



From Cognitive Decline to Dementia: A Bibliometric Study of Health Literacy among the Aging Population

Muhammad Solihuddin Muhtar¹ and Min-Huei (Marc) Hsu^{1,2}

¹ International PhD Program in Biotech and Healthcare Management, Taipei Medical University, Taiwan

² Graduate Institute of Data Science, Taipei Medical University, Taiwan

d931112002@tmu.edu.tw

Abstract. Health literacy among aging people is a critical factor in managing dementia and cognitive decline. It is associated with better health outcomes, lower healthcare utilization, and higher compliance with preventive services. Bibliometrix package under R environment was employed to analyze the database from the Web of Science with the topical search strategy of "health literacy" AND "aging" and "dementia* or cognitive*". Of 875 articles, 746 are included for further analysis. A steady rise in research evident in the publication growth of 17.33% per year. Key contributors are the United States, Australia, and the United Kingdom, engaging in domestic and multi-country collaborations, with China and Japan following. Authors' keywords analysis reveals the central theme is health literacy, closely tied to older adults, also associated with dementia and cognition. Thematic evolution emphasizes impactful themes like dementia, mental health, and epidemiology. Certain topics are poised for transition, including physical activity, age, randomized clinical trials, and health literacy in connection with aging. Keyword plus analysis from smaller timeframes, especially in the last decade, highlights concerns necessitating proactive measures for dementia and cognitive decline, emphasizing awareness, nutrition, mental health, technology, and educational preparedness for early intervention.

Keywords: First Keyword, Second Keyword, Third Keyword.

1 Background

Health literacy is defined as the degree to which individuals have the capacity to obtain, process, and understand the basic health information and services needed to make appropriate health decisions. Higher health literacy is directly associated with less frequent use of emergency rooms and hospital services. As the health-care system is becoming more complicated, health literacy is increasingly important, particularly for the aging society [1]. The proportion of people with inadequate health literacy increased sharply from 14.5% in the age group of 50–64 years to 53.2% in the age group of 65 years and older, showing the powerful effects of cognitive aging on health literacy. The challenge of choosing the optimal drug for controlling hyperten-

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sion is very different from consenting to CSF analysis by lumbar puncture. In an extreme scenario, the spouse of the person with dementia may be much concerned about forgetfulness or medication errors, yet the academic physician is trying hard to explain the diagnosis of a recently recognized disease entity [1].

Dementia has become a global health burden. The number of patients with dementia is growing rapidly worldwide and will almost double every 20 years, reaching 131.5 million in 2050. Much of the increase will be taking place in China, India, Taiwan, and other South Asian countries. Taiwan has turned from an aging to an aged society since 2018, with the prevalence of dementia at the age above 80 approaching 20% and will become a super-aged society in 2026 [1][2]. Dementia leads to increased costs for governments, communities, families and individuals. In 2019, the total global societal cost of dementia was estimated to be US\$1.3 trillion, equivalent to 1.5% of global gross domestic product (GDP). This number is expected to more than double by 2030, reaching US\$2.8 trillion [3].

In order to improve the lives of people with dementia and their caregivers while decreasing the community-wide impacts of the disease, the World Health Organization (WHO) announced the “global action plan on the public health response to dementia 2017–2025.” One of the plan’s most important strategies involves raising public awareness about dementia, thus fostering a more accurate understanding [4].

In summary, health literacy among aging people is a critical factor in managing dementia and cognitive decline. It is associated with better health outcomes, lower healthcare utilization, and higher compliance with preventive services. Therefore, improving health literacy, especially among older adults, is a crucial aspect of public health interventions in managing dementia and cognitive decline.

This bibliometric study aims to the following:

1. Exploring the global trends and patterns of research: this involves analyzing the number of publications, citations, and the frequency of certain keywords in the literature. The aim is to identify the most influential articles and authors in the field, and to understand the main topics and trends in the research [5][6].
2. Identifying gaps in the literature: this involves identifying areas where there is little or no research, which could indicate a need for further investigation. The aim is to contribute to the existing body of knowledge and to identify potential areas for future research [6].
3. Mapping the relationships between different research topics: this involves using methods such as co-word analysis, co-author analysis, and bibliographic coupling to understand how different topics are related to each other. The aim is to understand the intellectual structure of the field and to identify patterns of collaboration [6].
4. Understanding the impact of the research: this involves using evaluative bibliometrics to articulate the impact of a research output. The aim is to quickly evaluate scholarly work and to understand the significance of the research [5].
5. Providing a comprehensive overview of the field: this involves using both evaluative and relational bibliometric methods to provide a comprehensive overview of the field. The aim is to provide a detailed overview of the research

landscape, to identify lacunae of research in a particular area, and to get new ideas for investigation [5][6].

2 Methods

This bibliometric investigation employed the Web of Science (WoS) database for data compilation. The WoS was chosen by its extensive coverage of scholarly journals, ensuring a diverse collection of articles pertinent to health literacy among aging individuals at high risk of dementia or cognitive decline. Our search strategy focused on the topics "health literacy" AND "aging" and "dementia* or cognitive*".

We limited the searching to articles, reviews, book chapters, editorials, and proceedings in English. Exclusions comprised other publication types, those not in English, and materials from the year 2023 due to the ongoing nature of the year. We save the complete records and cited references of the results, organized in plain text format with each batch containing 500 articles. We combined all the downloaded text files for further analysis, using the Bibliometrix package operated under the R programming environment [7].

3 Results and Discussion

Our exploration of the Web of Science (WoS) database led us to initially identify a total of 875 articles relevant to health literacy among aging individuals at risk of dementia or cognitive decline from 1993 to 2023. After applying our predetermined exclusion criteria, 129 articles were discarded. As a result, a total of 746 articles were deemed suitable and were included in our final analysis. Figure 1 provides a brief overview of the study.



Fig 1. An overall overview of the study.

3.1 Annual Trend of Publications, Citations and Ares of Expertise

Our analysis of the annual publication trends in the Web of Science database revealed a steady rise in the number of articles published over the three-decade period, increas-

ing by 17.33% each year. This upward trend suggests an increasing interest and investment in health literacy and cognitive impairment among aging people over the years. However, there were noticeable years where the number of publications fell compared to the previous year, such as in 2007, 2012, 2016, 2019, and 2021. The last two years decrement are hypothetically related to the global Covid-19 pandemic [8]. This publication trend can be examined in figure 2.

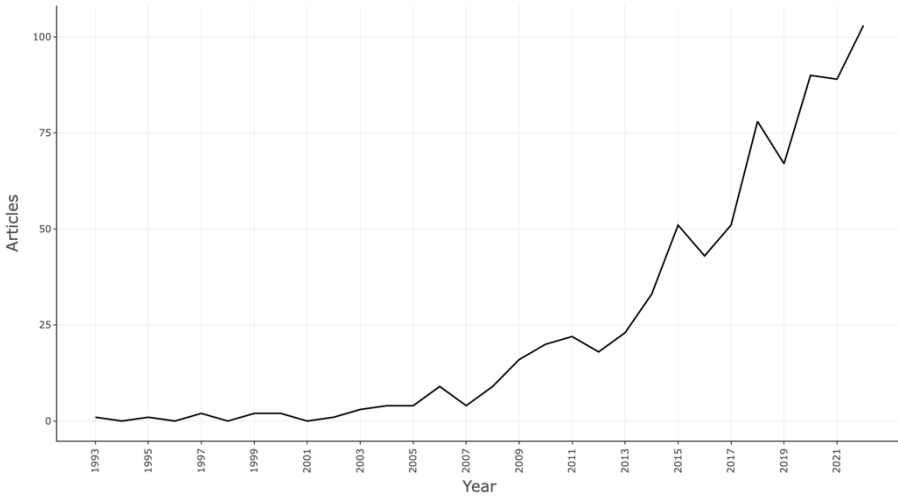


Fig 2. Annual publications demonstrated a steady increment during the early decade and gradually increasing in the last two decades.

While the publication count remains favorable, the likelihood of receiving citations is not as promising. Table 1 illustrates the annual average total citations for the published articles. To discern the articles with the highest citation counts and their publication years, we arranged the list based on the average total citations per article. The findings revealed that only two articles from 1999 stood out as the most cited within the last three decades [9][10]. This suggests that establishing foundational research on the topic can have a substantial impact over the long term. However, given the overall volume of publications, any article in this field has a significant chance of gaining exposure and citations.

Table 1. Average total citation per article by year

Year	MeanTCperArt	N	MeanTCperYear	CitableYears
1999	345	2.00	13.80	25
2000	169.5	2.00	7.06	24
2006	135.44	9.00	7.52	18
2005	125.75	4.00	6.62	19
2007	113.5	4.00	6.68	17
1995	85	1.00	2.93	29
2011	68.09	22.00	5.24	13

2009	66.25	16.00	4.42	15
2012	65.89	18.00	5.49	12
2008	60.22	9.00	3.76	16

To comprehend the connection among the cited journals, authors, and keywords, we depicted a three-fields plot in Figure 3. This visual representation allows us to delve into the authors' areas of expertise and the journals to which they were referenced, providing insights into the relationships between these elements. Wolf MS, as the top author wrote almost all topics covering the area, including but not limited to health literacy, aging, dementia and cognitive [11].

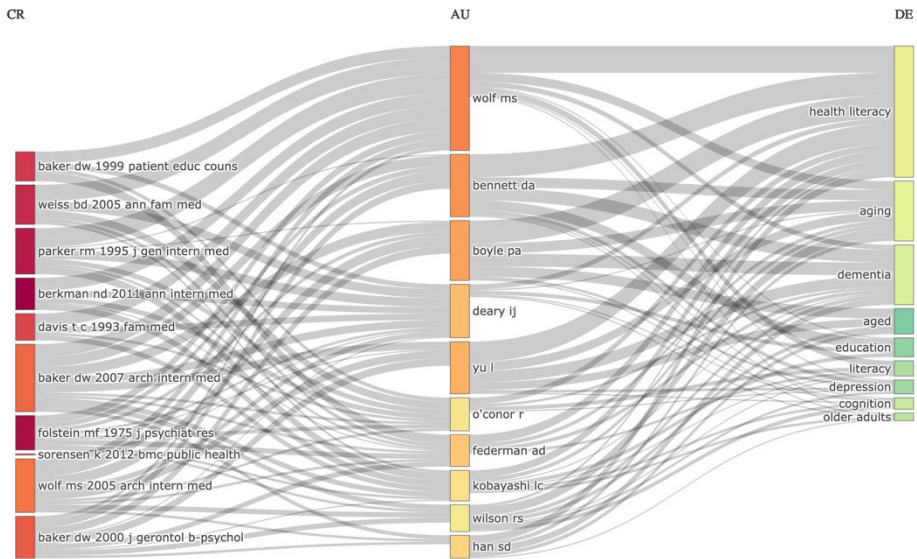


Fig. 1. Three-field plot revealed the area of expertise of top authors and journals they cited

In summary of this section, a noteworthy observation emerged: 89% of authors (3,151 out of 3,538) exclusively authored a single article. In striking contrast, a singular author, Wolf MS, authored an impressive 31 articles. Finally, we provided a comprehensive overview of the top affiliations in Table 2.

Table 1. Top 10 affiliation productivity

Affiliation	Articles n (%)
RUSH UNIVERSITY	79 (10.6)
UNIVERSITY OF CALIFORNIA SYSTEM	75 (10.1)
UNIVERSITY OF CALIFORNIA SAN FRANCISCO	72 (9.7)
HARVARD UNIVERSITY	49 (6.6)
NORTHWESTERN UNIVERSITY	44 (5.9)
FEINBERG SCHOOL OF MEDICINE	38 (5.1)

UNIVERSITY OF LONDON	36 (4.8)
UNIVERSITY OF NORTH CAROLINA CHAPEL HILL	35 (4.7)
UNIVERSITY OF SOUTHERN CALIFORNIA	32 (4.3)
VETERANS HEALTH ADMINISTRATION (VHA)	32 (4.3)

3.2 Collaboration Networks and Themes

In addressing collaboration networks, we begin by emphasizing the contributions of different countries in this field. Figure 4 unveils a global heatmap illustrating the number of publications. Dark blue indicates a higher publication count, whereas gray signifies the absence of publications from those countries in the field.

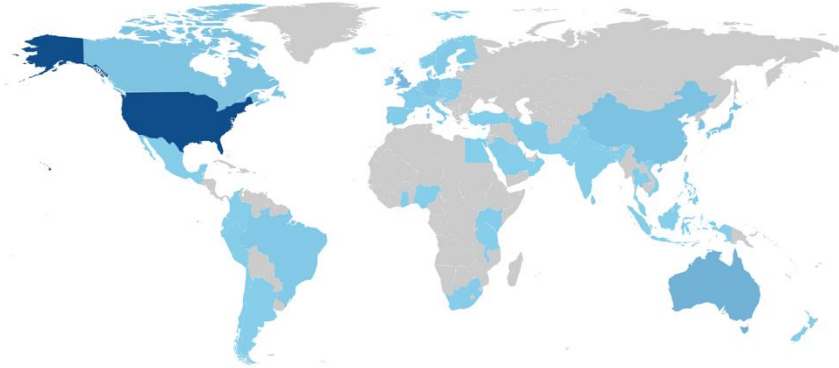


Fig. 2. Darker color represents higher productivity in the field of health literacy among aging people with the risk of dementia and cognitive impairment

Our findings indicate a growing depth in collaborations involving multiple countries. The United States takes the lead in initiating collaborations with other nations, followed by Australia and the United Kingdom. In this regard, one article specifically highlighted the increasing rate of dementia mortality in both United States and Australia [12].

Additionally, representation from the Asian community includes China, Japan, and Korea. In this area, however, we’ve seen a favorable news regarding aging people, though the prevalence of either dementia, cognitive decline or Alzheimer are relatively high [13][14][15]. A study found that successful aging in East Asia is influenced by a variety of factors, including health behaviors, socioeconomic status, and the healthcare system [16].

Table 3 provides further insights, distinguishing between MCP (multi-countries publication) and SCP (single-country publication) in contributing countries.

Table 2. Single vs multi countries collaboration publication

Country	Articles	SCP	MCP	MCP_Ratio
USA	317	264	53	0.167

AUSTRALIA	77	57	20	0.260
UNITED KINGDOM	67	39	28	0.418
CHINA	32	19	13	0.406
JAPAN	24	22	2	0.083
GERMANY	21	11	10	0.476
CANADA	20	15	5	0.250
KOREA	20	17	3	0.150
BRAZIL	16	12	4	0.250
NETHERLANDS	16	10	6	0.375

Regarding the co-occurrence of words within the topic, we employed the Louvain algorithm to cluster authors' keywords [17]. Out of the 746 articles, six clusters were generated, indicating that articles within each cluster were closely related to the discussed topic. However, certain keywords in a specific cluster also exhibited co-occurrence with keywords from other clusters. The frequency of this co-occurrence is represented by the edge weight. In Figure 5, the central theme of the field emerges as health literacy, closely linked with older adults in the same cluster. Simultaneously, it is associated with dementia, aging, and cognition from other clusters.

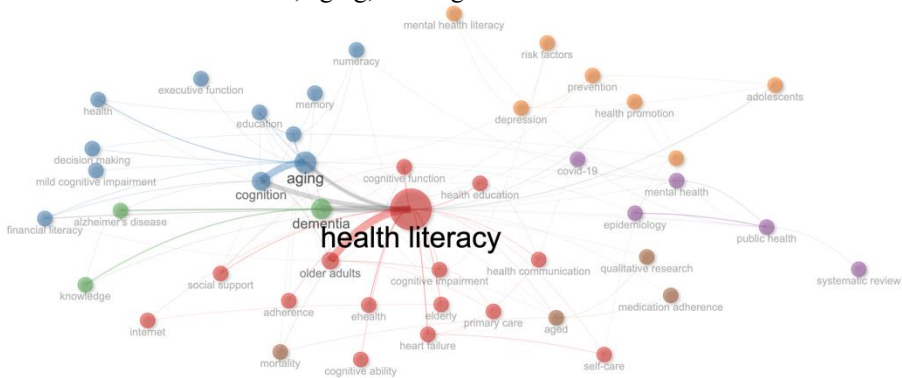


Fig. 3. Co-occurrence authors' keywords between same and different cluster. The width of the edge represents the frequency of the co-occurrence.

A more in-depth exploration leads us to potential research and study topics. To achieve this objective, we utilized a thematic map to discern ongoing and declining subjects. In Figure 6, the X-axis portrays network cluster centrality, signifying the degree of interaction with other graph clusters and measuring the significance of a study theme. The Y-axis represents density, a metric reflecting a cluster network's internal strength and theme growth [18]. It is evident that the health literacy, aging, and cognition topic cluster shows a high potential for transitioning to more central themes, as indicated by its position closer to the central line of density than the baseline. Conversely, topics like dementia, mental health and epidemiology, currently ongoing, have the potential for continuous growth in terms of density, along with the cluster of aged, elderly, and cognitive impairment. It is also interesting to note that

physical activity, age and randomized clinical trials are getting more attention and starting to shift from basic theme into motor theme.

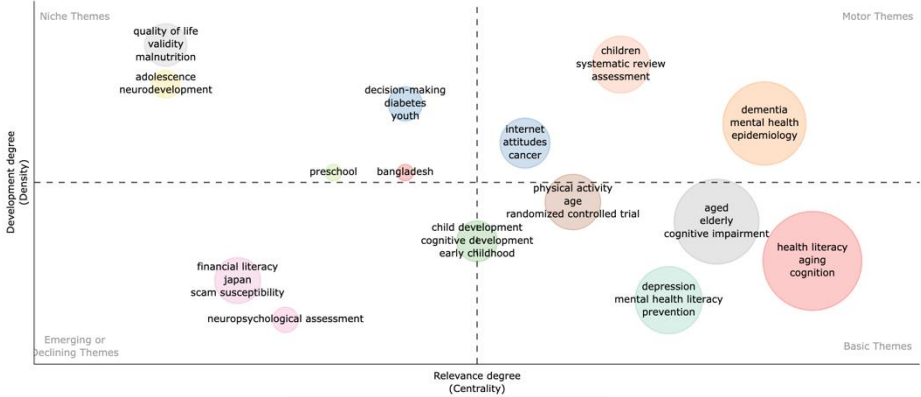


Fig. 4. Thematic map for themes identification. Motor themes quadrant represented what is currently highly developed and crucial for structuring research subject.

Finally, we examined the evolution of research themes over the past three decades concerning health literacy among aging individuals and their risk of dementia or cognitive decline. We divided the 29-year period into four distinct timeframes: 1993-2005, 2006-2011, 2012-2017, and 2018-2022. Figure 7 visualizes the evolution of these research themes. In this analysis, we utilized the keyword plus for theme evolution instead of the authors' keywords [19].

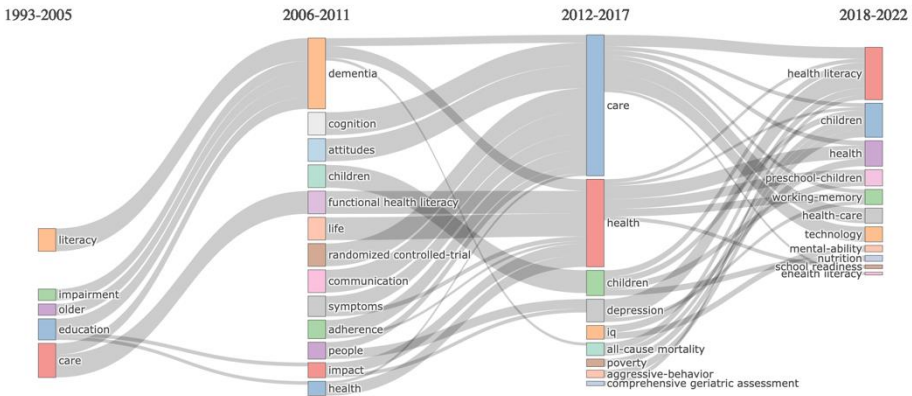


Fig. 5. Theme evolution across three decades.

Over the past ten years, research emphasis transitioned towards children and mental health concerns. Economic worries surfaced through discussions on poverty, while educational considerations were captured in the theme of school readiness. The significance of health literacy remained a constant focus, beginning with preschool chil-

dren, with an emphasis on technology's pivotal role. Nevertheless, challenges were acknowledged, particularly in e-health literacy discussions. This highlights the strategy of anticipating long-term risks through a multidisciplinary perspective.

4 Conclusions

In this study, we identified that the research in the field of health literacy for aging people, especially to those who have risk for dementia and cognitive decline, is steadily advancing, depicted by the number of publications in the last decade. The primary contributors to these studies are the United States, Australia, and the United Kingdom, engaging in both domestic and multi-country collaborations, with China and Japan following as the third and fourth most influential countries. The encouraging trend of multi-country collaboration is evident from the proportion of MCP.

From the authors' keywords analysis, the central theme of the field emerges as health literacy, closely linked with older adults in the same cluster. Simultaneously, it is associated with dementia, aging, and cognition from other clusters. Further exploration based on thematic evolution conducted on keyword plus, the theme of dementia, mental health, and epidemiology is currently on going and become critical in structuring research project. Other topics are ready to shift from basic theme into motor theme includes a cluster of physical activity, age and randomized clinical trial, another cluster of aged, elderly and cognitive impairment and other cluster of health literacy, aging and cognition.

Finally, by segmenting the timeframe into smaller windows, especially scrutinizing the topics within the last decade, we conclude that certain concerns have surfaced, necessitating proactive measures to mitigate the risk of dementia and cognitive decline. This involves enhancing awareness, ensuring proper nutrition, addressing mental health issues, leveraging technology, and preparing educational materials to instill early intervention strategies.

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