Reading the Older People Researches in Architecture through Bibliometric Analysis (1975-2022)

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Abstract

The increase in the elderly population all over the world has made it necessary for many disciplines, from health to psychology, from economics to humanities, to conduct field-oriented studies. Architecture is one of the disciplines that play an important role in old age in terms of its relationship with the built environment. This study aims to reveal the intellectual structure, research topics, and trends of scientific studies on elderly users in the discipline of architecture. In this study, in which bibliometric analysis of articles for older adults was made in the Web of Science database between 1975 and 2022, the structure of the field and relations were analyzed by creating science maps through performance analysis and VOSviewer software. In the analyzes made, it has been seen that the number of articles on the elderly has increased in recent years. Although it has a wide distribution in terms of subject variety; housing, aging in place, age-friendly environment, and accessibility are the current topics in the field. This study contributes to the literature by presenting the current course of elderly user-oriented studies in architecture from a bibliographic perspective. On the other hand, it is thought to be a guide for new research by revealing the deficiencies in the field.

Keywords

older people, bibliometric analysis, architecture, VOSviewer

1 Introduction

The world's population structure is changing rapidly with the increase in life expectancy and decrease in fertility due to developments in the field of health. According to the United Nations population projections for 2022, approximately 10% (771 million) of the world's population is aged 65 and over, while this rate is expected to reach 12% (994 million) in 2030 and 16% (1.6 billion) in 2050 (WHO, 2022). In other words, the number of older adults in the total population is increasing daily and the world is getting older. The rapid aging of the population has made it necessary for national and international governments, institutions, and organizations to carry out several studies aimed at ensuring that older adults maintain a healthy, active, and quality old age. Many disciplines, from health to psychology, from economics to humanities, have conducted studies in this field. Architecture is one of the disciplines that play an essential role in old age in terms of its relationship with the built environment. As individuals age, the places, neighborhoods, and communities they live in become more important in quality compared to adulthood. In old age, when the living space is limited, individuals need to continue to lead a healthy and independent life, to be included in social life, and to remain active.

From past to present, many studies have been conducted to raise awareness about the older population and the aging period. World Health Organization deals with detailed and comprehensive studies on population projections for older adults, economy studies, social and supportive services (Tarricone and Tsouros, 2008; WHO, 2000; 2001), home care, physical and psychological health, positive aging, quality of life, and active aging (WHO, 1989; 2002; WHOQOL Group, 1996). Another issue it addresses is the studies on older adults in the scientific area of architecture. "Age-friendly environments in Europe", a publication related to architecture, design, and older users, is one of them (WHO Regional Office for Europe, 2017).

It consists of eight different topics on how globally aging adults can age in an age-friendly city concerning health, housing, and social aspects. The chapter on housing related to the discipline of architecture primarily emphasizes that the existing housing stock has not been designed for older adulthood, so some adaptations are needed. The focus is on maintaining an equitable life for all older adults with improved housing designs. As a housing model, it has emphasized that individuals should primarily live in their residences. On the other hand, systems that provide grants to users in housing adaptations prevent institutionalization unless there is a need. Conversely, home care services that will facilitate the lives of individuals in case of need are included. In cases of necessity, different housing strategies such as nursing homes, retirement communities, shared housing, or co-housing had included.

On the other hand, many studies on housing models and housing options for older adults are carried out by various councils and organizations. Accessibility with the ongoing "Manual on how to create accessory dwelling units" (WHO Global Network for Age-friendly Cities and Communities, 2014) practice by the American Association of Retired Persons Community Challenge, and the ongoing "Advancing Age-Friendly Housing Policy" practices by Portland's Age-Friendly Advisory Council (City of Portland, 2018). It is aimed at promoting intergenerational activities and aging in place. The "Intergenerational house-sharing for South Bay" application, which was started by ElderHelp in 2018 and continues today, is also one of the studies carried out for a similar purpose (WHO Global Network for Age-friendly Cities and Communities, 2018). In the United Kingdom, the information centers established by the government in 2007 for older adults-friendly housing solutions inform individuals, provide financing for settlement, and carry out studies on housing design and planning. The common goal of these efforts is to enable individuals to live their old age in a better-qualified environment. The project titled "Guidelines for the Planning of Houses for Senior Citizens", which was carried out in 2007 with the cooperation of 5 countries (Italy, Sweden, Great Britain, Spain, and Hungary) within the scope of European Interregional cooperation projects between public institutions and equivalent institutions, focused on housing designs for older adult users. An interdisciplinary working group of architects, engineers, sociologists, economists, engineers, sociologists, and economists worked together in this study, which provides a kind of application guide for the renovation of existing houses or

the planning of new ones. This is a detailed architectural design guideline in 4 sections: housing needs, housing support services, housing neighborhoods, and urban context. It aims to help older adults in the European Union countries address housing problems, and help older adults around the world maintain their independence and aging in place (ERVET et al., 2007). The "Elderly-friendly Design Guidelines" was published by the Architectural Services Department (n.d.) of the Government of the Hong Kong Special Administrative Region, which is responsible for the design and implementation of many public facilities across the territory. The guidelines focus on design proposals that aim to raise awareness for the envisagement of an older adult-friendly living environment that supports active aging. The directive aims to meet the changing requirements of an aging society over time and provide a built environment for active aging. The directive covers general design issues such as planning, circulation, interior design, furniture, and exterior design and provides detailed and comprehensive information for each topic. Meanwhile, the Department of Housing, Planning and Local Government and Department of Health (2022) of the Government of Ireland published a study titled "Housing Options for Our Ageing Population: Policy Statement" which addresses the titles of aging in place, promoting sustainable lifelong housing, assistive technologies, social connectedness, and collaborative and human-centered design. On the other hand, in the future perspective, comprehensive information had provided on housing design for older adults, healthy and positive aging, housing options for older adults, and the studies they are targeting and conducting.

All these studies jointly aim to enable individuals to live their lifetimes in more qualified physical environments suitable for their needs. The literature review shows that it is obvious how important the design of the built environment and space design is for elderly users (Czaja et al., 2019; Farage et al., 2012; Feddersen and Lüdtke, 2018). Although various institutions and organizations have published regulations, awareness raising, and awareness studies on the subject, it is also substantial to analyze the academic studies that guide these developments, produce scientific data, and follow the current course. The study is significant because of providing information on how the articles about elderly users in the field of architecture are handled academically and scientifically, showing the changes in the trends in this subject over the years, and presenting a general perspective to researchers working and will work in the field. On the other hand, the

literature review played a significant role in determining the scope and limitations of the study. There are bibliometric studies about elderly in many fields of medicine, psychology, environmental sciences, public health, gerontology, care services, tourism, and communication in the literature (Akkan Suzan, 2022; Çakmak Karapınar, 2021; Dominko and Verbič, 2019; Garcia et al., 2021; Gonzalez-Alcaide et al., 2021; Müller et al., 2016; Soytas, 2021). However, a limited number of studies have been conducted in the scientific area of architecture. Bibliometric analysis researches for elderly users in architecture are studies in specific areas such as retirement villages, design methods, ergonomics, housing security, and pandemic period (Cao et al., 2021; Hong et al., 2022; Li et al., 2022; Osei-Kyei et al., 2020; Pamuk et al., 2022). From this point of view, when we look at the studies in architecture for elderly individuals, the fact that no study offers a broad perspective that can show the tendencies or voids in the field researchers want to focus on constitutes the original aspect of the study. In this sense, the contribution of the outputs to the scientific field is significant. The data was sourced purely from the Web of Science Core Collection database. Therefore, studies not scanned in the Web of Science database constitute the limitation of the research.

2 Methodology
The study aims to explore the conceptual, social, and intellectual structure of the publications about elderly users in the scientific field of architecture. In line with these purposes, aiming to measure the research components of the studies, reveal the relationships between those, and decipher the evolution of the subject and the current dynamics, research questions were listed below:
- What is the distribution of articles in the field by year?
- Which countries are the most productive in the articles related to the field?
- Which are the prominent institutions in the articles related to the field?
- Who are the most active and productive authors related to the field?
- What are the most influential journals on the subject of study?
- What are the most preferred languages in the articles?
- How do the articles show a distribution according to the indexes?
- What are the top ten most cited articles?

- What are the prominent themes and dominant topics in the articles?
- How do the article subjects change chronologically?
- What are the trend research topics covered?
- Which journals stand out in the co-citation source analysis of studies?

Aiming to reveal the relationship between the discipline of architecture and older adult users, this study consists of 3 basic steps (Fig. 1). In the first step of the study, a literature review on older users, old age, and architecture was conducted. In the literature review, information on the subject of the study was collected and utilized in the construction of the study framework. This step also was utilized in determining the original aspect and limitations of the study. For this reason, the article screening process was carried out using the WoS Core Collection, a database within Clarivate Analytics.

The second step was determining the sample and consisted of 4 stages. First, various academic databases such as Web of Science, Scopus, PubMed, and Google Scholar were listed. The WoS database contains above 21,000 internationally accessible, high-quality, and peer-reviewed journals published worldwide. This database is the world's leading information platform, which has the most comprehensive records from 1900 to the present, supports 256 disciplines, is compatible with data visualization programs, and includes a handy analysis tool (Ellegaard and Wallin, 2015; Kaya and Dinçer, 2023). On the other hand, this database allows searching more than one database concurrently from a single interface via the Web of Science™ Core Collection. It also collects bibliometric indicators from many disciplines (Grzybowska and Awasthi, 2020). The most important advantage of this database is that it is transparent, accessible, organized, and consistent (Zhao and Strotmann, 2015). For this reason, the article search was carried out using the WoS Core Collection, a database within Clarivate Analytics. In addition, the possibility of repetition of data in case of using more than one database was also efficient in this decision. Then, to determine the sample group entirely and correctly in the search, ten keywords related to the "elderly user" word group, frequently used in the literature and synonymous with each other, are listed. These are the word pairs elderly people, senior people, older people, elderly users, senior users, older users, elderly, older adult, senior, and old aged. Search in the database was carried
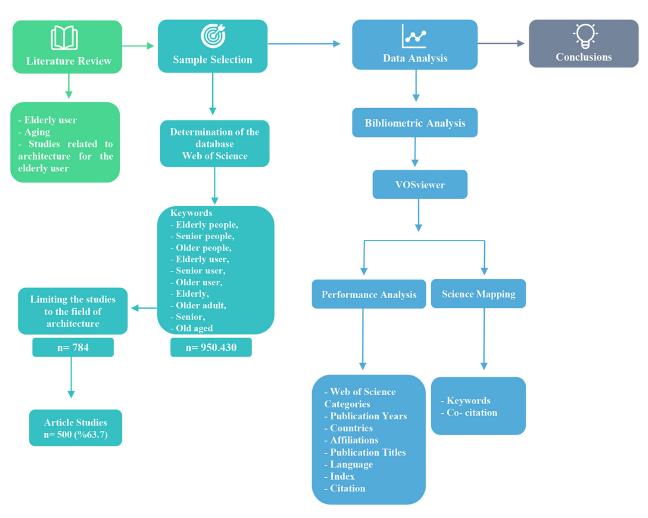
Fig. 1 Research design

out in the titles, abstracts, and keywords of the articles made between 1975-2022. The conjunction "or" was used between keywords in the search. Here, it was aimed to reach the most comprehensive result of the studies on the older adult user scanned in the database. As a result of the search conducted in December 2022, 950.430 scientific studies were reached. Then, to obtain data directly related to the subject of the study, the search was repeated by limiting the search to the category of "architecture" and 784 studies were identified. 63.7% of the studies were articles, 26.8% were papers, 3.1% were book chapters, 2.1% were book reviews, and 0.2% were books (Table 1).

Table 1 Type of work

Type	Record count	% of 784
Article	500	63.7
Proceeding paper	210	26.8
Book chapter	25	3.1
Book review	17	2.1
Book	2	0.2

Finally, within the scope of this study, books, book chapters, and papers were excluded. In addition to the small number of books and book chapters, they are generally descriptive and repetitive document types and papers can be incomplete studies. So, the study is limited to articles that have an influencing role in guiding the academic and scientific community. The 500 articles identified were determined as the sample of the study.

The third stage was the analysis of the data group obtained. Within the scope of the study, the bibliometric analysis technique was used to analyze the data. Bibliometric analysis, a popular analysis used today to analyze large volumes of data, focuses on exploring the intellectual structure of a particular research topic and analyzing social and structural relationships (Donthu et al., 2021; Park and Lee, 2022). In addition to making it possible to observe the evolution of the research field, the bibliometric analysis also sheds light on the literature, allowing a broad perspective on the overall structure of the field (Samiee and Chabowski, 2012; Zupic and Čater, 2015).

Bibliometric analysis, preferred in determining the trends in the area and the development in the process, provide information on the current structure of the literature to researchers who are or will be working on a similar subject, as well as revealing the deficiencies in the field and discussing new suggestions. Bibliometric analyses are divided into two groups: performance analysis and science mapping. Performance analysis is related to the numerical analysis of research components, while science mapping examines the relationships between research components (Baker et al., 2021; Cobo et al., 2011; Noyons et al., 1999; Ramos-Rodríguez and Ruíz-Navarro, 2004). Today, bibliometric analyses are performed manually or with various software programs. The use of software programs is more advantageous in terms of more comprehensive data analysis and updating than manual analysis. Considering the increase in the number of scientific studies produced every day in the current technological age and the development in technology, the VOSviewer software program (van Eck and Waltman, 2022) was used in the bibliometric analysis of the data in this study.

Within the scope of this study, a bibliometric analysis of the data was handled in two separate groups: performance analysis and science mapping. In performance analysis, numerical data analysis of article studies was performed. In performance analysis, the Web of Science category, publication year, country, institution, journal, language of publication, index, and citation components were examined. In science mapping, network visualizations for keyword and co-citation-source analysis were made using the VOSviewer program (van Eck and Waltman, 2022) compatible with the Web of Science database with a graphical user interface.

3 Finding and discussion

The findings of the study were evaluated under two separate headings: performance analysis and scientific mapping. The aim is to read the research components of the studies through numerical data within the scope of performance analysis. In this context, performance analyses were carried out on Web of Science categories, publication year, country, institution, author, journal, most cited study, language, and indexes. In scientific mapping, the interaction of the research components with each other is revealed with network visualizations. So, analyses were made on scientific maps related to keywords, chronological keywords, and co-citation analysis in the study.

3.1 Performance analysis

When the Web of Science categories of the studies was examined, it was seen that all of the analyzed studies (100%) were related to different disciplines as well as being in the category of architecture in the Web of Science database. Although building technology (9%) was predominant, urban studies, civil engineering, and environmental studies were the up-front disciplines. This shows that architecture interacts with various scientific areas (Table 2).

When the publication years of the studies were analyzed, it was seen that they were spread over a wide period between 1975-2022. Although 2021 was the year with the highest number of publications in the field of older population and architecture of 46 studies (9.21%), it was determined that the studies conducted in the field in the last ten years stood out. This situation coincides with the fact that the aging of the population day by day and the increasing ratio of the population aged 65 and over to the total population worldwide make studies in the field necessary. Especially, in the last ten years, the tendency towards built environment studies for the older adult population has increased (Fig. 2).

Considering the countries where studies in the field were conducted, the USA ranked first with 68 studies (13.62%). Then, England, Turkey, Japan, Japan, China, Korea, Italy, Austria, the Netherlands, and Spain were the other prominent countries with studies on the older population in architecture (Table 3). Countries with a high density of older population in the total population have relatively produced more studies in the field. In addition, we believe that in developed or developing countries, the high level of awareness of the aging of the population and the social consciousness towards awareness is effective in the productivity of scientific studies compared to undeveloped countries. Because developed countries such as Switzerland, Denmark, Austria, and Sweden were ranked lower in the ranking can be considered to be due to their population and number of researchers.

In terms of institutional distribution, Yıldız Technical University ranked first with seven studies (1.43%). This can be attributed to the fact that, as a technical

Table 2 Distribution of studies by Web of Science categories

Web of Science categories	Record count	% of 500
Architecture	500	100
Urban Studies	45	9.0
Construction Building Technology	38	7.6
Environmental Studies	25	5.0
Regional Urban Planning	13	2.6

Fig. 2 Distribution of studies according to publication years

Table 3 Distribution of studies by country

Countries	Record count	% of 500
USA	68	13.62
England	42	8.41
Turkey	41	8.21
Japan	24	4.81
China	21	4.20
Korea	20	4.00
Italy	19	3.80
Australia	16	3.20
Netherlands	16	3.20
Spain	14	2.80

Table 4 Distribution of studies by the institution

Affiliations	Record count	% of 500
Yıldız Technical University	7	1.43
Delft University of Technology	6	1.20
Gazi University	6	1.20
University of London	5	1.00
Yonsei University	5	1.00
The American Institute of Architects	4	0.79
Southeast University China	4	0.79
State University System of Florida	4	0.79
University of California System	4	0.79
University of North Carolina	4	0.79

university, in addition to building, building production, and application, studies suitable for different user profiles that are sensitive to society in the current architectural environment are included. Delft University of Technology, Gazi University, University of London, and Yonsei University were the other institutions contributing to the field (Table 4). This is consistent with the fact that prominent institutions are also productive countries.

Looking at the distribution of authors, G. A. Sevilla Cadavid, H. Lee, D. Kim, T. Yoshida, J. Penton, and K. Minami conducted three studies in the field. While G. A. Sevilla Cadavid stands out with studies on ergonomic inclusive design for older adult users, H. Lee conducted studies regarding older population care facilities (Cadavid et al., 2016; Lee and Lee, 2020; Park et al., 2013; Sevilla Cadavid and González Fernández, 2008; Sevilla Cadavid and Herrán Cuartas, 2015). D. Kim focused on studies related to different types of buildings, including older adult-friendly healthcare buildings and housing, while T. Yoshida studied the safety and security

needs of older adult users (An and Yoshida, 2011; 2013; Kim and Ohara, 2010; Kim et al., 2014; Kwon et. al., 2017; Qu et al., 2010). On the other hand, J. Penton came to the forefront with technical studies on older and disabled users, while K. Minami conducted studies on the housing stock of older adult users (Minami, 2015; Minami et al., 2022; Nishino and Minami, 2021; Penton, 1976; 1979a; 1979b) (Table 5).

The Journal of Asian Architecture and Building Engineering, which aims to contribute to global and local problems related to the built environment, ranked first

Table 5 Distribution of studies by authors

Authors	Record count	% of 500
G. A. Sevilla Cadavid	3	0.59
H. Lee	3	0.59
D. Kim	3	0.59
T. Yoshida	3	0.59
J. Penton	3	0.59
K. Minami	3	0.59

with 33 studies (6.61%). Architectural Design, Archnet-IJAR, Open House International, Architectural Record, Journal of Interior Design, Architectural Science Review, Bulletin KNOB, Journal of Green Building, and Frontiers of Architectural Research were other prominent journals contributing to the field (Table 6).

When the language of the writing of the studies was analyzed, English ranked first with 422 studies (84.56%). English was the preferred language in the vast majority of studies because it is the universal language worldwide. Spanish, Dutch, French, and Italian were the other current languages (Table 7).

When we look at the indexes where the studies were scanned, the Arts & Humanities Citation Index, which is for the area of arts and humanities, including the discipline of architecture, ranked first with 336 studies (67.33%). This can be attributed to the fact that it has an old history dating back to 1975 and includes more than 1,800 journals in 28 different arts and humanities disciplines (Table 8). Emerging Sources Citation Index, Science Citation Index Expanded, and Social Sciences Citation Index were the other indexes that mainly cover social and natural sciences.

The most cited article study was Eijkelenboom et al.'s (2017) study titled "Architectural Factors Influencing the Sense of Home in Nursing Homes: An Operationalization

Table 6 Distribution of studies according to the journals in which they were published

Publication titles	Record count	% of 500
Journal of Asian Architecture and Building Engineering	33	6.61
Architectural Design	32	6.41
Archnet-IJAR: International Journal of Architectural Research	21	4.20
Open House International	20	4.00
Architectural Record	15	3.00
Journal of Interior Design	15	3.00
Architectural Science Review	12	2.80
Bulletin KNOB	14	2.80
Journal of Green Building	13	2.60
Frontiers of Architectural Research	12	2.40

Table 7 Distribution of studies by publication languages

Language	Record count	% of 500
English	422	84.56
Spanish	29	5.81
Dutch	14	2.80
French	12	2.40
Italian	10	2.40

Table 8 Distribution of studies by publication languages

Web of Science index	Record count	% of 500
Arts & Humanities Citation Index (AHCI)	336	67.33
Emerging Sources Citation Index (ESCI)	141	28.25
Science Citation Index Expanded (SCI-Expanded)	37	7.41
Social Sciences Citation Index (SSCI)	34	6.81

for Practice". The study seeks to answer the question of which architectural factors were effective in the design of nursing homes regarding the sense of home and it was thought to be a resource for researchers working on similar issues as it provided a design guide that guides designers. Sepe's (2021) "Covid-19 Pandemic and Public Spaces: Improving Quality and Flexibility for Healthier Places" was in second place with 21 citations. The study focuses on designing better quality and flexible public spaces for older adults, young adults, and children during the pandemic. The high number of citations can be explained by the fact that the field of study is directly related to the pandemic we have recently experienced. Another study with 21 citations was Forsyth et al. (2019) "Improving Housing and Neighborhoods for the Vulnerable: Older People, Small Households, Urban Design, and Planning". The study, which aims to improve the housing and neighborhoods where older adult users live, draws attention to the fact that the physical conditions of housing in many countries, especially in the USA, are incompatible with older adult users. The study discusses supportive housing designs, neighborhood improvement, and participatory-collaborative solutions to maintain the independence of individuals. The third place was shared by four studies with 15 citations. Choi et al. (2019) "Future Changes to Smart Home Based on All Healthcare Service" is about integrating home healthcare services into smart homes in South Korea. Van Steenwinkel et al.'s (2012) "Home in Later Life: A Framework for the Architecture of Home Environments" focuses on raising awareness of the importance of residential care environments in meeting basic needs such as housing as well as the importance of feeling at home. Lee and Kline (2011), in "Wayfinding Study in Virtual Environments: The Elderly vs. the Younger-aged groups" aims to compare the wayfinding performance of older and younger groups using virtual reality. Liebowitz et al. (1979) "Evaluation: Designing for Confused Elderly People" is related to the evaluation of designs for older adult users (Table 9).
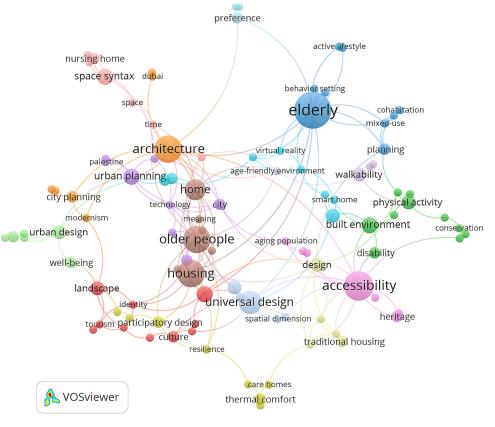
Table 9 Most cited articles

Article	Author	Journal	Citation
Architectural Factors Influencing the Sense of Home in Nursing Homes: An Operationalization for Practice	Eijkelenboom et al. (2017)	Frontiers of Architectural Research	31
Covid-19 Pandemic and Public Spaces: Improving Quality and Flexibility for Healthier Places	Sepe (2021)	Urban Design International	21
Improving Housing and Neighborhoods for the Vulnerable: Older People, Small Households, Urban Design, and Planning	Forsyth et al. (2019)	Urban Design International	21
Future Changes to Smart Home Based on AAL Healthcare Service	Choi et al. (2019)	Journal of Asian Architecture and Building Engineering	15
Home in Later Life: A Framework for the Architecture of Home Environments	Van Steenwinkel et al. (2012)	Home Cultures	15
Wayfinding Study in Virtual Environments: The Elderly vs. the Younger-aged groups	Lee and Kline (2011)	Archnet-IJAR: International Journal of Architectural Research	15
Evaluation: Designing for Confused Elderly People	Liebowitz et al. (1979)	AIA Journal	15
Color Preference Cool Versus Warm in Nursing Homes Depends on The Expected Activity for Interior Spaces	Torres et al. (2020)	Frontiers of Architectural Research	13
Neighbourhood Adaptability for Hong Kong's Ageing Population	Zang et al. (2019)	Urban Design International	12
A Priority-based 'Design for All' Approach to Guide Home Designers for Independent Living	Demirkan and Olguntürk (2014)	Architectural Science Review	12

3.2 Science mapping

Through the VOSviewer software program (van Eck and Waltman, 2022), a science map was created from the network visualizations of the keywords of the studies. In the keyword map, subject distributions and relationships related to the field were revealed. The keyword map provides an overview of the studies by defining the focus of the article studies (Fig. 3). The total number of keywords

Fig. 3 Common keyword map of studies

obtained from the studies was 1,508. For easy comprehensibility and readability, the keyword map was composed of 122 words with a minimum frequency threshold of 2. In the map, a total of 15 clusters were formed according to the relationship status and all of them were shown with a different color. Some of the overlapping words were not shown on the map to avoid confusion. On the map, the frequency of use of the keyword and the size of the circle were shown in direct proportion. In other words, the larger the circle size, the more keywords were used. The links connecting the circles represented relationships. Topic similarities and relatedness were defined by the distance of the connection lines. The fact that keywords were close to each other was due to the connection between them.

The most frequently used keywords in the studies were "elderly", "older people", "accessibility", "housing", "home" and "universal design". The keyword "elderly" was mainly associated with the words architecture, housing, aging, universal design, and virtual reality. In the articles with the keyword "older people", the topics of housing, home, aging in place, age-friendly environment, technology, and inclusive design were predominant. The keyword "accessibility" was linked to the built environment, architectural design, and universal design. On the other hand, urban planning, space syntax, nursing home, walkability, and thermal comfort were other topics addressed in older population studies. Considering the distribution and diversity of the keywords, it was seen that the studies on older adult users in the discipline of architecture were spread over a wide area.

Science maps of the chronological changes in the topic trends of keywords in the last 10 years were created through layer visualizations (Fig. 4). The chronological change of the topic trends is expressed with color and tone differences in the maps. While the trend in studies between 2012-2014 focused on walkability, thermal comfort, landscape, and technology; between 2014-2016, on universal design, housing, accessibility, planning, and active lifestyle. Between 2016-2018, space syntax, urban planning, building environment, inclusive design, and smart home studies came to the forefront; while between 2018-2020, urban design, home, physical activity, and well-being were the focus of the studies. In 2020-2022, homes, age-friendly environments, aging in place, nursing homes, and human-centered design were the focus areas. The changes in the study areas and the orientation towards housing topics such as housing designs for the needs of older users, the physical suitability of the immediate surroundings of housing, sense of home, age-friendly environment designs, smart homes compatible with supportive services are consistent with the government's encouragement of older users to age in place.
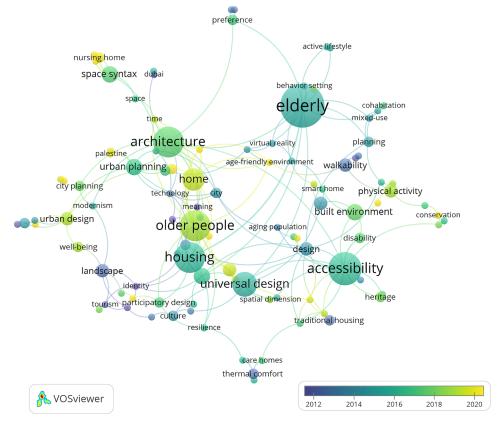

Fig. 4 Chronological map of the keywords of the studies

When the co-citation analysis and cited source analysis of the studies were performed, 8182 sources were identified and network visualizations of 84 sources that met the minimum citation threshold of 10 were created. In the co-citation network, two studies are connected when they appear together in the reference list of another study. Looking at the map, it is seen that "Environment and Behavior" and "Journal of Environmental Psychology" are the two journals that are most strongly connected. This can be attributed to the fact that these two journals include studies on similar topics as well as seminal and influential publications. On the other hand, the interaction of these two journals with the Journal of Architectural and Planning Research, Color Research and Application, and Health Environments Research & Design Journal also stood out (Fig. 5).

4 Conclusion

Older population studies, which have become increasingly important with the aging of the world population, have become the subject of research in the field of architecture as well as the field of study of many disciplines, such as health, psychology, sociology, gerontology, and social work. In this study, the general structure of older population studies in architecture was deciphered through bibliometric analysis of subject trends, performance analysis, and science maps. In performance analyses, we focused on numerical data analysis of research components such as Web of Science category, year, country, institution, journal, the language of publication, index, and citation.

From this point of view, the years in which studies were predominant, the most productive country, authors and institutions contributing to the field, prominent journals, indexes, and the most cited articles were identified. In science maps, network visualizations and keyword and co-citation-source analyses were discussed. The results obtained are as follows:

- In light of the studies reached as a result of comprehensive and detailed research and the data obtained from this study, bibliographic studies focused on elderly users have been very popular in the scientific area of architecture for the last three years globally (Cao et al., 2021; Ghamari et al., 2021; Hong et al., 2022; Li et al., 2022; Osei-Kyei et al., 2020; Wong et al., 2023). Especially between the years 2010 and 2022, the number of articles for elderly users increased rapidly.
- Housing, accessibility, and universal design were the most discussed topics in the elderly population studies conducted in the discipline of architecture. However, the current issues that stand out today are related to housing, aging in place, and an older adult-friendly environment.
- When the results of this study and the previous bibliometric studies on the scientific area are evaluated together, the studies for elderly users mainly focused on housing. This situation is also related to the issue of aging in place, which is prominent in international policies regarding the elderly population. Housing,
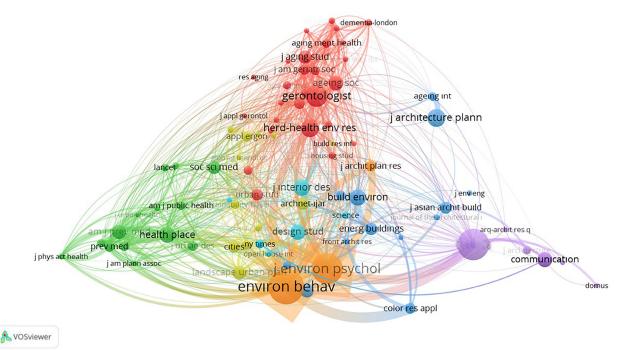

Fig. 5 Common citation-source analysis map of the studies

being the most outstanding alternative for elderly sheltering, sustains its importance in the architectural literature. In addition, prominent bibliometric studies on the elderly and housing are also related to housing security (Cao et al., 2021; Wang and Kim, 2023) and smart homes (Choi et al., 2021; Hong et al., 2022; Sun and Li, 2021).

- In the study, the tendency to the subject is higher in countries where the elderly population is high in the total population. As seen in this study and previous bibliometric studies, the United States predominantly ranks first concerning productivity and impact (Cao et al., 2021; Wang and Kim, 2023). This situation, as shown by other bibliometric studies on the elderly user, seems to be that researchers in this country have done more and more comprehensive studies on the subject of elderly users in architecture and coincides with the most productive countries in other studies. Also, the contribution of Asian countries such as Japan and China, and European countries such as Australia, Italy, the United Kingdom, and Spain to the field is evident. The fact that different countries publish on the same research area reflects the universality of the research topic. Besides, it can be said that particularly researchers in the United States and the United Kingdom (Ghamari et al., 2021; Hong et al., 2022) and the journals published in these countries are more influential.
- Keyword maps provide information about the topics focused on over time and the scope of research. In the chronological deciphering of the maps, the topics of "home", "aging in place", "age-friendly environment", and "smart home", aim to enable individuals to age independently with supportive technologies as much as possible in the place they are used to and in an environment, they are familiar with, have come to the fore. In this context, when considered generally, it is possible to say that the keyword sets revealed are similar to the map in other bibliometric studies (Choi et al., 2021; Hong et al., 2022; Sun and Li, 2021). Since the studies in question are bibliometric studies on a specific subject/field, more detailed information is given on the subject discussed. On the other hand, "universal design", "accessibility", "walkability", and "built environment" discussed in previous years are relatively at the forefront nowadays.

The data obtained from the studies reveal the current course of the field and guide researchers, institutions, and organizations by enabling them to follow academic studies on the current literature. We believe that the study will give researchers who will produce new works an idea about current research topics and deficiencies in the field and support the design of original studies. On the other hand, we anticipate that the data and results will contribute to raising awareness about the area.

The data of the study is limited to the article studies between 1975 and 2022 in the Web of Science database of the determined keyword list. New studies to be conducted can be expanded by including various types of publications such as papers, books, book chapters, etc., rather than being limited to articles. In addition, the study can be expanded with different databases such as Scopus, Lens, PubMed, Dimensions, and in-depth content analysis on current subject trends can be carried out and the studies conducted in the last 10 years can be analyzed in detail.

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