A review of domestic residential area suitable aging landscape design research from 2010 to 2020 ——Visual analysis based on VOSviewer software

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Abstract. Population aging is a global problem in the 21st century, especially in China, where the elderly population is huge and has become a severe social reality. Therefore, how to make the elderly enjoy their old age and spend their old age happily in the community environment is a problem facing the current society. In this paper, CNKI is taken as the literature source, and relevant keywords such as community aging landscape and elderly community landscape from 2010 to 2020 are searched. The related research hotspots in recent ten years are analyzed by VOSviewer data visualization software, and the current research status is briefly described. It can be seen from the analysis that the research methods are gradually scientific and systematic, and the research hotspots are gradually changing from the formal landscape of the elderly community to more practical and targeted target landscapes such as health care and healing, microclimate and gardening therapy, and the trend of cross-disciplinary research is gradually obvious. On this basis, this paper attempts to analyze the future development trend of the aging community landscape by domestic scholars, with a view to providing help for further research.

1. Introduction
Since the 20th century, the aging of the population has become an important trend of social development, and how to actively deal with this phenomenon is an urgent problem for scholars. According to China's current economic level, the characteristics of aging and the living wishes of the elderly, the old-age care model of "taking home-based care for the elderly, relying on community care for the elderly and supporting institutional care for the elderly" has been determined\textsuperscript{[1]}. Therefore, relying on the existing community to provide living facilities for the elderly is helpful to relieve the pressure of China's old-age service and medical security.

Although community home-based care for the aged is in line with the national conditions and the wishes of the elderly, the development of the aged society was not anticipated at the beginning of community construction, so the design of suitable aging in existing communities can provide a livable family environment for the elderly\textsuperscript{[2]}. The residential environment is the main place for the elderly to participate in social interaction, leisure and entertainment, and research shows that long-term outdoor activities are beneficial to the mental health and physical health of the elderly, so paying attention to the landscape environment of residential areas is of great significance to enhance the happy life of the elderly \textsuperscript{[3]}. 

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This paper will analyze the research direction and hot spots of each time period in recent ten years, and briefly expound the development trend of the future community aging landscape in combination with the current social problems.

2. Data sources and research methods

2.1. Source of data
In this paper, the literature of CNKI database is taken as the research object, which basically includes all the journals in landscape design direction, so this paper chooses this database for analysis. This research takes 2010-2020 as the retrieval time range, and takes the related words such as "old residential landscape", "old residential landscape" and "old community landscape" as the key words, and searches on the database platform of China Knowledge Network. Finally, after screening, a total of 264 related journal literatures are collected. According to the format requirements of VOSviewer visualization software, the corresponding format requirements are derived as the research data sources.

2.2. Research method
VOSviewer is a free visualization software program developed by Van Eck and Waltman of Leiden University in the Netherlands, which is widely used in literature analysis [4], and it can clearly construct the atlas of authors, journals and keywords. Therefore, in this paper, the retrieval results are analyzed by using the metrology visualization software VOSviewer. In order to make the visualization results clearer, keywords with frequency of 1 are filtered.

3. Publication volume and journal distribution
From the retrieved 264 journal papers, it can be seen that, as shown in Figure 1.

![Figure 1. Time distribution of the number of journals related to the ageing landscape in residential areas from 2010 to 2020](image)

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Except for 2017, the overall number of papers related to the aging landscape design of residential areas showed an upward trend from 2010 to 2019. This paper was written in 2020, and it can be reasonably predicted that at least 30 more papers will be published at the end of the year. Therefore, from this trend, it can be seen that domestic scholars keep a high degree of attention to the relevant research contents such as the aging landscape of residential areas, and this situation will continue to exist with the social phenomenon of aging population and the relevant support of national policies, and will always be a hot topic, and its importance is becoming more and more prominent.

It can be seen from the journals published in the literature that in order to make the data more concise and clear, the journals with 1 published papers are filtered, as shown in Table 1. Shanxi Architecture, Beauty & Times and Modern Horticulture Architecture have published more than 10 papers, accounting for 5.3%, 4.5% and 4.2% of the retrieved documents respectively. The rest are mainly published in Architecture & Culture, City & House, Housing and Real Estate, which shows
that the selected journals are mostly related to culture, design, architecture and residence, and landscape.

Table 1. Overview of selected papers and the respective journals.

| Journal title                    | Number of papers |
|----------------------------------|------------------|
| Shanxi Architecture              | 14               |
| Beauty & Times                   | 12               |
| Modern Horticulture              | 11               |
| Architecture & Culture           | 9                |
| City & House                     | 9                |
| Housing and Real Estate          | 8                |

4. The main content analysis

4.1. Highly cited paper
Taking 2010 to 2020 as the time node, the top 3 high-frequency cited articles are selected from 264 selected journal articles for analysis, as shown in Table 2. Relevant scholars mainly focus on the aging-suitable landscape in the old-age community relying on institutions, and the age distribution of the target population is relatively stable and targeted. Compared with institutional pension, more elderly people choose home-based pension. In the research content of the landscape suitable for aging, it is mainly related to rehabilitation and health, which shows that the community landscape should have the function of health care and healing, so as to make up for the decline of the physiological function of the elderly and make the landscape have the function of "providing for the aged" [5]. Generally speaking, the landscape suitable for aging mainly focuses on the space needs, aesthetic needs, recreation needs, safety needs and other aspects of the elderly. Through the construction of community landscape, the sense of happiness and existence of the elderly can be increased, and a livable and beautiful living environment for the elderly can be created.

Table 2. Top 3 papers in the field of aging community landscape design from 2010 to 2020

| Paper name                                                                 | Times cited |
|----------------------------------------------------------------------------|-------------|
| A Review of Studies on City Planning Responding to the Aging Society in China | 127         |
| Planning and Designing a Composite Community for the Aged                   | 27          |
| A Case Study of Taikang Yanyuan Community for the Aged                      |             |
| Research on the Senior-suited Road Design of Neighborhood Outdoor Environment | 26          |

4.2. Analysis of Research Knowledge Evolution
Using the Overlay Visualization function of VOSviewer software, the average citation relationship of different keywords is analyzed[6]. The colors on the graph range from blue to yellow, which can reveal the research hotspots in different periods.
As shown in Figure 2, the hot words mainly focus on 2014-2019, and the hot keywords in 2014-2017 mainly focus on the exploration stage of home-based aged care model in the context of an aging society. Rele vant words such as old-age care model, community-based aged care, home-based aged care, population aging, planning and design, etc. At this stage, the main target groups are also carefully studied, with key words such as old people's psychology and humanization. New hot keywords began to appear in 2017-2018, such as landscape design, old-age community, public space, aging-resistant design, etc., indicating that relevant scholars began to study the aging-resistant renewal of landscape environment in old communities. From 2018 to 2020, some related words appeared, such as landscape suitable for aging, plant landscape, horticultural therapy, rehabilitation landscape, landscape preference, ccrc, etc., which indicated that relevant scholars began to study the environmental quality improvement of the community suitable for aging, and the landscape design was no longer limited to the visual requirements such as beauty, and the community landscape focusing on health and healing would become the next research hotspot.

Figure 2. Cluster diagram of landscape keywords in the aged residential areas from 2010 to 2020

On the density visualization map of VOSviewer, each point will be filled with color according to the density of elements around the point. the higher the density, the darker the displayed keyword color. As shown in Figure 3, excluding some commonly used words such as aging-suitable community and old-age community, the related hot spots are mainly concentrated in the outdoor space and outdoor landscape of the community, and the research target population is mainly concentrated in the elderly groups in affordable housing. Compared with other communities, the quality of life of the community is not high, and it is generally low-income families. Therefore, it is of social significance and value to update the landscape aging-suitable in affordable housing. In the landscape design of aging-suitable communities, researchers mainly focus on the renovation of the space with social functions, which can attract the elderly to stay here and engage in a series of social activities, such as playing chess, exercising, walking the dog, etc. The elderly prefer collective activities and there are a large number of people, so it is more obvious to renovate the space with aging-suitable functions. In the functional facilities of community landscape, we mainly focus on the design of barrier-free facilities, and it is also important to adjust the landscape details so that the elderly can have no worries about their activities. According to the degree of aggregation and dispersion of density map, we can
see that there is less attention to the space of the ground floor residence, so there is great research potential to update the aging-adaptive function in this area.

Figure. 3. Landscape keyword density view of aged residential areas from 2010 to 2020

5. Conclusion and suggestions
Based on VOSviewer visualization software, this paper analyzes 264 landscape designs about community aging from 2010 to 2020. From the perspective of landscape design, the relevant aging studies are mainly carried out after 2016, and after that, the number of literatures began to increase greatly. In terms of research content, the community aging landscape mainly takes health, healing and safety as the guiding principles, and optimizes the landscape elements in the community according to the psychology and physiology of the elderly, such as barrier-free facilities, healthy plants, traffic streamline, community microenvironment and so on. In terms of spatial function, according to the behavioral habits and psychological needs of the elderly, relevant scholars mainly give priority to communication gathering places and walking spaces. In terms of research methods, domestic scholars actively learn practical experience from countries with mature aging development, such as the United States, Japan, Singapore, etc., and shift from a single home-based care model to a systematic care mode in the whole community and all fields, so as to find out a community-based care development model that is in line with the actual situation in China. In terms of research trends, relevant scholars have shifted from qualitative research focusing on the psychological, physiological characteristics, social patterns, activity habits, preference types and landscape preferences of the elderly, etc., to quantitative research on community-based evaluation index systems, such as health and livability. Through quantitative diagnosis, there are deficiencies in the community, so as to give reasonable suggestions for transformation and provide guidance for future community construction. In the field of disciplines, the trend of interdisciplinary is becoming more and more obvious. Existing scholars have started to study rehabilitation and healing landscape from single-disciplinary thinking such as plant landscape form and layout combined with pathology and psychology. Therefore, it is obviously insufficient to think from the perspective of design, and it is necessary to combine the knowledge of other specialties to create a livable home that is truly suitable for aging. In terms of technical means, the traditional form of questionnaire survey is to ensure the validity of data, which is time-consuming and laborious in data collection, and also causes great mental pressure on the surveyed population. Based on this, scholars began to combine new means such as big data to improve efficiency and accuracy.

On the whole, the research on community aging landscape will continue to advance and keep a certain degree of research enthusiasm, and with the continuous innovation of science and technology,
various intelligent means will be applied to community aging. At present, most of the research results are still at the theoretical level, so how to turn theory into practice is the next question that scholars should think about.

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