



A Multidimensional Strategy for Aging-friendly Enhancement of Public Spaces in Aging Residential Communities in Zhengzhou Under the PSPL Framework

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Abstract

With the intensification of population aging, the enhancement of age-friendly standards in deteriorating urban communities has become an urgent issue that requires immediate attention. This paper delves into the strategies for age-friendly transformation of public spaces in the aging communities of Zhengzhou. Drawing on the theoretical foundations of age-friendly design, public space design, and community space planning, it proposes a multifaceted approach that involves improving spatial layouts, optimizing lighting and safety, increasing green spaces, enhancing social functions, integrating smart technologies, and implementing barrier-free designs. These measures aim not only to improve the quality of life for the elderly but also to invigorate the overall vitality of the community, thereby providing both theoretical foundations and practical guidance for the age-friendly renovation of Zhengzhou and other similar cities.

Keywords

PSPL-oriented design; Aging-friendly planning; Public space; Aging residential communities; Environmental design

Introduction

With the accelerating momentum of global population aging, the demand for urban public spaces that are attuned to the complex physiological and psychosocial needs of older adults has emerged as a central concern in contemporary urban planning and spatial design discourses (Hu & Ye, 2024). In this context, Zhengzhou—a rapidly urbanizing metropolis—faces the dual pressures of urban renewal and the functional obsolescence of its aging residential quarters. Historically, these communities were not conceived with aging populations in mind; deficiencies in accessibility, safety, and spatial inclusiveness are particularly acute in their public domains. To address these challenges, this study adopts a PSPL-oriented analytical framework to formulate multidimensional strategies aimed at enhancing the aging-friendliness of public spaces in Zhengzhou's older neighborhoods. By synthesizing theoretical insights and spatial diagnostics, the study aspires to inform the development of context-sensitive, implementable interventions that can both improve the lived experiences of elderly residents and catalyze broader socio-spatial rejuvenation.

1. Theoretical Framework and Application of Aging-friendly Design

1.1 Aging-friendly Design Theory

Aging-friendly design theory emerges from a growing recognition of the unique needs of the elderly population, aiming primarily to mitigate the inconveniences and risks they encounter in their daily lives through adaptive design of buildings and environments (Zhou, 2024). According to the World Health Organization (WHO), aging-friendly design seeks to enhance the accessibility and safety of built environments, allowing older adults to live independently and comfortably. Beyond mere physical modifications to space, aging-friendly design must also address the psychological and social needs of the elderly. This includes the rational planning of spatial layouts, the optimization of lighting, the reinforcement of safety measures, and the provision of supportive infrastructure tailored to the cognitive and physical capabilities of older individuals (Sun, 2024). Aging-friendly design not only effectively improves the quality of life for seniors but also fosters their independence and sense of social integration within both their communities and families.

1.2 Community Spatial Planning Theory Under the PSPL Framework

Community spatial planning theory under the PSPL (Public Space Planning and Landscape) framework emphasizes the enhancement of the comprehensive functionality of public spaces through scientific spatial layouts and design, thereby creating multidimensional environments that meet the needs of residents. Within the PSPL framework, community spaces must not only fulfill the basic functional requirements of residents but also elevate the quality of life through a multi-faceted approach—strengthening social functions, improving ecological environments, and enriching cultural atmospheres. This theory places particular emphasis on optimizing spaces for social interaction, leisure areas, and the integration of cultural and educational facilities through spatial design, promoting communication and collaboration among various demographic groups. In the aging-friendly renovation of older communities in Zhengzhou, the PSPL orientation offers a multidimensional optimization approach for spaces, enhancing the living conditions of elderly residents through physical improvements while simultaneously fostering stronger social and cultural cohesion within the broader community, thereby invigorating overall community vitality (Wu & Zhao, 2024).

2. The Impact of Environmental Design on Aging-friendly Spaces

2.1 Spatial Layout and Adaptation to Elderly Activities

In the context of aging-friendly renovations within deteriorating communities, spatial layout stands as one of the paramount factors in enhancing the quality of life for elderly residents. As the physical capabilities of older adults gradually decline, traditional community designs often fail to adequately address their particular spatial needs. Aging-friendly spatial design must be intricately attuned to the evolving mobility and functional limitations of the elderly, ensuring that obstacles such as narrow, convoluted passages, steep stairs, or excessive inclines are avoided. Complex spatial configurations not only complicate movement but also elevate the risk of accidents, such as falls, which are particularly dangerous for seniors. To alleviate these burdens, design should incorporate barrier-free pathways, ramps, and handrails, ensuring ease and safety for elderly mobility (Zhang et al., 2023).

2.2 Lighting and Safety Enhancement Strategies

In the realm of aging-friendly design, the provision of appropriate lighting and safety measures forms the cornerstone of ensuring the smooth execution of daily activities for older individuals. With advancing age, seniors often experience a decline in vision, which becomes particularly pronounced under low light conditions, impairing their ability to perceive their surroundings. To mitigate these challenges, the lighting design of public spaces must prioritize adequate illumination, avoiding excessively harsh direct light or overly dim areas that may obscure potential hazards. This is crucial in minimizing the risk of accidents. Special attention should be given to the layout of lighting in public areas and walkways, ensuring that elderly individuals have sufficient visual support when navigating in the evening, thus reducing the likelihood of falls and other safety incidents.

2.3 The Impact of Green Spaces and Natural Elements on Elderly Health

Green spaces hold significant psychological and physiological benefits for elderly individuals. Natural environments not only assist in alleviating the stress of daily life but also have a profound effect on improving emotional well-being. Thoughtful selection of plant species, enhancement of greenery, and the thoughtful placement of small-scale landscape

features contribute to creating aesthetically pleasing and inviting spaces. The inclusion of amenities such as seating areas and pathways in green spaces not only facilitates rest and social engagement but also strengthens community ties, encouraging interaction between elderly residents and others.

3. Social Interaction and Community Vitality

3.1 Functional Design of Social Spaces

The social needs of elderly individuals occupy a central role in the design of aging-friendly communities. As people age, they often face feelings of loneliness and social isolation, challenges that are intrinsically linked to a lack of spaces conducive to their social engagement and interaction opportunities (Dong et al., 2023). Social interaction has a profoundly positive impact on the mental health of older adults, serving to significantly reduce feelings of loneliness and depressive symptoms. Consequently, the aging-friendly renovation of older communities must give special attention to the functional design of social spaces. These might include leisure seating areas, activity rooms for seniors, and communal gathering spaces, all of which not only provide platforms for elderly individuals to interact with neighbors but also enhance the frequency and quality of social exchanges.

The design of social spaces should carefully consider the mobility and cognitive characteristics of older adults, avoiding overly complex layouts or locations distant from core residential areas. By incorporating seating arrangements that facilitate prolonged use and shaded leisure zones, the design can encourage elderly residents to venture outdoors and engage in regular conversations with friends and neighbors. The strategic placement of these functional spaces is critical in enhancing community cohesion, as it fosters a deeper sense of community identity and belonging for elderly individuals. Moreover, the activity spaces within these communities should be adapted to the physical conditions of the elderly, incorporating barrier-free pathways, handrails, and comfortable seating to ensure a secure and welcoming environment for social interactions.

3.2 Facilities and Activities Promoting Neighborhood Interaction

In the design of aging-friendly communities, beyond the optimization of physical spaces, the facilitation of neighborhood interactions through purposeful facilities and activities is of paramount importance. Neighborhood interaction not only provides elderly individuals with vital social support but also elevates the overall vitality and sense of security within the community. Aging-friendly renovations should thus include multifunctional activity squares, senior cultural centers, and other public facilities that encourage interactions among elderly residents.

Organizing group activities such as dance classes, fitness routines, and craft-making workshops specifically tailored for seniors represents a critical strategy for fostering neighborhood interaction. These activities not only offer a platform for socialization but also contribute to maintaining both physical health and mental vitality. By hosting regular community events and festive celebrations, the bonds between neighbors are deepened, further strengthening social ties and collaboration within the community. Such positive interactions improve the overall satisfaction of elderly residents with their community environment, enhance their sense of security, and ultimately promote their social participation and life satisfaction.

3.3 Cultural and Educational Resources in Public Spaces

Public spaces serve not only as venues for socializing and relaxation but also as important conduits for cultural and educational activities. The availability of cultural and educational resources significantly enhances the quality of life for elderly residents. In aging-friendly renovations, the design of public spaces should integrate cultural facilities such as libraries, senior learning centers, and cultural exhibition areas, enriching the spiritual and cultural lives of older adults. These facilities not only provide access to a wealth of cultural resources but also stimulate the elderly's interest in cultural activities, promoting lifelong learning and the transmission of knowledge.

Recent studies underscore the growing educational needs of the elderly, particularly in areas such as information technology and health management. Thus, communities should establish learning centers specifically for older adults, offering courses in computer training, health education, and other areas. These educational resources not only enhance seniors' skills and self-confidence but also help them navigate the rapidly changing social landscape, further fostering their social engagement. The inclusion of cultural exhibition spaces within these communities can offer elderly individuals opportunities to showcase their talents and cultural expressions, thereby enriching their interactions with other community members and strengthening their sense of self-worth and identity.

4. Service Facilities and Technological Support

4.1 Aging-friendly Service Facility Configuration

In the aging-friendly renovation of deteriorating communities, the configuration of service facilities stands as a critical component in enhancing the quality of life for elderly residents. A thoughtfully designed array of aging-friendly amenities not only improves the daily convenience for older adults but also plays a pivotal role in safeguarding their health and well-being (Li, Li, & He, 2024). Among these, accessible bathrooms represent one of the most fundamental provisions. By designing spaces that cater to the unique needs of seniors—such as wider spaces, lower washbasins, and the installation of handrails—such facilities significantly reduce physical discomfort or potential dangers resulting from inadequate accessibility. Moreover, the incorporation of smart technologies, such as intelligent toilets and shower systems, elevates the independence and comfort of elderly users, while slip-resistant flooring materials mitigate the risk of falls. The importance of health service stations in aging communities has increasingly been recognized. For instance, in Changfeng Street, Putuo District, Shanghai, collaborations between local communities and online delivery platforms have led to the development of a “Senior Mode” mobile application, offering training to help elderly individuals purchase medication, meals, and daily necessities online, thus alleviating the challenges posed by limited mobility. Furthermore, health service stations offer routine health check-ups, disease prevention services, and health consultations, greatly enhancing the elderly’s capacity for self-managed health care. Equally important is the installation of emergency medical equipment, which is a critical aspect of aging-friendly renovations. Cities like Zhengzhou have equipped older communities with accessible emergency medical devices and easy-to-reach emergency call systems, ensuring that elderly residents can quickly receive assistance in the event of a sudden illness. Strengthening such service facilities provides a more comprehensive safety net for the elderly, alleviating health-related concerns and fostering greater independence for older adults.

4.2 Application of Smart Technologies in Communities

With the relentless advancement of technology, smart technologies have become an indispensable element in the aging-friendly renovation of older communities. These technologies not only improve the comfort of elderly residents but also substantially enhance the safety and convenience of their living environments. A prime example of such innovation is the smart home system, which integrates voice control, automatic temperature regulation, and smart lighting to offer a more user-friendly living experience. In these systems, elderly individuals can adjust the indoor temperature or lighting with simple voice commands, which is particularly beneficial for those with mobility impairments or declining memory. Additionally, smart home systems feature automatic reminders that alert users if they forget to turn off lights or close windows, further enhancing their independence and peace of mind. Telemedicine and intelligent health monitoring systems also exemplify the integration of technology to support elderly well-being. By wearing devices such as smart wristbands, seniors can transmit their health data in real-time to doctors or caregivers, facilitating early detection and prompt intervention in cases of health abnormalities. Smart sensors can monitor the movements of elderly residents, and in the event of unusual activity, the system automatically sends alerts to family members or caregivers, ensuring timely action. The deployment of these smart technologies not only enhances elderly individuals’ health management capabilities but also mitigates the risks associated with health issues. Moreover, the application of these technologies streamlines community management by leveraging data analysis to provide more personalized services based on the health status and activity patterns of elderly residents. Undoubtedly, the introduction of such technologies offers a novel solution to the challenges of aging-friendly renovations in older communities.

4.3 Accessibility Design and Enhancement of Elderly Convenience

As a fundamental requirement of aging-friendly renovations, accessibility design aims to create safer, more convenient living environments for elderly residents (Li, 2024). The design of public spaces—such as community roads, squares, and buildings—should prioritize the integration of barrier-free pathways, ensuring that older adults can navigate their surroundings with ease. By optimizing ramp designs, adding wider passageways, and installing accessible restrooms, significant improvements can be made to the mobility and convenience of elderly residents. In some community renovations, ramps have been specifically designed for seniors with limited mobility, ensuring easy access to public buildings and eliminating the difficulties posed by steep stairs or narrow corridors. The establishment of designated accessible parking spaces is another crucial measure for enhancing the convenience of elderly individuals. Traditionally, parking lots have often overlooked the specific needs of seniors, but many communities undergoing renovation now include reserved accessible parking spaces, ensuring that older residents can park and move around with ease. These parking spaces are

strategically located near entrances, facilitating quick access to the community. Additionally, improvements in transportation accessibility, such as the installation of barrier-free passages at community entrances and the inclusion of elevators and automatic doors, further streamline elderly access to public transportation. Through these thoughtful accessibility designs, the freedom of movement for elderly residents within the community is markedly increased, and the safety risks associated with mobility limitations are reduced. These modifications not only empower elderly individuals to live more independently but also expand their opportunities for social participation, thereby enhancing their overall quality of life.

5. Conclusion

This study, grounded in the PSPL-oriented community spatial planning theory, presents a multidimensional strategy for the aging-friendly renovation of public spaces in Zhengzhou's deteriorating communities. Through a comprehensive analysis of environmental design, social interaction, service facilities, and technological support, this study highlights that aging-friendly renovations must focus on enhancing the convenience, safety, and social needs of elderly residents. Notably, improvements in spatial layout, lighting, safety infrastructure, accessibility design, and the integration of smart technologies will significantly elevate the quality of life for seniors. Additionally, the enhancement of social interaction and neighborhood relations fosters greater community vitality and cohesion. The PSPL-oriented approach offers a systematic solution for improving community functions and enriching the living quality of elderly residents, providing invaluable insights for practical implementation in urban regeneration efforts.

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