and Stevens JA. The most cited paper was "Risk Factors for Falls among Elderly Persons Living in the Community". The study revealed that the Journal of the American Geriatrics Society was the most active journal. Co-occurrence analysis identified five major clusters of topics related to aging and falls. Despite global research activity, collaboration across country lines, especially between developed and developing countries, was lacking. Research on risk factors, particularly related to balance and gait issues, received significant attention. However, there was insufficient focus on addressing the diverse needs of aging individuals, including cultural and socioeconomic factors.

Introduction

Falls in older adults are a significant public health concern, with nearly one-third of older adults experiencing a fall each year (World Health Organization, 2007). Mapping the research landscape of falls in older adults provides insights into the current state of research, identifies gaps in knowledge, and highlights opportunities for future research. A systematic review of the literature on falls in older adults found that the majority of research has focused on individual-level risk factors, such as age, sex, and chronic health conditions, rather than on broader contextual factors, such as social and environmental factors (Gillespie et al., 2012). This review also identified a need for more research on effective fall prevention interventions and for studies that explore the experiences and perspectives of older adults who have fallen.

Further evidence of the need for a more comprehensive approach to falls in older adults comes from a recent meta-analysis that found that multifactorial interventions, which address both individual-level and contextual factors, are more effective at reducing the risk of falls than single-component interventions (Parry et al., 2013). This analysis also highlighted the importance of tailoring interventions to individual needs and preferences and involving older adults in the development and implementation of fall prevention strategies. Overall, mapping the

research landscape of falls in older adults reveals the need for a more holistic and person-centered approach to fall prevention that considers both individual-level and contextual factors and engages older adults as partners in the research process.

A great deal of previous research into fall-related in older adults has focused on the challenges. It is now well-established from a variety of studies that have relatively small sample sizes, which can limit the generalizability of the findings. This can make it difficult to draw strong conclusions or make recommendations for broader populations. Perhaps, issues related to ethical considerations also play a major role in this research trend and challenges. Falls can be a serious health concern for older adults, and conducting research on falls can raise ethical considerations related to informed consent, risk of injury, and balancing the benefits and risks of fall prevention interventions.

Up to now, in terms of data collection, previous studies on falls go unreported and are difficult to capture through self-report or other means. This can make it difficult to accurately assess the frequency and risk factors of falls. Previous research findings into fall-related studies have been inconsistent and contradictory, which might be due to their measurement issues. Measuring falls and fall-related outcomes can be complex, as there is often variability in how falls are defined and measured. This can make it difficult to compare findings across studies and draw strong conclusions. By addressing these challenges and continuing to conduct high-quality research in this area, researchers can identify effective interventions to prevent falls and improve the quality of life for older adults. In order to present the direction of future falls research in the geriatrics population, we downloaded English-language articles and reviews from the Scopus database and analyzed them visually using VOSviewer and Harzing POP.

The general objectives in this current study were to identify the main areas and current interactions between falls in the field of older adults and suggest future research directions. Specifically, there are four research questions:

(i) Research Question 1: What is the current publication trend in board diversity?

(ii) Research Question 2: Which are the most influential articles on board diversity?

(iii) Research Question 3: Who are the most influential authors, top countries, and institutional on-board diversity?

(iv) Research Question 4: Which themes involving board diversity are the most popular among scholars?

This bibliometric analysis will be beneficial for researchers, policymakers, and individuals to understand the research trends in falls in older adults and to discover the potential and opportunities for future research (Bahri, Adnyana, Hasan, Ray, Paramitha, 2022; Suseelan, Chew, Chin, 2022)

Method

A bibliometric analysis study is a mechanistic approach to understanding the global research trends in a specific area based on the outputs of the academic literature database. This kind of approach distinguishes a bibliometric analysis paper from a review paper which is primarily intended to discuss the latest progress, challenges, and future directions of a certain topic (see Figure 1).

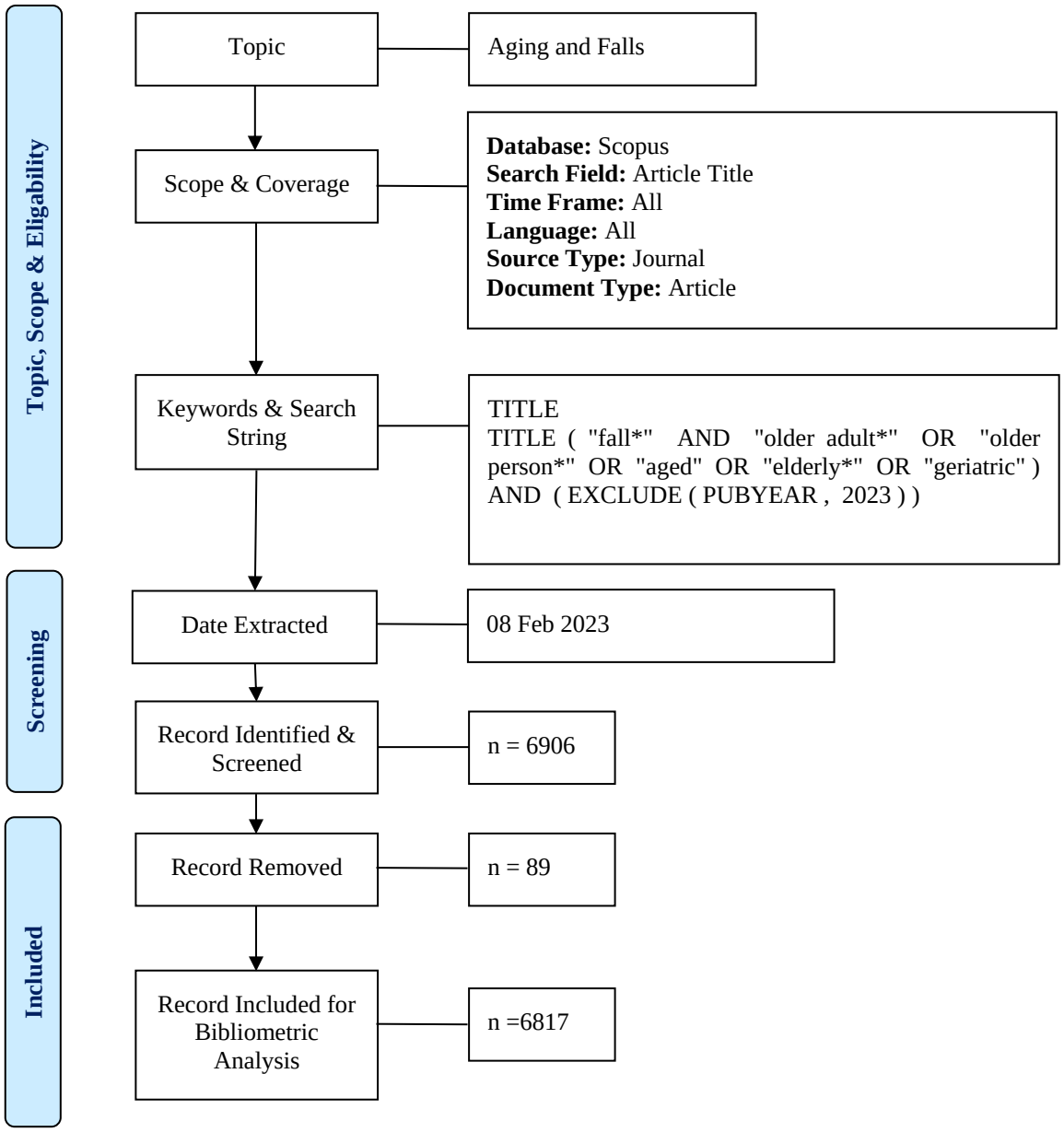

Figure 1. The Study Flowchart

Data Source and Search Strategy

Data mining was conducted within February 18 2023 using Scopus database. The central theme in this study was research articles containing “fall* and “older*” in the article title. The oldest publication dates to 1842 and the more recent ones are from 2022. The query string used for the search was: TITLE ("fall*" AND "older adult*" OR "older person*" OR "aged" OR "elderly*" OR "geriatric") AND (EXCLUDE (PUBYEAR , 2023)). This query string resulted in 6817 documents. These articles contained terms such as review, recent, progress, critical, revisit, advance, highlight, in the title and abstract. The search results of the central theme were analyzed based on year, source, author, affiliation, country/territory, subject area, and document type. Bibliometric indicators such as total publications, total citations, CiteScore, FWCI and h-index were used for ranking purposes.

Method

Bibliometric Maps Using Analysis of Co-Authorship and Analysis of Co-Occurrence

Citation, bibliographical, and author keywords information of 6815 articles were exported to VOSviewer (version 1.6.7, Center for Science and Technology Studies, Leiden University, The Netherlands), a software tool for constructing and visualizing bibliometric maps. Maps created using VOSviewer include items. In this study, the items are the objects of interest, namely the author keywords. Between any pair of items, there can be a link—connection or relation between two items. Each link has a strength, represented by a positive numerical value. The higher this value, the stronger the link.

In the case of co-authorship analysis, the link strength between countries indicates the number of publications that two affiliated countries have co-authored, whereas the total link strength indicates the total strength of the co-authorship links of a given country with other countries. Similarly, in the case of co-occurrence analysis, the link strength between author keywords indicates the number of publications in which two keywords occur together. In the analysis of co-authorship, we included all 252 countries affiliated with 6469 authors. The affiliated countries/territories were clustered into 5 continents: Africa, America, Asia, Europe, and Oceania. Analysis of co-occurrence of author keywords involved 6574 keywords. In VOSviewer, minimum occurrences of a keyword to be analyzed was set to 50. Overlay visualization mode was selected to view the average publication year, number of occurrences, and link strength of the keywords. The colour of a keyword indicates the average publication year of the documents in which a keyword occurs.

Results

Publication Output and Growth of Research Interest

For a period of 180 years, a total of 6815 research articles had been published (See Figure 2). The oldest publication dates to 1948, and there was no other publication record until 1955. It is suggested that strong interest in fall-related in older adults' research started from 1977. It was also found that the number of publications increased by 100 for every two years. Therefore, it is anticipated that the annual publication will continue to rise. However, most of these articles are not freely available and the user has to pay to access the information in them. We suggest that an article will likely receive more citations if it is published through an open-access journal.

Fall-related research areas are extensive and many research groups worldwide are working actively in these areas. Analysis on the subject area showed that medical concerns are the primary focus in fall-related in older adult's studies. This is evidenced by the total publications classified under the following subject areas: Medicine (5154 articles, 75.63%), Nursing (1230 articles, 18.05%), Biochemistry, Genetics and Molecular Biology (877 articles, 12.87%), and Health Professions (782 articles, 11.47%). Indeed, fall study is a multidisciplinary area and one of the publications was categorized under multi-disciplinary area.

Results also showed that the articles used in this study were published in more than 20 different languages. English 5919; 84.80 %) was the most commonly used language followed by French (170; 2.44%), Spanish (158, 2.26 %),

German (154, 2.21%) and Portuguese (145, 2.08%). Other languages that took about less than 2% such as Japanese, Chinese, Dutch, Turkish, Italian, Korean, Polish, Russian, Danish, Hebrew, Persian, Czech, Slovak, Finnish, Norwegian, Swedish, Greek, Hungarian, Malay, and Slovenian were used in less than 100 articles. When a publisher submits an article in a foreign language to be indexed in Scopus, the article should have a title and abstract in English.

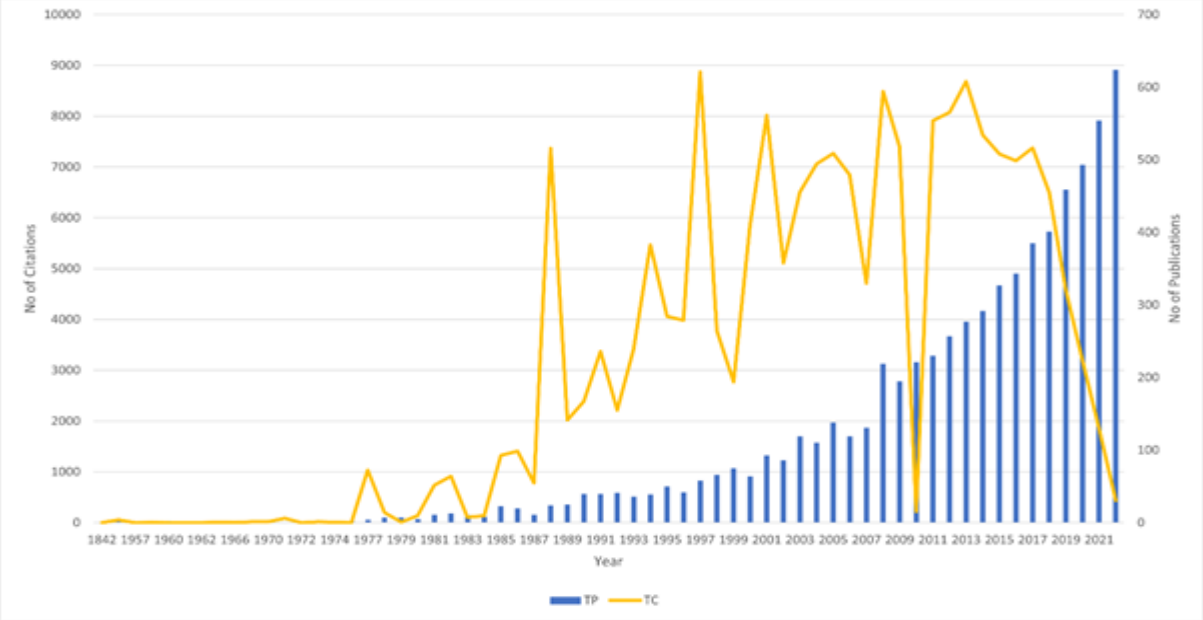

Figure 2. Total Publications and Citations by Year

Preferred Journals

Our results showed that the top 10 most productive journals are owned by twelve (12) different publishers (See Table 2). The top three journals were published by Wiley-Blackwell, Lippincott Williams and Wilkins, BioMed Central Ltd., Springer Nature and Elsevier Ireland Ltd. The most productive journal was Journal of the American Geriatrics Society with 231 articles covering 3.39% of the total publications, followed by BMC Geriatrics (149, 2.19%) and Archives of Gerontology And Geriatrics (98, 1.44%). Massachusetts Medical Society was not the most active journals, however one of their articles published in 1988 was the most cited article, with 4944 citations. According to the CiteScore 2016 report, eleven journals had a CiteScore of 5 and above. Journals of the highest and lowest CiteScore belonged to Aging Clinical and Experimental Research (11), and Rigakuryoho Kagaku (0), respectively.

Table 1. Most Active Journals

Source Title	**TP**	**TC**	**Publisher**	**Cite Score**	**SJR 2018**	**SNIP 2018**
Journal Of the American Geriatrics Society	231	21738	Wiley-Blackwell, Lippincott Williams and Wilkins	8.8	2.133	2.24

Source Title	TP	TC	Publisher	Cite Score	SJR 2018	SNIP 2018
BMC Geriatrics	149	3221	BioMed Central Ltd., Springer Nature	4.8	1.153	1.693
Archives Of Gerontology and Geriatrics	98	2888	Elsevier Ireland Ltd	5.3	0.953	1.412
Age And Ageing	97	10005	Oxford University Press, NML(Medicine)	11	1.75	3.23
Aging Clinical and Experimental Research	89	1685	Springer Science and Business Media Deutschland GmBH, Springer Nature, NML (Medline)	5.9	0.911	1.471
International Journal Of Environmental Research And Public Health	83	677	Multidisciplinary Digital Publishing Institute (MDPI)	4.5	0.814	1.44
Journals Of Gerontology Series a Biological Sciences And Medical Sciences	83	8449	Oxford University Press, Gerontological Society of America	9.6	1.712	1.738
Archives Of Physical Medicine and Rehabilitation	66	6263	W.B.Saunders, Elsevier	5.3	0.953	1.412
Geriatrics And Gerontology International	65	1334	Blackwell Publishing, John Wiley and Sons Inc	4.8	0.814	1.114
Plos One	56	1736	Public Library of Science	5.6	0.852	1.368
Gerontology	53	2564	S.Karger AG	7.7	1.267	1.667
Osteoporosis International	53	2656	Springer London	7.6	1.108	1.844
Gait And Posture	50	2015	Elsevier B.V.	4.3	0.682	1.24
Rigakuryoho Kagaku	47	47	Society of Physical TherapyScience (Rigaku Ryoho Kagakugakkai)	0	0.106	0.043
Journal Of Geriatric Physical Therapy	44	1213	Wolters Kluwer Health, Lippincott Williams and Wilkins, American Physical Therapy Associations	6.1	0.941	1.579

Notes: TP=total number of publications; TC=total citations;

Leading Countries, Top Institutions and International Collaboration

Figure 3 shows the top 15 most productive countries contributing to the growth of fall-related studies in older

adults in worldwide. About 60% of the global publications were contributed by the United States and Japan indicating these two countries are key players in the fall-related research progress. The United States was the leading country with 1632 publications in a total of 92372 journals, covering 39% of the global total publications. With one-half of USA's total publications, Japan was ranked the second most productive country. The total number of publications (TPi) from The University of Sydney was 104, followed by National Center for Geriatrics and Gerontology 96, followed by Universidade de São Paulo 69, respectively. The distribution of countries/territories per region is shown in Figure 3.

The closer two countries are located to each other in VOSviewer, the stronger their relatedness and the stronger the link between the two countries, the thicker the line. The highest number of countries per region came from Africa (59) followed by Europe (57), Asia (54), North America (42), Oceania (26), and South America (14). Results of co-authorship showed that the US was the most affiliated country, linked to 39 countries/territories with 491 times of co-authorship. The list was followed by the UK (37 links, 324 co-authorships), Canada (36 links, 256 co-authorships), Australia (35 links, 254 co-authorships), Netherlands (32 links, 204 co-authorships), and others. It was also shown that 2/3 of the listed countries had international collaborative publications with less than 10 countries. Several possible factors contributing to the dynamic of international collaboration can be attributed to the diversity of research partners, the high percentage of foreign postgraduates/ visiting scholars, and strong research funding. It is also important to have a flexible and stable research policy to ensure the stability of international collaboration.

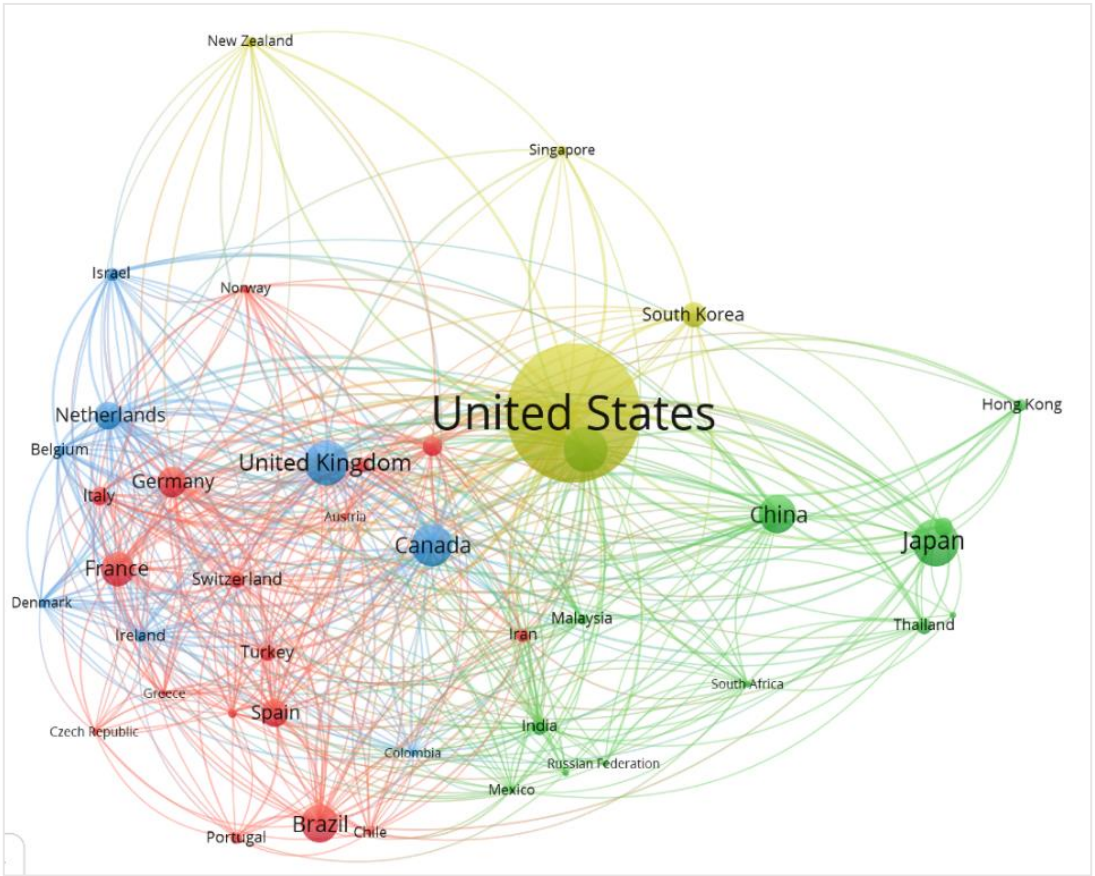

Figure 3. The Top 15 Most Productive Countries and Academic Institutions in Fall-Related Publications

Table 2. Top 15 Most Productive Countries contributing to the Growth of Fall-related Studies in Older Adults

Rank	Country	TPc	Academic Institutions	TPi	Rank	Country	TPc	Academic Institutions	TPi
1	United States	92372	Harvard Medical School	96	8	Germany	4426	Robert Bosch Krankenhaus Stuttgart	35
2	Japan	6656	National Center for Geriatrics and Gerontology	50	9	Spain	3871	Hospital Universitari de Bellvitge	17
3	Australia	13834	The University of Sydney	104	10	Netherlands	11313	Vrije Universiteit Amsterdam	53
4	United Kingdom	18916	Nottingham University Hospitals NHS Trust	23	11	South Korea	3287	Seoul National University	14
5	Canada	19928	University of Toronto	50	12	Sweden	5244	Karolinska Institutet	45
6	Brazil	4576	Universidade de São Paulo	69	13	Italy	3621	Università degli Studi di Firenze Alma Mater Studiorum Università di Bologna	11
7	China	3519	Fudan University	17	14	Taiwan	2306	National Yang-Ming University Taiwan	33

Tpc: Total Publications of A Given Country; Tpi: Total Publications of A Given Academic Institution.

Leading Authors

Table 3 lists the 15 most prolific authors in fall-related research in aging, affiliated to eight countries as follows; USA (3 authors), Australia (3 authors), Japan (3 authors), Canada (2 authors), Ireland (1 author), Germany (1 author), Finland (1 author) and Israel (1 author). Lord SR from Australia led the list with a record of 54 publications, 27 h-index, and 4175 times citations. The 2nd and 3rd top authors, Kenny RA from Ireland and Steven JA from the United States recorded 42 total publications (20-h index, 1531 times citations) and 32 total publications (24-h index, 4241 times citations), respectively.

Table 3. Most 15 Productive Authors

Author's Name	Affiliation	Country	TP	NCP	TC	C/P	C/CP	h	g
Lord, S.R.	UNSW Sydney, Sydney	Australia	54	77.31	4175	77.31	54.00	27	54
Kenny, R.A.	School of Medicine, Trinity College Dublin, Dublin,	Ireland	42	36.45	1531	36.45	42.00	20	39
Stevens, J.A.	University of North Carolina Injury Prevention Research Center, Carolina,	United States	32	132.53	4241	132.53	32.00	24	32
Becker, C.	Robert Bosch Krankenhaus Stuttgart, Stuttgart,	Germany	31	27.32	847	27.32	31.00	14	29
Liu-Ambrose, T.	The University of British Columbia, Vancouver	Canada	31	40.32	1250	40.32	31.00	16	31
Suzuki, T.	University of Yamanashi, Kofu,	Japan	31	32.19	998	32.19	31.00	18	31
Kannus, P.	UKK Institute Finland, Tampere,	Finland	30	77.1	2313	77.10	30.00	18	30
Hausdorff, J.M.	Tel Aviv Sourasky Medical Center, Tel Aviv-Yafo,	Israel	29	158.1	4585	158.10	29.00	21	29
Hill, A.M.	University of Maine, Orono,	United States	29	10.9	316	10.90	28.99	12	16
Beauchet, O.	University of Montreal, Montreal,	Canada	28	50.18	1405	50.18	28.00	17	28
Lipsitz, L.A.	Harvard Medical School, Boston,	United States	28	120.96	3387	120.96	28.00	24	28
Clemson, L.	The University of Sydney School of Health Sciences, Sydney,	Australia	27	28.41	767	28.41	27.00	11	27
Shimada, H.	Keio University School of Medicine, Tokyo	Japan	26	25.92	674	25.92	26.00	15	25
Yamada, M.	Graduate School of Medicine, Tokyo,	Japan	26	20.92	544	20.92	26.00	15	23
Sherrington, C.	Faculty of Medicine and Health, Sydney,	Australia	25	59.84	1496	59.84	25.00	14	25

Notes: TP=total number of publications; NCP=number of cited publications; TC=total citations; C/P=average citations per publication; C/CP=average citations per cited publication; h=h-index; and g=g-index.

Author Keywords

The minimum number of co-occurrence of a keyword was set 50. Of the 6574 author keywords was recorded, a total of 45 meet the threshold and were mapped in the VOSviewer. For each of the 45 keywords, the total strength of the co-occurrence links with the other, keywords will be calculated. The keywords with the greatest total link strength were selected. The word "falls" occurred 1472 times with 2067 total link strength, followed by the keyword "elderly" (937 times, 1360 total link strength) and "accidental falls" (631 times, 943 total link strength), respectively (see Figure 4).

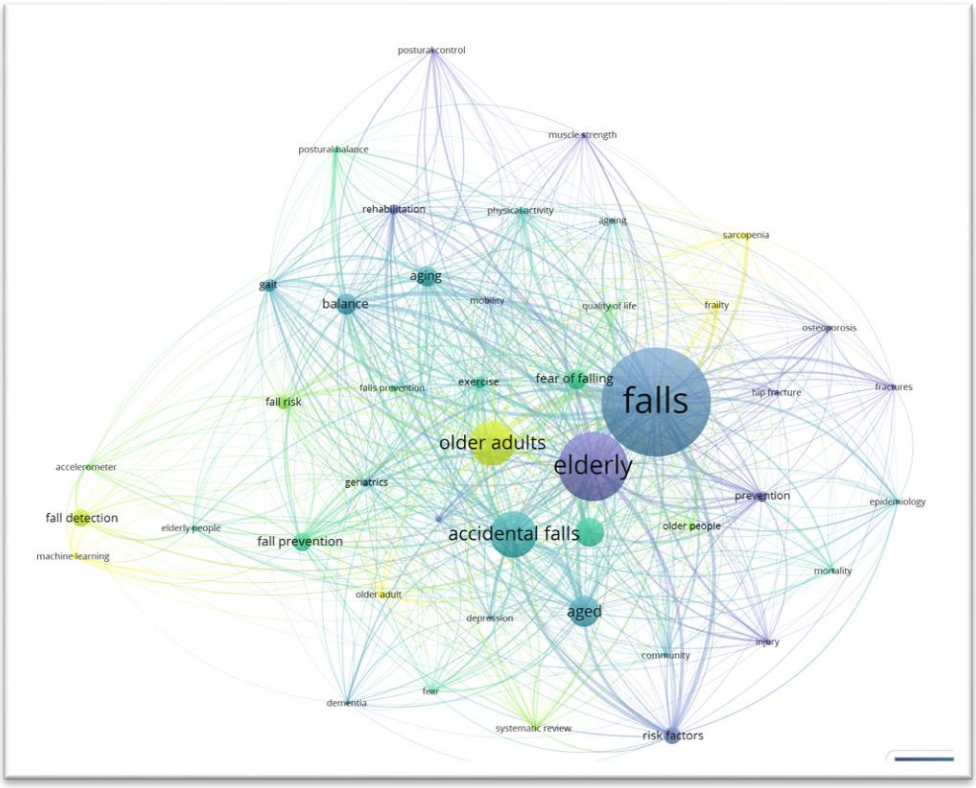

Figure 4. The Most Common Author's Keywords in Fall-related Publications

Discussion

In this study, there are five main clusters, namely (i) Risk factors and falls (ii) Fall detection in falls (iii) Fall prevention and Exercise (iv) Determinants of Falls, and (v) Psychological and Falls. Cluster 1 mainly reports the highest ranking, and the majority of this cluster explains the factors associated with falls among older adults. Previous studies had argued that osteoporosis and sarcopenia are important risk factors for falls in older adults, as they can contribute to decreased bone density, muscle weakness, and impaired balance and gait (Latham et al., 2019). These factors may increase the risk of fractures and other injuries, leading to disability and reduced quality of life in older adults.

On the other hand, some studies suggest that the relationship between osteoporosis, sarcopenia, and falls may not be as straightforward as previously thought. For example, a recent systematic review and meta-analysis found that the association between osteoporosis and falls was not significant after controlling for confounding factors, such as age and comorbidities (Huang et al., 2021). Similarly, another meta-analysis found that sarcopenia was not consistently associated with falls in older adults, and that the strength of the association varied depending on the definition and measurement of sarcopenia (Chen et al., 2020). Overall, while there is evidence to support the idea that osteoporosis and sarcopenia may contribute to falls in older adults, the extent of this relationship remains unclear. Future research is needed to better understand the complex interplay between these risk factors and other factors that contribute to falls in older adults, such as medication use, cognitive impairment, and environmental hazards.

Next in the Cluster 2 was discussed on reported the common fall detection tools such as accelerometer as well as machine learning in falls. Accelerometers are commonly used in wearable devices and smartphones to detect falls in older adults. Machine learning algorithms can be used to analyze the accelerometer data and distinguish between normal activities and fall events. A study by Boulton and colleagues (2019) evaluated the accuracy of different machine learning algorithms in detecting falls using accelerometer data from a wearable device. They found that a support vector machine (SVM) algorithm had the highest accuracy (90.5%) in detecting falls compared to other machine learning algorithms.

Another study by Delahoz and colleagues (2021) used a smartphone-based accelerometer to detect falls in older adults. They developed a machine learning algorithm that combined accelerometer data with demographic and health-related variables to improve the accuracy of fall detection. The algorithm achieved a sensitivity of 97.4% and a specificity of 99.6% in detecting falls.

A systematic review by Spruit and colleagues (2021) examined the use of wearable sensors, including accelerometers, for fall detection in older adults. They found that the accuracy of fall detection using accelerometers varied widely across studies, with reported sensitivities ranging from 37% to 100% and specificities ranging from 46% to 99%. Overall, the use of accelerometers and machine learning for fall detection in older adults shows promising results. However, further research is needed to evaluate the accuracy and feasibility of these methods in real-world settings. These studies demonstrate the potential for technology-based fall prevention interventions, and their role in improving the health outcomes of older adults.

In the Cluster 3 discussing on the fall prevention and exercise impact on the aging population. Falls are a significant health concern for older adults, with the potential to result in serious injuries and loss of independence. As such, preventing falls among this population is a critical public health issue. One effective approach to fall prevention involves multifactorial interventions, which address multiple risk factors for falls simultaneously. A systematic review by Sjösten et al. (2018) found that multifactorial interventions reduced falls by 36%. These interventions typically involve a comprehensive assessment of an older adult's physical, cognitive, and environmental status, followed by the implementation of multiple interventions tailored to the individual's specific needs.

Another effective approach to fall prevention is exercise programs, which can improve balance, strength, and mobility. A meta-analysis by Sherrington et al. (2019) found that exercise-based interventions reduced the rate of falls by 23% and the number of fallers by 15%. Exercise programs can take many forms, including group classes, individualized programs, and home-based programs. They may involve a variety of exercises, such as resistance training, balance training, and gait training.

Environmental modifications are also an important component of fall prevention. Home modifications such as installing grab bars, improving lighting, and removing tripping hazards can reduce the risk of falls. A meta-analysis by Gillespie et al. (2012) found that home modification interventions reduced falls by 39%. Healthcare professionals can play a critical role in identifying and addressing environmental risk factors for falls among older

adults, such as inadequate lighting or slippery floors. In conclusion, fall prevention strategies for older adults can take many forms, including multifactorial interventions, exercise programs, and environmental modifications. These interventions have been shown to be effective in reducing falls among older adults, with a range of studies demonstrating significant reductions in falls and fall-related injuries. By addressing the multiple risk factors for falls that older adults may face, healthcare professionals can help improve the health, well-being, and independence of this vulnerable population.

Meanwhile in Cluster 4, the majority of the publications discussed related to poor muscle strength and postural control that can affect mobility and increase the risk of falls in older adults in several ways. Firstly, reduced muscle strength can lead to decreased physical function, making it difficult for older adults to perform daily activities such as walking, climbing stairs, or getting up from a chair (Liu et al., 2020). This can increase the risk of falls as they may lose their balance or trip while attempting these activities. Additionally, decreased muscle strength can lead to decreased bone density and increased frailty, which are also risk factors for falls (Pizzigalli et al., 2021).

Secondly, poor postural control can also increase the risk of falls in older adults. Postural control refers to the ability to maintain balance during standing or walking, and it requires the integration of sensory information from various sources, including the eyes, inner ear, and somatosensory system (Maki & McIlroy, 2006). Older adults with poor postural control may have difficulty maintaining their balance while walking on uneven surfaces or while performing other activities, increasing their risk of falls. Moreover, the interaction between muscle strength and postural control is important in maintaining mobility and preventing falls in older adults. A study by El-Khoury et al. (2013) found that a multifactorial exercise program that combined strength and balance training was effective in reducing the risk of falls in older adults. This suggests that interventions that address both muscle strength and postural control are important in maintaining mobility and preventing falls in older adults.

Poor muscle strength and postural control can negatively affect mobility and increase the risk of falls in older adults. Interventions that address both factors, such as strength training and balance training programs, have been shown to be effective in reducing the risk of falls and maintaining mobility in older adults. Therefore, healthcare professionals should consider these factors when developing fall prevention strategies for older adults and incorporate interventions that address these factors into their clinical practice.ter 4 more into determinants of falls.

In the last cluster 5, most of the previous studies discusses on related the psychological components and falls. Depression is a common condition in older adults that can lead to decreased physical activity, reduced balance and coordination, and cognitive impairment, all of which can increase the risk of falls. A systematic review of 27 studies found that older adults with depression were more likely to experience falls compared to those without depression (Varela et al., 2019). This increased risk of falls may be due to several factors, including decreased muscle strength, impaired balance, and reduced cognitive function. Addressing depression in older adults through appropriate interventions such as pharmacological and non-pharmacological treatments, including cognitive behavioral therapy and exercise, may help to reduce the risk of falls (Stubbs et al., 2014).

Dementia is a neurodegenerative condition that can cause cognitive and functional impairments in older adults.

Dementia has been linked to an increased risk of falls, with one systematic review and meta-analysis of 19 studies reporting that older adults with dementia had a significantly higher risk of falls compared to those without dementia (Veronese et al., 2018). This increased risk of falls may be due to several factors, including impaired balance, gait abnormalities, and reduced muscle strength.

Interventions targeting cognitive and physical function, such as exercise programs and environmental modifications, may help to reduce the risk of falls in this population (Li et al., 2012). Fear of falling is a common concern among older adults and can lead to decreased physical activity and increased social isolation, both of which can increase the risk of falls. Paradoxically, fear of falling itself can also increase the risk of falls, with one systematic review of 24 studies reporting that older adults with a high level of fear of falling had an increased risk of falls compared to those with a lower level of fear of falling (Stubbs et al., 2014). Addressing fear of falling through interventions such as exercise programs, cognitive-behavioral therapy, and home modifications may help reduce the risk of falls in this population (Varela et al., 2019).

In conclusion, depression, dementia, and fear of falling are all significant factors that can contribute to an increased risk of falls in older adults. Healthcare professionals can help reduce the risk of falls in this population by addressing these factors through appropriate interventions such as exercise programs, cognitive-behavioral therapy, and environmental modifications.

Conclusions

This study has provided an overview of fall-related in aging research trends based on 6815 publications retrieved from the Scopus database. Publication growth has been rapid since the last 10 years, and it is anticipated to continue to rise. We have discovered countries/academic institutions (United States and United Kingdom) that have a massive number of publications and strong international collaborations. These entities can be an opportunity for researchers from other countries to broaden their research collaborations. We have discussed several areas that are currently well-explored such as material sciences incorporating fall detections and psychological components related to falls research, which can be potential hot topics for future studies.

Future studies to compare the outputs from multiple databases such as Scopus and Web of Sciences are recommended. The search results from Web of Science, for instance, the display automatically the most popular articles in the field by a feature known as ‘hot paper’, a feature that is still lacking in Scopus. This hot paper feature displays key papers that are recognized very soon after publication, reflected by a rapid and significant number of citations. Conducting bibliometric analysis using multiple data sources will be useful for a more comprehensive study.

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Appendix A.

ID	label	cluster	Weight <Links>	Weight <Total link strength>	Weight <Occurrences>	Score <Avg. pub. year>	Score <Avg. citations>	Score <Avg. norm. citations>
1	community	1	29	118	52	2014.8077	27.6731	0.8817
2	elderly	1	43	1360	937	2012.6852	28.2209	0.9216
3	epidemiology	1	27	131	73	2014.6986	30.8219	1.2726
4	fall	1	41	479	395	2015.6	12.2633	0.8042
5	falls	1	44	2067	1472	2013.8118	30.3383	1.1975
6	fractures	1	27	126	55	2011.1455	56.9636	2.3357
7	hip fracture	1	21	91	64	2011.6094	28.7344	1.1279
8	injury	1	28	162	80	2012.975	39.6	1.5643
9	mortality	1	23	88	51	2015.5098	24.2549	1.1674
10	older people	1	37	178	104	2016.8077	24.6923	1.5988
11	osteoporosis	1	30	105	54	2013.2778	29.5556	0.9795
12	prevention	1	34	337	154	2012.9481	26.987	0.9072
13	sarcopenia	1	26	107	57	2018.4561	31.1053	2.626
1	accelerometer	2	18	97	70	2016.6571	21.6429	1.2336
2	elderly people	2	24	82	72	2015.1389	18.0556	1.1062
3	fall detection	2	15	122	235	2017.4128	18.4809	1.1784
4	fall prevention	2	37	321	245	2015.9388	36.1592	1.0508
5	fall risk	2	36	250	186	2016.8495	24.6667	1.2068
6	falling	2	36	126	86	2013.6279	30.3372	0.9527
7	geriatrics	2	38	175	115	2014.4522	19.6261	0.7253
8	machine learning	2	17	72	60	2019.35	11.1667	1.2411
9	older adult	2	25	109	74	2017.8919	14.0811	0.839
1	ageing	3	33	123	62	2014.6452	35.8871	1.4391
2	exercise	3	40	369	165	2015.3333	28.3273	1.1905
3	falls prevention	3	27	112	95	2015.7053	15.9895	0.8342
4	fear of falling	3	41	431	276	2015.9674	28.7935	1.3781
5	frailty	3	31	143	82	2018.2317	13.2439	1.2048
6	older adults	3	41	930	609	2017.5074	20.5041	1.3569
7	physical activity	3	34	184	94	2015.2128	26.1915	1.379
8	quality of life	3	31	141	69	2016.4928	20.9855	1.0987
1	aging	4	43	504	274	2014.781	25.6095	1.097
2	balance	4	39	589	286	2014.2832	42.4406	1.3213

3	gait	4	39	370	173	2014.3931	44.3526	1.8055
4	mobility	4	34	149	61	2013.459	39.3934	1.199
5	muscle strength	4	26	98	50	2012.98	38.96	1.0992
6	postural balance	4	25	155	81	2016.0247	19.3457	0.9945
7	postural control	4	20	94	51	2013.0392	31.3529	0.908
8	rehabilitation	4	35	288	143	2013.3706	49.7832	1.2351
1	accidental falls	5	40	943	631	2014.7924	31.1743	1.1011
2	aged	5	40	746	418	2014.3971	31.2273	1.1699
3	dementia	5	25	104	61	2014.2951	22.3607	1.1569
4	depression	5	27	119	56	2014.2143	26.4107	1.3004
5	fear	5	25	111	50	2015.76	22	0.7889
6	risk factors	5	39	469	240	2013.4208	39.7542	1.2968
7	systematic review	5	29	155	64	2016.9531	57.25	2.9294