

Review

# Age-Friendly Space Design in Continuing Care Retirement Communities: A Scoping Review

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**How To Cite:** Wu, Z.; Liu, J.; Zhong, W.; et al. Age-Friendly Space Design in Continuing Care Retirement Communities: A Scoping Review. *Urban and Building Science* **2025**, *1*(1), 11. <https://doi.org/10.53941/ubs.2025.100011>

Received: 12 September 2025

Revised: 18 November 2025

Accepted: 19 November 2025

Published: 25 November 2025

**Abstract:** Since the beginning of the 21st century, improvements in medical care and the popularization of healthy lifestyles have significantly extended life expectancy, accelerating the global aging trend. Consequently, the rapid growth of the older population has led to a substantial increase in demand for age-friendly products and services, making it essential for residential space design better to address the living and activity needs of older adults. In China, home-based care remains the preferred choice for most older adults, while traditional institutional care is often met with psychological resistance due to its closed environment. Positioned between these two models, the Continuing Care Retirement Community (CCRC) model provides a sustainable approach to aging by meeting the multi-stage and life-cycle needs of older adults, ranging from independent living to assisted care. Using a scoping review approach, this study identifies the research hotspots in the field of elderly care and spatial design, and integrates these findings with the design principles of elderly-oriented architecture to establish the key focal points in the design of Continuing Care Retirement Communities (CCRCs). These key points provide theoretical guidance for optimizing age-friendly residential space design and enhancing the overall quality of life for older adults in CCRC settings.

**Keywords:** continuing care retirement community; age-friendly environmental; space design; universal design

## 1. Introduction

Continuing Care Retirement Community (CCRC) is a comprehensive senior living model that integrates multiple facilities and services to offer multi-level, personalized care options [1]. It provides one-stop solutions including safety assurance, rehabilitation and wellness services, barrier-free accessibility, daily care, educational and recreational activities, and spaces for social interaction [2]. The target population is divided into three groups: independent seniors, who constitute the majority of the community and mainly enjoy medical, wellness, and leisure services [1]; assisted-living seniors, who have limited mobility and require professional support for daily activities, enabling them to transition smoothly to a more assisted lifestyle while remaining in a familiar environment [3]; and nursing-care seniors, who have lost mobility or cognitive ability and require 24-h professional care, with the community ensuring their daily needs, medical rehabilitation, and safety [1].



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Continuing Care Retirement Community (CCRC) has a long history of development abroad. Its origins can be traced back to the early 19th century, when religious groups and fraternal organizations initiated efforts to provide housing and care for older adults [4]. After a series of financial setbacks in the late 1970s and early 1980s, the CCRC model gained widespread acceptance in the United States, leading to a rapid increase in the number of such communities [5]. Following its expansion, the United Kingdom established its first CCRC community, Hartrigg Oaks, in 1998 [6]. This pioneering project became widely recognized for its human-centered facilities, solid reputation, diversified services, neighborhood-style social activities, and individualized pricing schemes [6]. Japan also adopted the CCRC model to address the pressures of urban aging and to encourage the relocation of older adults from central cities to suburban areas [7]. Projects such as Yokohama Sun City [8] and Ginza Sun City [9] exemplify the localized adaptation of the CCRC model, enhancing seniors' quality of life while mitigating the challenges of urban overpopulation. Overall, CCRC has been validated internationally as a mature eldercare model with significant research and practical value.

In China, elderly care has mainly been implemented through three approaches: home-based care, community-based care, and institutional care, under the “9073” policy framework (90% home-based, 7% community-based, and 3% institutional) [10]. Although these models have expanded rapidly, they often operate in isolation, resulting in fragmented services and a lack of continuity of care. Home-based care remains informal and relies heavily on family members [11]; community day-care centers are small-scale, focusing primarily on social or recreational services [12]; and institutional care mainly targets the disabled elderly, with uneven quality and limited accessibility [13]. In recent years, China has promoted the integration of medical and elderly care, yet the coordination between medical and social systems remains insufficient [14].

The Continuing Care Retirement Community (CCRC) model, introduced from Western countries, provides a more integrated and sustainable solution [4]. It combines independent living, assisted living, and skilled nursing within one community, allowing residents to age in place as their care needs change [1]. Compared with the current fragmented system, CCRC offers continuity of care, a higher level of professionalization, and a better balance between medical, social, and psychological support [4].

In China, CCRC-based senior housing is still in the exploratory stage, with theoretical studies continuously deepening. Scholars have examined its localization pathways from multiple perspectives. Lam and Yan analyzed the development barriers of CCRCs in Shanghai, highlighting financial risks, policy gaps, and poor service quality as key challenges [1]. Li et al. investigated the factors influencing the purchase intention of CCRCs in Shenzhen using the Theory of Planned Behavior and SEM analysis, and found that product performance and subjective norms were the primary determinants [15]. Wang et al. conducted a sentiment analysis of over 1,000,000 Weibo posts and found that public attitudes toward CCRCs are predominantly positive, with concerns remaining about fraud and health and safety issues [16]. Together, these studies reveal that while the CCRC model holds significant potential for meeting China's aging population needs, its development is constrained by financial, policy, and management barriers.

In summary, CCRC has evolved into a well-established and internationally recognized eldercare model, offering a continuum of care that meets older adults' diverse physical, psychological, and social needs. Therefore, the objectives of this study are as follows:

RO1: To systematically review and synthesize the current research hotspots and development trends of the CCRC model worldwide, focusing on spatial design.

RO2: To integrate the current design principles of elderly-oriented architecture and establish the key design focal points applicable to CCRC environments.

## 2. Materials and Methods

A bibliometric retrieval was conducted using Scopus (Elsevier) and the Web of Science Core Collection (Clarivate) to comprehensively map the global research landscape on Continuing Care Retirement Communities (Figure 1). The search covered publications from 2000 to 2025 and was restricted to peer-reviewed journal articles published in English. Screening adhered to predefined PICOS criteria (Table 1). All searches were completed on 10 September 2025.

256 records were initially identified from Scopus and 328 from the Web of Science Core Collection. All retrieved records were exported with complete bibliographic information, including authors, title, abstract, keywords, source, publication year, and references. The combined dataset was then imported into Rayyan (a systematic review screening tool) for duplicate detection. Duplicates were identified primarily through DOI matching, supplemented by title and author normalization to ensure accuracy. After removing duplicates, 392 unique and valid articles were retained for subsequent analysis.

The cleaned dataset was subsequently imported into VOSviewer for bibliometric and network visualization analyses. Co-occurrence analysis of keywords and co-authorship networks was performed to identify the CCRC literature's research hotspots and collaboration patterns [17]. This process ensured a comprehensive, accurate, and reproducible dataset, providing a robust foundation for subsequent bibliometric and network analyses of CCRC-related research.

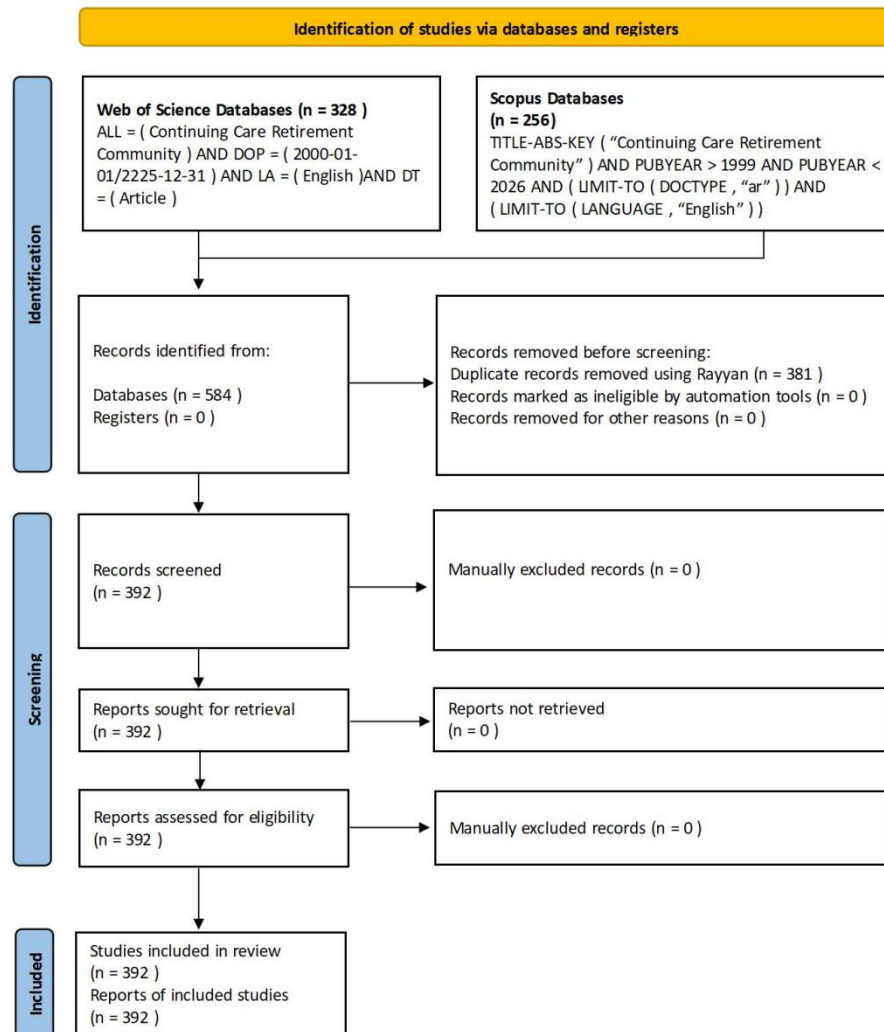


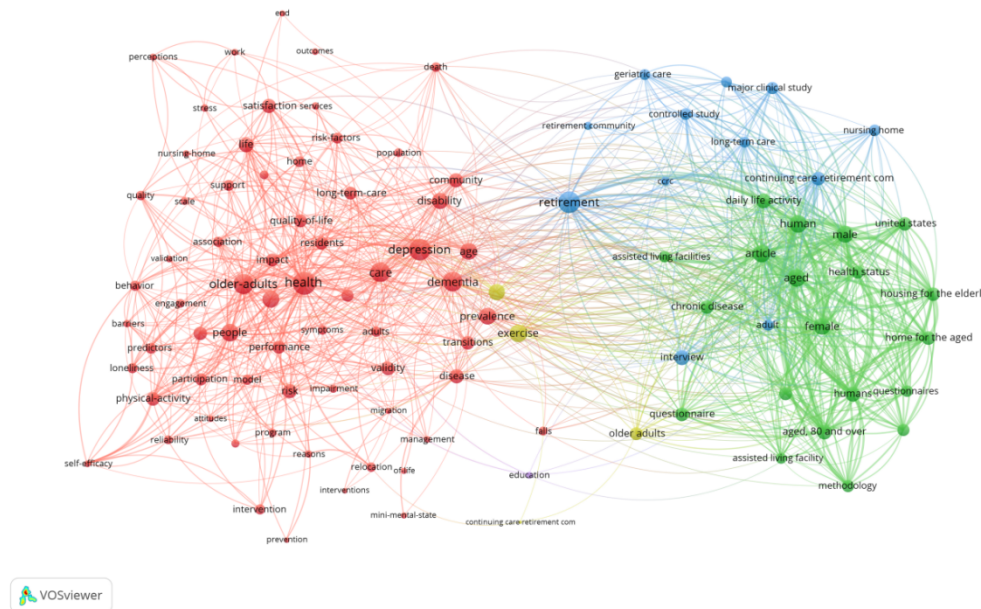
Figure 1. Flowchart.

Table 1. Search criteria (PICOS).

Item	Inclusion Criteria	Exclusion Criteria	Item	Inclusion Criteria	Exclusion Criteria	Item	Inclusion Criteria	Exclusion Criteria
Population (P)	Older adult; elderly; older;seniors; aging population; geriatric	Non-older populations	Setting/Exposure (I/E)	CCRC-related research	Non-CCRC-related research	Outcomes (O)	Studies of CCRC services, nursing care, policies, design, and architecture. Empirical studies	Studies reporting only biomedical outcomes. Editorials, news, patents, conference abstracts without full text
Study design (S)	(quantitative/qualitative/mixed); evaluation studies; and high-quality reviews		Language/time	Full-text English; no date limit (or specify range)	No full text; very poor machine-translated texts			
Keywords and Synonyms	Continuing Care Retirement Community, CCRC, continuum of care continu care retirement	N/A						

### 3. Bibliometric Analysis

The bibliometric analysis [17], conducted through a keyword co-occurrence network generated by VOSviewer, revealed several distinct thematic clusters that collectively outline the current intellectual structure and research hotspots surrounding Continuing Care Retirement Communities (CCRCs) and related domains. A total of 104 keywords met the minimum occurrence threshold ( $\geq 5$ ) and were grouped into three major clusters, each represented by a different color in the visualization (Figure 2).



**Figure 2.** Co-occurrence Analysis of Keywords.

Cluster 1 (Red-Physical and Mental Health of Older Adults): This cluster focuses on the physical and psychological well-being of older adults, with high-frequency terms including older adults, health, depression, dementia, quality of life, physical activity, and interventions. The dominance of these terms suggests that CCRC-related research has been primarily health-oriented, focusing on the prevention of cognitive decline, management of chronic diseases, and promotion of mental well-being [18]. However, most studies adopt a clinical or behavioral health perspective, often overlooking the spatial and environmental factors that influence these outcomes.

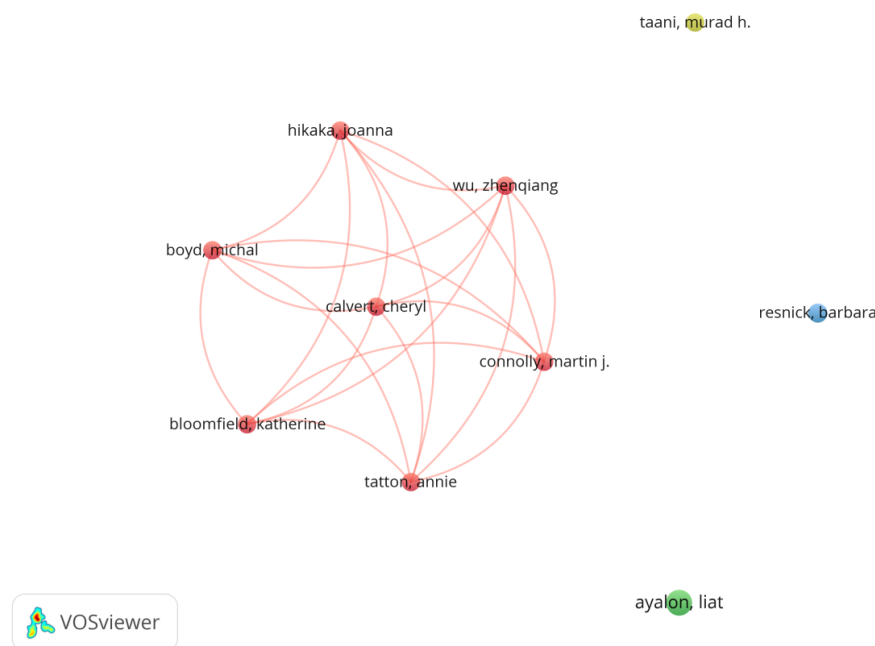
Cluster 2 (Green-Methodologies in CCRC Research): The second cluster includes methodological and demographic terms such as aged, male, female, questionnaire, interview, methodology, and health status. These indicate that the field relies heavily on survey-based, cross-sectional, and descriptive research designs. While such methods have contributed to understanding residents' demographic characteristics and self-reported health, they provide limited insight into longitudinal or spatial-behavioral dynamics within CCRCs [19].

Cluster 3 (Blue-Care Facilities for Older Adults in CCRC): This cluster comprises terms such as retirement, geriatric care, long-term care, nursing home, assisted living facilities, and continuing care retirement community. It reflects research focused on the planning, operation, and evaluation of eldercare institutions and community-based facilities. While this body of work underscores the systemic role of CCRCs in providing a continuum of services—from independent living to assisted and skilled nursing care—it tends to prioritize operational management and service delivery over architectural and environmental design considerations [1].

The three clusters reveal a research landscape that is thematically rich yet conceptually fragmented. The literature demonstrates strong progress in medical and management dimensions but comparatively limited engagement with spatial and environmental design perspectives. This imbalance underscores the need to identify key design focal points that integrate insights from gerontology, environmental psychology, and architectural design, thereby deepening our understanding of how CCRC environments can holistically support aging in place and enhance overall well-being.

The co-authorship network (Figure 3) reveals several collaborative clusters within the field of CCRC research. The largest and most cohesive cluster is formed by Joanna Hikaka, Zhenqiang Wu, Cheryl Calvert, Martin J. Connolly, Katherine Bloomfield, Michal Boyd, and Annie Tatton, who demonstrate intensive collaboration and a shared focus on aging populations, clinical outcomes, and community-based care interventions.

Their collective output reflects a strong emphasis on clinical gerontology and community healthcare, which continues to shape much of the empirical foundation of CCRC-related research.



**Figure 3.** Author Co-authorship Network.

However, the network also shows limited cross-linkages between this dominant group and other scholars such as Barbara Resnick, Liat Ayalon, and Murad H. Taani, who appear as isolated or peripheral nodes. This indicates that research on CCRCs remains disciplinarily concentrated and geographically localized, with a small number of leading teams driving the majority of publications. While such specialization has deepened knowledge in medical and psychosocial dimensions, it has also constrained the diversification of research perspectives—particularly in architectural design, spatial quality assessment, and policy implementation.

From a broader academic standpoint, this fragmented collaboration pattern suggests that the field lacks a unified interdisciplinary discourse linking gerontology, healthcare management, and environmental design. Strengthening international and cross-sector partnerships could help bridge these silos, promoting more integrative and context-sensitive studies that address both clinical and environmental determinants of well-being in CCRC settings.

The bibliometric analyses combining keyword co-occurrence and author co-authorship networks provide a comprehensive overview of the current research landscape on Continuing Care Retirement Communities (CCRCs). The keyword co-occurrence results reveal that research hotspots are concentrated on three main areas: the health and psychosocial well-being of older adults, methodological approaches for assessing needs and outcomes, and the planning and operation of community-based eldercare facilities, with particular emphasis on the role of continuing care across the service continuum. These findings indicate that the field has gradually evolved toward a more holistic and multidisciplinary approach, integrating health interventions, rigorous measurement tools, and environmental design considerations.

The author co-authorship network highlights a core group of highly collaborative researchers whose work collectively advances the knowledge base of aging and community care. However, several influential authors remain relatively isolated, suggesting that the research network is still fragmented and that there is potential for stronger cross-institutional and international collaboration. Future studies could benefit from drawing upon interdisciplinary insights to develop more context-specific frameworks that enhance aging-in-place and overall quality of life within CCRCs.

#### 4. Age-Friendly Residential Space Design in CCRC

The keyword clustering analysis in the previous chapter revealed the current research hotspots and development trends in the fields of elderly care and spatial design. Building on this foundation, the present chapter integrates these research hotspots with the design principles of elderly-oriented architecture to systematically identify the key focal points in the design of Continuing Care Retirement Communities (CCRCs). The aim is to

bridge theoretical insights and practical applications, enabling spatial environments to better respond to the physical, psychological, and social needs of older adults at different stages of care.

#### 4.1. Physiological and Psychological Characteristics of Older Adults

With advancing age, older adults experience a progressive decline in physiological function, substantially increasing their risk of illness. Aging affects nearly all organ systems and tissues, including cerebral and cerebellar atrophy, deterioration of vision and hearing, loss of taste and smell, and degeneration of the musculoskeletal system [20,21].

In the sensory system, aging leads to the gradual decline of the five senses (sight, hearing, smell, taste, and touch), which weakens the ability of older adults to receive and process external information [22]. In the cognitive system, aging is characterized by brain atrophy and degeneration of the nervous system, resulting in slower motor responses, impaired movement coordination, memory decline, poor reaction time, and reduced attention span [23]. Muscle atrophy and osteoporosis frequently cause mobility limitations in the motor system [24]. These changes lead to slower movement speed, delayed motor responses, and reduced tolerance for intense physical activity, increasing the risk of falls and injuries [20].

After retirement, older adults can arrange their own time more freely, but their range of social interaction often narrows [25]. Combined with age-related functional decline, this reduction in social engagement may trigger negative emotions [26]. Some older adults who experience a greater psychological gap may even develop severe mental health issues [25]. Older adults are more prone to negative emotions and a lack of psychological security, such as feelings of loss, frustration, loneliness, or inferiority [27]. Such negative emotional states are primarily attributable to a strong sense of social isolation, reflecting personal loneliness and social disconnection [25]. Physical limitations further restrict social participation, while role transitions after retirement, insufficient family communication, and decreased involvement in public affairs exacerbate their psychological vulnerability and sense of isolation [28,29].

Well-designed Continuing Care Retirement Communities (CCRCs) can play a vital role in addressing these challenges through age-friendly spatial planning and community engagement strategies [7]. Shared public spaces, such as activity rooms, dining halls, and landscaped courtyards, can foster daily social interactions and emotional support among residents, helping to reduce loneliness and enhance a sense of belonging [30]. Barrier-free circulation systems and walkable layouts promote independent mobility and spontaneous encounters. At the same time, diversified functional zones, such as fitness areas, cultural studios, and therapeutic gardens, encourage continued participation in meaningful activities [31]. In addition, CCRC design that emphasizes accessibility, privacy balance, and visual connectivity supports both autonomy and social inclusion, contributing to improved mental well-being and quality of life for older adults [32].

In summary, the combined effects of physiological decline, cognitive impairment, and reduced social engagement make older adults more susceptible to illness, mobility limitations, and psychological vulnerability, underscoring the need for supportive environments that promote safety, social participation, and emotional well-being.

#### 4.2. Design Dimensions for Age-Friendly Residential Spaces

##### 4.2.1. Universal Design

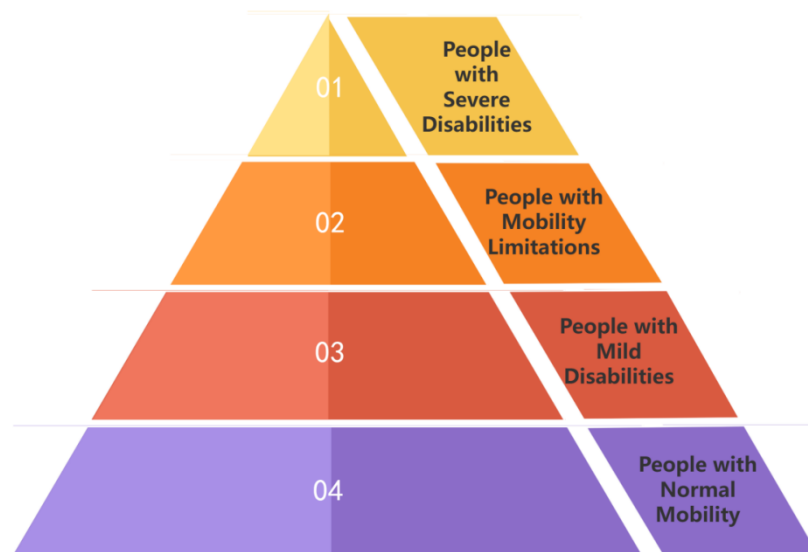
Universal design is a philosophy aimed at providing equitable and non-discriminatory services for all users throughout a product or space's design and use stages [33]. Rather than focusing exclusively on specific groups, universal design seeks to create inclusive environments where individuals with varying ability levels can achieve their goals independently and without stigmatization [32]. The concept is often illustrated through the user pyramid model (Figure 4), which divides users into three categories [34]: those with severe disabilities who require assistance in daily activities, individuals with mobility limitations caused by functional decline, and those with mild disabilities or no disabilities [31]. Traditional barrier-free design tends to follow a top-down approach, prioritizing the needs of severely disabled individuals before considering those of other groups [34]. In contrast, universal design adopts a bottom-up perspective that aims to meet the needs of all users simultaneously, ensuring that individuals with functional limitations can participate in daily activities in a manner comparable to non-disabled users [34].

Several core principles underpin the philosophy of universal design. As summarized in previous studies [31–35] universal design advocates equitable use, flexibility, simplicity, and perceptibility to ensure that environments and products can be accessed and understood by people with diverse abilities. It further emphasizes safety, tolerance for error, low physical effort, and sufficient spatial provision for movement and manipulation. Collectively, these principles



aim to create inclusive environments that accommodate individual differences and promote usability, comfort, and dignity for all users.

These principles provide a holistic framework for creating inclusive, accessible, and safe environments. They are particularly relevant for designing residential spaces in CCRCs, where diverse users with varying physical and cognitive abilities must be accommodated in ways that promote autonomy, dignity, and quality of life.



**Figure 4.** Pyramid Model of Users.

#### 4.2.2. Age-Friendly Environmental Design

Age-friendly environmental design focuses on creating indoor and outdoor living spaces that meet older adults' residential and rehabilitative needs [36]. Given the physiological and psychological characteristics of aging, the living environment must provide safety, accessibility, and a sense of security [21]. Inadequate or poorly designed environments can hinder daily activities and adversely affect physical and mental health [37]. For instance, insufficient lighting, overly steep steps, and unclear safety warnings can increase the risk of falls, resulting in severe consequences [38]. Improper furniture arrangement or sharp edges on walls and furniture may cause secondary injuries in the event of a fall [39]. Moreover, the absence of emergency call systems can delay timely assistance, and excessively bright colors or high noise levels may cause irreversible sensory damage [36]. Therefore, proactive and inclusive design is essential to ensure a safe and supportive living environment for aging populations.

The design of age-friendly environments is guided by three fundamental principles: safety, convenience, and comfort. Safety is the foremost principle, requiring the elimination of floor level differences to reduce tripping hazards and using non-slip and sound-absorbing flooring materials to prevent falls and minimize secondary injuries [40]. Handrails, emergency call systems, and safe power supply systems should be incorporated to enhance overall safety and allow timely assistance in emergencies [40].

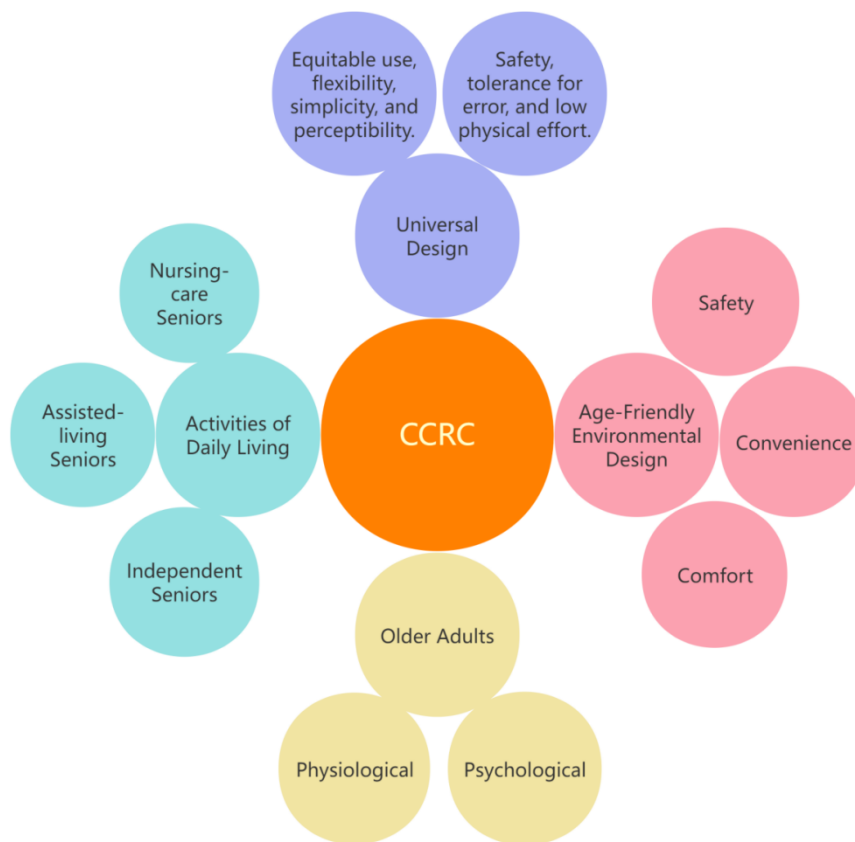
Convenience emphasizes sufficient circulation space and smooth movement paths to support older adults' daily activities [30]. Indoor layouts should minimize sharp turns, create open and unobstructed pathways, and incorporate furniture and smart devices that are simple, ergonomic, and easy to operate [30,39]. Design should also account for functional decline, offering assistive devices and user-friendly interfaces that compensate for reduced mobility or dexterity [30].

Comfort focuses on creating a pleasant, natural, and built environment that supports physical and psychological well-being [41]. Outdoor spaces should provide ample sunlight, fresh air, and a quiet atmosphere, while indoor spaces should be bright, well-ventilated, and decorated in soft, calming colors. Furniture should be appropriately firm, visually simple, and arranged to promote relaxation and mental tranquility, contributing to restorative living and emotional stability [39].

In summary, age-friendly environmental design must integrate safety, convenience, and comfort to create living spaces that not only reduce health risks and support daily activities but also promote psychological well-being and overall quality of life for older adults.

#### 4.2.3. Key Focuses of CCRC Design

Based on the user characteristics of CCRCs (Section 1), the analysis of older adults' physiological and psychological factors (Section 4.1), the philosophy of universal design (Section 4.2.1), and the principles of age-friendly environmental design (Section 4.2.2), several key considerations are identified for residential spaces in Continuing Care Retirement Communities (CCRCs) (Figure 5).



**Figure 5.** Flower Design in CCRC.

Figure 5 illustrates that CCRC residential space design is positioned at the intersection of multiple knowledge dimensions and user groups. On the one hand, universal design and age-friendly environmental design provide the overarching theoretical foundations for this approach. At the same time, the physiological and psychological characteristics of older adults specify the functional, sensory, and emotional needs that the environment must respond to. On the other hand, residents in CCRCs can be broadly categorized into independent seniors, assisted-living seniors, and nursing-care seniors, representing different levels of mobility and care dependence. Together, these elements define the core design focus of CCRCs: to create residential environments that are responsive to functional changes, grounded in inclusive design principles, and adaptable to the diverse needs of older adults across different stages of care.

## 5. Discussion

The findings of this review underscore the crucial importance of aligning residential space design in CCRCs with the physiological, psychological, and behavioral needs of older adults. Across existing scholarship, aging is consistently associated with progressive decline in sensory, cognitive, and motor functions, which not only elevates the risk of falls and injuries but also intensifies social withdrawal, anxiety, and emotional vulnerability [24]. Beyond biological explanations of aging, accumulated evidence shows that residential environments can significantly exacerbate or buffer functional decline by shaping older adults' sense of safety, control, and social connectedness [25,27].

This further underscores the importance of integrating universal design principles with age-friendly approaches to ensure that spatial strategies remain responsive to the diverse and evolving ADL levels of older adults. Rather than applying a fixed set of accessibility features, there is a need for dynamic and adaptive design considerations that accommodate functional changes over time and support seamless transitions across different stages of care. However, many of these priorities remain conceptual, revealing a clear limitation in the existing



body of work: they are seldom operationalized into CCRC-specific design decisions, evaluation criteria, or performance indicators.

Another cross-cutting theme concerns the recognition that functional abilities in later life are dynamic rather than fixed. Residential environments should incorporate flexibility and adaptability through modular layouts, convertible rooms, or multi-functional communal areas to accommodate transitions between care levels without forcing residents to relocate or experience disruptive environmental changes [16]. Yet, empirical evidence on how such adaptable environments actually perform in operational CCRCs remains limited. Much of the existing work still focuses on prescriptive recommendations or isolated case descriptions, rather than systematic post-occupancy evaluations or longitudinal assessments of behavioral and psychosocial outcomes.

Critically, research on CCRCs remains uneven in its emphases. A substantial proportion of publications continues to prioritize functional accessibility, risk reduction, and medical safety [1,6,7]. While these concerns are essential, this safety-oriented paradigm often marginalizes psychosocial and experiential dimensions, such as belonging, identity, privacy, and sensory comfort, which are mentioned but rarely operationalized. Likewise, universal design and age-friendly frameworks are frequently cited, yet seldom adapted to the specific spatial logics, care models, and institutional cultures of CCRCs [31,33,36]. This highlights a persistent gap between normative discourse and built-environment practice, as well as the tendency to conflate “barrier-free” compliance with genuinely supportive and meaningful environments for older adults.

Within this context, the design focal points synthesized in this review serve not only as a consolidation of existing recommendations but also as a critical lens on current CCRC design thinking. By integrating insights from gerontology, environmental psychology, and architectural research, this review emphasizes the need to move beyond a narrow, compliance-driven understanding of accessibility toward a more holistic conception of aging in place that incorporates emotional experience, cultural adaptation, and environmental identity. Future investigations should therefore adopt more interdisciplinary and evidence-based approaches, including post-occupancy evaluation, participatory design with residents and care staff, and mixed-method assessments, to examine how specific spatial interventions influence autonomy, dignity, and quality of life over time. Such work is essential for bridging the gap between high-level design principles and the everyday realities of aging in CCRC environments.

## 6. Conclusions

This study systematically analyzed the physiological and psychological characteristics of older adults. It synthesized the principles of universal design and age-friendly environmental design to identify the key design focal points for residential spaces in Continuing Care Retirement Communities (CCRCs). By addressing the sensory, cognitive, motor, and psychological needs of older adults, these design focal points emphasize safety, convenience, and comfort as the core dimensions of age-friendly design, underpinned by inclusive and equitable design principles.

The bibliometric analysis revealed that existing research on CCRCs has predominantly focused on health outcomes, methodological approaches, and community-based care models, but remains limited in addressing architectural and spatial design perspectives. This study builds upon these findings by linking the characteristics of older adult users with spatial design priorities, providing theoretical insights for evidence-based and user-centered design practices.

The identified design focal points provide practical guidance for architects and interior designers in creating inclusive, adaptable, and supportive living environments. They also serve as evaluative references for identifying spatial deficiencies in existing facilities and for improving environmental quality to meet the diverse needs of older adults better. Applying these design principles can enhance autonomy, safety, and social participation, thereby promoting aging in place and contributing to the sustainable development of community-based eldercare systems.

Nevertheless, several critical constraints of this study should be acknowledged. The literature search was limited to English-language publications and conducted across only two databases, which may have resulted in the exclusion of relevant studies. Additionally, this study did not include on-site or empirical evaluation of CCRC environments, and its analytical focus remains primarily on the Chinese context. Future research should therefore expand data sources, incorporate multilingual and longitudinal analyses, and include field-based evaluations to enhance the robustness and universality of the conclusions.

In summary, future research should further validate these design focal points through empirical investigations, such as post-occupancy evaluations (POE), behavioral observations, and user satisfaction studies, to examine their effectiveness in real-world CCRC contexts. Moreover, cross-disciplinary and cross-cultural research is encouraged to refine and adapt these design priorities to different social and environmental settings, ensuring their broader applicability and contribution to global efforts toward age-friendly and inclusive environments.

## Author Contributions

Z.W.: Conceptualization, methodology, writing-original draft; J.L.: Data curation, software, visualization; W.Z.: Data curation; J.Y.: Visualization; C.M.: Writing-review & editing. All authors have read and agreed to the published version of the manuscript.

## Funding

This research was funded by [Guangxi Young and Middle-aged University Teachers (Scientific Research) Basic Ability Enhancement Project “Interactive Design Research on Digital Exhibition of Intangible Cultural Heritage from New Media Perspective”] grant number [2024KY1701].

## Institutional Review Board Statement

Not applicable.

## Informed Consent Statement

Not applicable.

## Data Availability Statement

The bibliometric data analyzed in this study were retrieved from the Scopus (Elsevier) and Web of Science Core Collection (Clarivate) databases. The data are available from these databases and can be accessed with the appropriate institutional or individual subscription.

## Conflicts of Interest

The authors declare no conflict of interest.

## Use of AI and AI-Assisted Technologies

No AI tools were utilized for this paper.

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