

Built environment and social health of the elderly in Harbin:

A comparative study of communities built before and after housing reform

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Abstract

China's housing reform and urban renewal have changed the spatial structure and social relations of urban communities, and the original ties between people and places have gradually dissolved, with the elderly facing more adjustment difficulties in the new environment. Taking Harbin, China as an example, this study focuses on the work-unit community and commercial housing community built before and after the housing reform, compares the basic characteristics of the two environment and elderly residents, and impacts on the social health of the elderly. The results showed that there were significant differences in environmental perception and social health between them. In terms of the influence relationship, the accessibility of facilities such as parks, supermarkets and public canteens has a significant positive impact on the social functioning level of the elderly, while the accessibility of medical facilities, retail stores and bus stops has a significant positive impact on the social support. A safe and smooth walking environment is more beneficial for the elderly to obtain social support. The proportion of the elderly, the level of community service, community cohesion and community type are all important factors affecting the social health. The two types of communities should formulate refined development strategies based on different environmental characteristics and population attributes, so as to enhance the sense of social integration and overall happiness of elderly residents.

Keywords

Built Environment, Social Health, the elderly, Impact Relationship, Community, Harbin

1. Introduction

China is entering an aging society at the fastest rate in history, and by 2027, China will transform from an 'aging' society to an 'aged' society, and the promotion of healthy aging has become an urgent task and a serious challenge for national development and construction. Ageing causes changes in the physical and mental aspects of the human body, which in turn leads to a slight deterioration in hearing, vision, dexterity, agility and memory, thus increasing the health vulnerability of the older population. At the same time, the contact between retired older people and their social networks gradually decreases, and the combination

of these factors leads to a narrowing of the scope of travelling, with the community becoming the main place for their daily activities (Huang et al., 2019). Under the influence of rapid urbanisation and housing reforms, the construction patterns, demographic and environment changes have led to huge changes in the original social space and sense of identity that residents had established with their 'place' (Cheng and Li, 2022). Older people face more difficulties in adjusting to this rapidly changing environment.

The community environments are important in facilitating social interactions and enhancing the quality of life and social health of older adults (Small and Adler, 2019). With the increase of age, the health and cognitive level of the elderly are gradually declining, and the degree of social adaptation and participation is deteriorating. The need to adjust emotions, improve health and relieve loneliness through social activities is increasing. In addition to the medical and health field, the built environment in the community has a great influence on its daily behavior and quality of life (Rosso et al., 2011; Huang et al., 2019; Dong et al., 2021; Moogoor et al., 2022; Zhang and Yao, 2022). Integrating resources at the community level and exploring ways to optimise the environment for older people's living, travelling, healthcare and nourishment to create a safe, convenient, comfortable and barrier-free livable environment for older people is an urgent issue under the goal of active ageing. (National Health Commission of the People's Republic of China, 2019)

2. Literature review

Social health is one of the three dimensions of health defined by the World Health Organisation, which requires people to adapt to social life, play social roles and perform social functions effectively (Dong et al., 2023). The social health of an individual is closely related to the level of education, social culture, family, career and relationships, and is a higher level of health status based on physical and mental health. Studies have shown that people who are better integrated into the community tend to live longer and have stronger resilience when encountering accidents such as diseases. The stress buffering model suggests that the supportive strengths provided by social relationships buffer the negative effects of stress on health. The main effects model also proposes that social relationships confer richer roles and meaning to people's lives, thus encouraging healthy behaviours (Holt-Lunstad et al., 2010). In contrast, social isolation is a significant risk factor for the disease and has even surpassed other risk factors such as physical inactivity and obesity (Holt-Lunstad et al., 2010, 2015). Exposure to loneliness can be seen as a social form of 'pain' with a significant impact on well-being. Throughout the life course, older age is characterised by a higher risk of social isolation and greater health vulnerability (Svensson et al., 2022).

Urban communities are integrated spatial vehicles for the daily lives and social interactions of older persons. The overall character of China's social transformation over the past three decades can be summarised by the shift from the 'unit state' to the 'community state'. This transformation does not only mean a shift in living space, but also a transformation of social composition and interaction, and a transformation of the social governance system (Zhao and Hu, 2009). Harbin, as a city with a long history, has a large number of old unit communities. These communities are mainly the products of settlements formed under the First and Second Five-Year Plans in the course of industrialisation, and are used to house workers and their families, with obvious unit and historical features. Most of the residents of the community work in the same organisation and have experienced the development of the community together. This long-term experience creates a deep emotional bond between neighbours, based on which a good neighbourhood atmosphere is formed. After the housing reform, a large number of closed commercial housing have been built rapidly. These residential areas often emphasize the safety and environmental grade unilaterally in isolation, but bring other harms such as the disruption of the spatial hierarchy, lossing control at various scales and the destruction of native human-land relationships (Zhao

and Hu, 2009). Living in unfamiliar and unsafe environments affects older people's willingness to get out and may make them more vulnerable to loneliness and depression (Svensson et al., 2022; Zhang and Yao, 2022). Therefore, it is crucial to study the social health of elderly residents in the community and the patterns of influence of the community environment on them in the context of different periods of time, in order to implement targeted planning interventions for age-friendly communities.

The community environment provides many of the essential elements for social connections for older residents. Well-developed transport offers more possibilities to get around and visit friends and relatives, while homes, restaurants, libraries, parks, fitness trails, fairs, etc. provide more opportunities for encounters and interactions (Small and Adler, 2019). It has also been found that places with more pedestrian-friendly environments provide more opportunities for beneficial or unintentional interactions for community members, as well as more mobility possibilities and social connections for people with disabilities (Kwon et al., 2017; Pfeiffer et al., 2020; Kim et al., 2024). Neighborhood green space can improve the mental health and social participation through the sense of place experience in public space (Enssle and Kabisch, 2020). However, public space design details, such as safety hazards like pavement obstructions and poorly maintained fitness facilities, can discourage older people from outdoor activities, whereas high-quality leisure environments that are both comfortable and pleasing are more conducive to mobilising willingness to travel (Kweon et al., 1998; Dong et al., 2020; Enssle and Kabisch, 2020). It is clear that the social health of older people is closely related to the multiple built environments in the community, but it is not yet possible to determine the relationship between the different dimensions of the built environment and social health.

Based on the above analyses, this study is oriented towards social health, with older people as the main body, and by analysing the built environment and social health of older people in the two types of communities formed before and after the housing reform. Identifying relevant environmental indicators and revealing patterns of influence in order to clarify the differences and commonalities between different types of communities in their social health support systems for older persons. To help develop more accurate age-friendly planning intervention strategies and build a more inclusive community environment.

3. Methods

3.1. Data collection

The study selected 14 representative communities in the central urban area of Harbin, including 7 old unit-based communities (built before 2000) and 7 new commercial housing communities (built after 2000). The questionnaire scale was designed with 5-level Likert scale method. Questionnaire interviews were conducted in the field with randomly selected older residents aged 60 years and above, specifically focusing on the evaluation of the multidimensional community environment representations proposed above, social interaction preferences, and social health (from the PROMIS Adult Self-Reported Social Health scale (v2.0), including the core dimensions of social function and social relationship) (Hahn et al., 2010, 2014) and information on the socioeconomic attributes of the older adults interviewed. The number of questionnaires in each community was basically limited to about 30 to ensure a reasonable sample distribution.

The research team carried out the questionnaire distribution work in April-July 2024, and finally 440 questionnaires were recovered, 21 incomplete and untrue questionnaires were excluded, and finally 419 valid questionnaires were obtained, with a valid recovery rate of 95.23%. The respondents included 246 female older persons (58.7%) and 173 male older persons (41.3%) (Table 1).

More than half of the respondents have an education level of junior high school and below, and most of their incomes are clustered between 2,000 and 5,000 yuan. 71.1 percent of the elderly choose to live with their spouses or children, while 17.9 percent live alone.

Table 1. Socio-demographics of respondents (N = 419). Source: Author's own research

Variable	Category	Number	Proportion (%)	Variable	Category	Number	Proportion (%)
Gender	Female	246	58.7	Education Level	Primary school and below	103	24.6
	Male	173	41.3		Middle school	154	36.8
Age	60-64	94	22.4		High school	110	26.3
	65-69	108	25.8		College	36	8.6
	70-74	93	22.2		Bachelor's degree and over	16	3.8
	75-79	69	16.5	Living Arrangement	Alone	75	17.9
	≥80	55	13.1		With spouse	226	53.9
Pension Income	Below 2k	79	18.9		With children	73	17.4
	2k-5k	256	61.1		With spouse and children	41	9.8
	5k-10k	81	19.3		Other	4	1.0
	10k-30k	3	0.7				

3.2. Data analysis

Factor Analysis. In order to avoid the problem of possible covariance between the variables, the data analysis stage began with an exploratory factor analysis of each dimension of the community environment factor, the essence of which is to find as many composite variables as possible that reflect the original information and are independent of each other. The results are shown in Table 2 and the KMO (Kaiser-Meyer-Olkin) values indicate that the use of factor analysis is appropriate. The cumulative variance contribution of the factors indicates that the new variables reflect the information of the original variables better. Factor loadings were generated using principal component analysis and varimax rotation, while factors with factor loadings less than 0.5 were excluded (Hu et al., 2021).

Multiple Regression Analysis. The common factor obtained from the above exploratory factor analysis was used as the independent variable, and the six sub-dimensions of social health level were used as the dependent variables. Controlling for socio-economic characteristics such as age, education level, pre-retirement occupation, residence mode, monthly income, online social frequency and physical limitation status, multiple linear regression analyses were conducted, and a total of six models were obtained for the influence of community environment on the dimensions of social participation, satisfaction, emotional support, instrumental support, informational support, and companionship (Model 1–6). The value of R^2 in the model shows an acceptable model fit and the results of regression analysis are shown in Tables 5 and 6.

4. Results

4.1. Characteristics of the community environment

Based on the results of factor analysis and multiple linear regression, three key dimensions of the community environment were identified: facility, spatial design, and social environment. 14 secondary factors such as small commercial facilities, outdoor activity facilities, environmental quality, walkability, and community cohesion and 42 tertiary factors were recognized (Table 3).

Table 2. Factor Analysis of community environment. Source: Author's own research

Community Environment	Common Factor	Dimension	Indicator	Factor Loading
Facilities	X1	Small Commercial Facilities	Number of restaurants	0.829
			Accessibility of restaurants	0.779
			Number of pharmacies/clinics	0.679
			Accessibility of convenience stores	0.632
			Accessibility of pharmacies/clinics	0.619
	X2	Outdoor Activity Facilities	Number of convenience stores	0.605
			Number of squares	0.831
			Number of parks	0.811
			Accessibility of parks	0.774
			Accessibility of squares	0.773
	X3	Financial Service Facilities	Accessibility of banks/post offices	0.863
			Number of banks/post offices	0.836
	X4	Indoor Activity Facilities	Accessibility of activity centers/rooms	0.870
			Number of activity centers/rooms	0.853
	X5	Public Transport Facilities	Number of bus stops	0.841
			Accessibility of bus stops	0.812
	X6	Comprehensive Commercial Facilities	Accessibility of supermarkets	0.917
			Number of supermarkets	0.890
	X7	Public Canteens	Accessibility of public canteens	0.928
			Number of public canteens	0.923
KMO			0.719	
Cumulative Explained Variance/%			79.44%	
Spatial Design	X1	Environmental Quality	Regular maintenance	0.782
			Rest facilities	0.697
			Fitness facilities	0.681
			Landscape	0.639
			Barrier-free facilities	0.630
			Housing quality	0.628
			Lighting	0.592
			Sanitation	0.515
	X2	Park and Square Design	Activity facilities	0.882
			Infrastructure	0.840
			Greenery	0.830
	X3	Walkability	Street connectivity	0.821
			Pedestrian infrastructure	0.796
			Safety and smoothness	0.509
	KMO			0.885
	Cumulative Explained Variance/%			63.44%
Social Environment	X1	Community Cohesion	Neighborhood trust	0.924
			Neighborhood atmosphere	0.889
			Neighborhood identity	0.848
	X2	Community Services	Community organizations or activities	0.872
			Property management	0.772
	X3	Population Structure	Proportion of elderly population	0.783
			KMO	
	Cumulative Explained Variance/%			79.72%

Note: Principal component analysis was used for factor extraction, with orthogonal rotation using Kaiser normalization. Factors with loadings below 0.5 were excluded.

Table 3. Comparison of the two types of community environments. Source: Author's own research

Community Environment	Old work-unit communities (n=209)		New commercial communities (n=210)		Independent t-Test	
	Mean	S.D.	Mean	S.D.	t 值	Sig. (2-tailed)
Facilities						
Parks No. (Number)	3.78	1.083	2.77	1.262	8.778	0.000***
Squares No.	3.64	1.18	3.28	1.22	3.114	0.002***
Convenience Stores No.	4.32	0.886	4.23	0.93	0.931	0.352
Supermarkets No.	3.28	1.38	2.66	1.22	4.903	0.000***
Restaurants No.	4.15	0.928	4.09	1.01	0.712	0.477
Activity Centers No.	2.05	1.28	2.27	1.35	-1.707	0.089*
Public Canteens No.	1.10	0.326	1.29	0.78	-3.260	0.001***
Pharmacies/Clinics No.	3.96	1.06	4.05	0.83	-0.974	0.331
Banks/Post Offices No.	3.69	1.127	3.57	1.04	1.198	0.232
Bus Stops No.	4.14	1.01	3.86	0.74	3.296	0.001***
Parks Access	3.79	1.033	2.96	1.33	7.167	0.000***
Squares Access	3.92	1.10	3.74	1.18	1.618	0.106
Convenience Access	4.28	0.909	4.17	0.86	1.281	0.201
Supermarkets Access	3.12	1.44	2.56	1.23	4.349	0.000***
Restaurants Access	4.17	0.933	4.03	1.03	1.446	0.149
Activity Centers Access	2.18	1.43	2.51	1.53	-2.261	0.024**
Public Canteens Access	1.16	0.587	1.39	0.92	-3.017	0.003***
Pharmacies/Clinics Access	3.96	1.07	4.02	0.89	-0.596	0.551
Banks/Post Offices Access	3.62	1.215	3.47	1.13	1.353	0.177
Bus Stops Access	4.00	1.13	3.83	0.82	1.725	0.085*
Overall Facility satisfaction	3.79	0.680	3.53	0.73	3.796	0.000***
Spatial Design						
Park/Square Greenery	3.85	0.76	3.39	1.12	4.904	0.000***
Park/Square Activity facilities	3.66	0.835	3.19	1.08	5.047	0.000***
Park/Square Infrastructure	3.66	0.78	3.33	1.02	3.700	0.000***
Pedestrian infrastructure	3.70	0.797	3.73	0.82	-0.440	0.660
Street connectivity	3.99	0.76	4.01	0.71	-0.333	0.739
Safety and smoothness	3.42	0.99	3.30	1.08	1.197	0.232
Lighting	3.70	1.074	3.80	1.17	-0.882	0.378
Rest facilities	3.38	1.18	3.26	1.19	1.099	0.273
Fitness facilities	3.48	1.29	3.11	1.04	3.188	0.002***
Regular maintenance	2.64	1.36	2.78	1.12	-1.152	0.250
Barrier-free facilities	2.05	0.903	2.60	1.17	-5.396	0.000***
Housing quality	3.14	1.05	3.42	0.89	-2.940	0.003***
Landscape	3.40	1.08	3.45	1.07	-0.479	0.632
Sanitation	3.45	1.147	3.37	1.13	0.703	0.483
Social Environment						
Proportion of the elderly	4.29	0.74	4.30	0.84	-0.167	0.868
Community organizations or activities	2.06	0.97	2.04	0.98	0.203	0.839
Neighborhood atmosphere	3.74	0.941	3.81	0.77	-0.808	0.420
Neighborhood trust	3.75	0.93	3.61	0.79	1.570	0.117
Neighborhood identity	3.66	1.07	3.54	0.85	1.246	0.213
Property management	2.60	1.312	2.82	1.03	-1.957	0.051*

*p < 0.1, **p < 0.05, ***p < 0.01.

According to the statistics, in terms of the facilities, both types of neighbourhoods demonstrate a high abundance and good accessibility of retail shops, medical facilities and public transport facilities (average score above 4). However, it is worth noting that both types of communities are notably lacking in facilities such as activity centres and communal canteens, a finding that contrasts with the high demand for such facilities among the older resident groups. By further comparing the differences, the old communities show obvious advantages in the number and accessibility of parks and supermarkets, and the rich Settings of square space and bus stops contribute to their high overall facility satisfaction. This suggests that, despite aging infrastructure, older communities maintain unique strengths in the layout of amenities that enhance daily leisure and shopping convenience. In contrast, new residential communities excelled in the number and accessibility of activity centers and public canteens, likely reflecting forward-thinking planning that addressed residents' diverse lifestyle needs.

In terms of public space design, new residential communities demonstrate a more pedestrian-friendly design, with superior housing quality compared to old work-unit communities, providing safer and more convenient mobility for elderly residents, especially those with limited mobility. In contrast, old work-unit communities excel in green space layout and recreational facilities, offering a rich environment for leisure and fitness, reflecting a long-term commitment to improving residents' quality of life. Both types exhibit good street connectivity, but they lack sufficient barrier-free design and regular maintenance of outdoor facilities.

Additionally, In the social environment, elderly residents perceived a higher proportion of older populations generally, reflecting the broader trend of societal aging. Old work-unit communities, with their historical background and close-knit structure, demonstrated higher levels of neighborhood trust and cohesion, though not statistically significant, offering insights into social capital accumulation across different community types. New residential communities, with modern management and efficient operations, excelled in property management. However, both types show potential for improvement in community vitality and resident engagement.

4.2. Characteristics of social health of the elderly

Elderly residents in both community types reported higher levels of instrumental and informational support (above 50 points), surpassing emotional support and companionship. This may be attributed to family, neighborly help, community services, or government policies that address practical challenges and information gaps. Work-unit communities showed higher social participation, with stronger perceptions of

Table 4. Comparison of social health evaluation results. Source: Author's own research

	Old work-unit communities (n=209)		New commercial communities (n=210)		Independent t-Test	
Social health	Mean	S.D.	Mean	S.D.	t 值	Sig.(2-tailed)
Social Function						
Ability to Participate	48.55	6.11	47.91	5.52	1.14	0.256
Satisfaction with Participation	48.68	4.91	48.39	5.08	0.61	0.543
Social Relationships						
Emotional Support	47.67	6.34	47.00	6.00	1.10	0.272
Instrumental Support	52.62	5.99	54.36	6.33	-2.89	0.004***
Informational Support	52.99	6.23	54.48	6.46	-2.41	0.017**
Companionship	47.98	7.06	47.48	6.38	0.77	0.443

*p < 0.1, **p < 0.05, ***p < 0.01.

emotional support and companionship, though no significant intergroup differences were found. However, instrumental and informational support was significantly higher in newly developed commercial housing, likely due to better facilities and more efficient management systems (Table 4).

4.3. Effect of neighbourhood characteristics on social health

Community facilities. In terms of facilities, the study selected the number and accessibility of facilities to characterise the abundance and convenience of facility provision. We found that the number of parks, restaurants, and bus stops around the community had a significant impact on both social health dimensions, social function and social relationships; It is worth exploring whether too many of these facilities can have a negative impact on instrumental support or informational support. It may be that because settlements accompanied by a large number of parks, restaurants and other amenities in the surrounding area will attract a large number of people who are not from their own neighbourhoods, with a high level of disruption and safety concerns for the senior population, they will avoid moving around in densely populated areas. More bus stops will provide easier travelling conditions, with more choices to travel and a wider range of activities, which will promote older people's participation in activities.

Accessibility to parks, hypermarkets, and public canteens has a significant positive effect on the level of social function only; Older residents who have better access to parks are more likely to engage in recreational behaviours such as walking and talking in parks, as well as forming relatively fixed 'circles' of interaction, thus receiving more instrumental support; Settlements close to large supermarkets tend to be in relatively busy and convenient, with more opportunities for socialising; The availability of public canteens is a strong attraction for elderly residents, who are willing to eat there, and many of them eat regularly in groups, resulting in a better satisfaction of social participation.

The number of pharmacies or clinics, accessibility to stores and bus stops have a significant positive effect on social support, and overall facility satisfaction also has some positive effect on residents' social support. That easy access to public transport contributes significantly to all four types of social support. Older adults in neighbourhoods with better retail accessibility and higher facility satisfaction tend to have more instrumental support. That is, they often have trusted people to help them with errands, chores and care.

Spatial design. The design of public spaces, walking environments, and spatial quality influence the social relationships of the elderly significantly. The safe and smooth walking environment has the strongest positive influence on social support. In contrast, public spaces with better infrastructure tend to offer lower levels of emotional and informational support, as such spaces are typically found in newer residential areas with weaker neighborly ties. However, housing quality, landscaping, and sanitation have a positive effect on social relationships, as higher environmental quality encourages the elderly to engage in outdoor activities, providing more opportunities for social interaction and fostering friendships.

Social environment. The social environment significantly influences the social health of the elderly. Key factors include the proportion of elderly residents, community services, cohesion, and community type. Communities with a higher elderly population see greater social participation, as members of the same age group share common interests and concerns, which facilitates lasting friendships. Frequent community activities and a welcoming atmosphere enhance community identity, providing emotional support and companionship, and preventing social isolation, which improves social health. However, property management shows a negative correlation with social health: older communities with less effective management often foster closer neighborly ties, while newer communities with better management tend to have more distant relationships among residents.

Sociodemographic characteristics. The study found that advancing age has a negative effect on the participation in social activities among older people, but due to physical limitations, older people tend to

receive more attention or be cared for by their loved ones. In terms of literacy, people with bachelor's degrees tend to be supported by more tools as they have a greater knowledge base and more technical types of occupations. Those who are self-employed had lower levels of social participation because they spend a great deal of their time in the shops they operate, taking up time and energy for other social participation.

In terms of mode of residence, those living with couple or children have better social health than those living alone. In terms of income, seniors at higher income levels (more than 5k yuan per month) also have better social health. People with limited outdoor walking, public transport and interactions tend to have significant negative impacts on their social functioning. In terms of online social, the elderly who do not use the Internet and those who use online social interaction many times a week have a better level of social activities. The former prefers face-to-face communication, while the latter communicates with relatives and friends because of making good use of the Internet.

In addition, in terms of community types, the level of tool support and information support for the elderly in the newly-built commercial housing community is higher than that in the old unit. They generally have a good economic foundation, and most of them live in husband and wife, or go to their children's residence to help look after their grandchildren, so they will be more likely to get advice and help from their relatives when they are in trouble.

5. Discussion and conclusion

Amid rapid urban and community changes, the social health challenges of the elderly require attention. This study, using survey data, highlights differences in the built environment and social health between communities developed before and after housing reform. Factor analysis and multiple regression identify key environmental factors influencing elderly social health, including facility quantity and accessibility, walking conditions, public space design, and the social environment. Overall, elderly residents in older work-unit communities perceive stronger neighborhood trust and sense of belonging, with better facilities. However, community services and spatial quality still require improvement. In contrast, commercial housing communities offer more comprehensive services, property management, and user-friendly designs, providing greater instrumental and informational support. However, neighborly relationships tend to be weaker, highlighting the need for a warmer environment. To address the diverse spatial resources and heterogeneous needs, various renewal strategies are necessary to create more elderly-friendly community environments.

This study is, of course, limited by the subjectivity of data collection, and the scientific rigor of the scales and questionnaires can still be further improved. Future research should focus on the following areas, with an emphasis on the social dimensions of healthy cities. First, the interaction effects between different aspects of the built environment on social health need further investigation. For instance, activity spaces may mitigate the impact of spatial proximity. Moreover, the influence of various spatial design elements on social relationships may not be independent, highlighting the need for a comprehensive analysis of multiple dimensions of the built environment to better understand these complex interactions. Second, it is important to explore the marginal utility of the built environment on social health. Some studies suggest that factors like population density may have threshold effects on social activities. Understanding these nonlinear relationships can lead to more targeted and practical strategies. Finally, future research should explore these dynamics across various population groups and cultural contexts.

Table 5. Associations between community environment and elderly individuals' social health (Model 1 - Model 3). Source: Author's own research

Variable		Model 1		Model 2		Model 3	
		R2	0.510	R2	0.593	R2	0.468
		B	S.E.	B	S.E.	B	S.E.
Constant		32.834***	4.230	41.579***	3.312	18.704***	4.674
Number of facilities	Park	-0.687**	0.339	-0.658**	0.265	-0.498	0.374
	Plaza	0.163	0.346	-0.079	0.271	-0.307	0.382
	Convenience store	-0.735	0.486	-0.015	0.381	-0.559	0.538
	Mall/supermarket	-0.341	0.343	0.180	0.269	0.665*	0.379
	Restaurant	-0.914**	0.424	-0.244	0.333	-0.536	0.468
	Active center	-0.045	0.409	-0.549*	0.320	-0.043	0.452
	Public canteen	-0.378	0.668	-0.190	0.524	0.404	0.738
	Clinic/Pharmacy	0.702	0.439	-0.391	0.344	0.418	0.485
	Bank/Post Office	0.488	0.403	0.395	0.316	0.092	0.446
	Bus station	0.889**	0.422	0.497	0.332	0.173	0.466
Accessibility of facilities	Park	0.599*	0.340	0.710***	0.266	0.423	0.375
	Plaza	-0.074	0.331	-0.128	0.259	-0.026	0.366
	Convenience store	0.422	0.472	0.331	0.370	0.173	0.522
	Mall/supermarket	0.875***	0.338	0.243	0.265	0.032	0.374
	Restaurant	0.504	0.390	-0.181	0.307	0.449	0.431
	Active center	-0.265	0.356	0.041	0.279	-0.204	0.393
	Public canteen	1.169**	0.547	0.726*	0.430	0.159	0.605
	Clinic/Pharmacy	0.049	0.423	0.485	0.332	-0.133	0.467
	Bank/Post Office	-0.386	0.374	-0.322	0.294	0.066	0.413
	Bus station	-0.259	0.393	0.346	0.309	1.230***	0.434
Overall satisfaction		0.494	0.453	0.278	0.357	0.120	0.501
Open space design	Afforestation	0.374	0.460	0.295	0.362	0.875*	0.509
	Activity facility	0.43	0.449	0.185	0.352	-0.164	0.496
	Infrastructure	0.419	0.462	-0.263	0.362	-0.900*	0.510
Walkability	Pedestrian infrastructure	-0.159	0.412	0.269	0.323	0.163	0.456
	Street connectivity	0.466	0.429	0.101	0.336	-0.056	0.474
	Safety leveling	-0.267	0.350	-0.228	0.274	-0.052	0.387
Environmental quality	Lighting	0.217	0.296	-0.213	0.232	-0.156	0.327
	Rest facilities	-0.227	0.363	-0.160	0.286	0.509	0.401
	Fitness facilities	-0.109	0.352	0.188	0.277	-0.003	0.390
	Regular maintenance	0.563*	0.288	0.259	0.226	-0.091	0.318
	Barrier-free facilities	-0.181	0.294	0.330	0.230	0.079	0.325
	Housing quality	-0.221	0.297	0.244	0.233	0.238	0.328
	Landscape	0.386	0.359	0.057	0.281	-0.060	0.397
	Sanitary	-0.203	0.304	-0.179	0.239	0.730***	0.336
Pop. Structure	Old population proportion	0.699***	0.352	0.083	0.276	0.042	0.389
	Organizations/Activities	0.492*	0.288	0.227	0.226	0.517	0.319
	Property management	-1.064***	0.317	0.259	0.249	-0.373	0.350
	Neighborhood Atmosphere	0.365	0.477	0.537	0.377	1.379***	0.527
	Trust	0.396	0.504	0.310	0.395	0.076	0.556
Community cohesion	Community identity	0.415	0.392	0.140	0.308	0.852	0.434
Age		-0.043	0.040	-0.091***	0.031	0.096**	0.044
Education Level	Primary School or Below	0.000	--	0.000	--	0.000	--
	Junior High School	-0.647	0.706	0.015	0.553	0.933	0.780
	Senior High School / Technical School	0.35	0.832	0.160	0.652	1.811**	0.919
	Junior College	0.019	1.232	-0.250	0.966	1.561	1.362
	Bachelor's Degree or Above	1.614	1.451	1.832	1.138	2.117	1.603
Pre-retirement occupation	Management Staff of Enterprises	0.000	--	0.000	--	0.000	--
	Government Staff	-0.504	1.092	-1.626*	0.855	-2.618**	1.206

Variable		Model 1		Model 2		Model 3	
		B	S.E.	B	S.E.	B	S.E.
Living Arrangement	Professional Staff (Doctors, Teachers, Lawyers, etc.)	-0.802	0.878	-1.066	0.688	-1.679*	0.970
	Self-employed	-2.226*	1.259	-0.962	0.986	0.043	1.391
	Commercial/Service Industry Workers	0.017	1.128	-0.784	0.884	-0.560	1.247
	Migrant Workers	-0.247	1.024	-0.447	0.802	-0.637	1.132
	Unemployed	-0.01	1.544	-0.623	1.209	-1.612	1.706
	Other Occupations	-1.07	1.538	-3.105***	1.204	-2.867*	1.699
	Alone	0.000	--	0.000	--	0.000	--
	With Spouse	0.939	0.704	0.687	0.552	2.824***	0.778
	With Children	-0.044	0.811	1.633**	0.635	2.343***	0.896
	With Spouse and Children	0.73	1.012	0.983	0.792	3.309***	1.118
	Other	3.933	2.504	3.820*	1.961	-2.008	2.767
	Below 2k	0.000	--	0.000	--	0.000	--
	2k-5k	0.741	0.790	0.563	0.619	-0.086	0.873
	5k-10k	-0.052	1.077	1.115	0.846	1.015	1.190
	10k-30k	6.623*	2.939	1.518	2.302	2.073	3.248
Online Social Frequency	Never	0.000	--	0.000	--	0.000	--
	Rarely	0.661	0.837	1.434**	0.659	-0.438	0.925
	Once a Month	0.543	1.597	1.300	1.251	-3.915**	1.764
	Weekly or More Frequently	1.062	0.738	1.145**	0.578	0.295	0.816
Physical Limitations	Limited Outdoor Walking	-3.585***	1.091	-2.623***	0.855	-0.327	1.205
	Limited Use of Public Transport	-2.57***	0.928	-2.202***	0.728	-1.937*	1.026
	Limited Outdoor Socializing	-0.5	1.333	-3.714***	1.044	-0.452	1.473
Length of Residence		0.016	0.020	0.003	0.016	0.044*	0.022
Community Type		0.942	0.686	0.104	0.538	0.534	0.758

*p<0.1(weak correlation), **p<0.05(moderate correlation), ***p<0.01(strong correlation)

Table 6. Associations between community environment and elderly individuals' social health (Model 4 - Model 6). Source: Author's own research

Variable		Model 4		Model 5		Model 6	
		R2	0.405	R2	0.408	R2	0.501
		B	S.E.	B	S.E.	B	S.E.
Constant		36.971***	4.969	34.798***	5.103	19.189***	4.929
Number of facilities	Park	-0.681**	0.398	-0.810**	0.408	-0.069	0.395
	Plaza	-0.160	0.406	-0.514	0.417	-0.286	0.403
	Convenience store	-0.615	0.571	-1.099*	0.587	-0.378	0.567
	Mall/supermarket	-0.123	0.403	0.581	0.414	0.409	0.400
	Restaurant	-0.732	0.498	-1.252**	0.511	-0.119	0.494
	Active center	-0.054	0.480	-0.459	0.493	-0.580	0.476
	Public canteen	0.147	0.785	-0.167	0.806	0.819	0.778
	Clinic/Pharmacy	0.195	0.516	-0.131	0.529	1.038**	0.511
	Bank/Post Office	-0.459	0.474	-0.563	0.487	-0.329	0.470
	Bus station	-0.819*	0.496	-1.066**	0.509	0.147	0.492
Accessibility of facilities	Park	0.671*	0.399	0.331	0.410	0.318	0.396
	Plaza	-0.527	0.389	-0.238	0.399	-0.110	0.386
	Convenience store	1.183**	0.555	0.924	0.570	-0.199	0.550
	Mall/supermarket	0.406	0.397	-0.229	0.408	0.047	0.394
	Restaurant	-0.161	0.458	0.187	0.471	0.180	0.455
	Active center	0.029	0.418	0.032	0.430	0.170	0.415
	Public canteen	-0.623	0.643	0.420	0.660	-0.138	0.637
	Clinic/Pharmacy	-0.813	0.497	-0.034	0.510	-0.600	0.493
	Bank/Post Office	0.518	0.440	0.338	0.451	0.380	0.436
	Bus station	1.149**	0.462	1.555***	0.474	1.533***	0.458
Overall satisfaction		1.279**	0.532	0.638	0.546	0.539	0.528

Variable		Model 4		Model 5		Model 6	
		B	S.E.	B	S.E.	B	S.E.
Open space design	Afforestation	-0.476	0.541	0.254	0.555	0.997*	0.536
	Activity facility	0.686	0.527	0.597	0.542	-0.523	0.523
	Infrastructure	-0.761	0.543	-1.109**	0.557	-0.808	0.538
Walkability	Pedestrian infrastructure	0.303	0.485	0.232	0.498	0.476	0.481
	Street connectivity	-0.581	0.504	-0.061	0.517	-0.188	0.500
	Safety leveling	0.671	0.411	1.173***	0.422	0.277	0.408
Environmental quality	Lighting	-0.055	0.347	0.333	0.357	-0.076	0.344
	Rest facilities	0.277	0.427	0.531	0.438	0.616	0.423
	Fitness facilities	-0.266	0.414	-0.149	0.425	-0.219	0.411
	Regular maintenance	0.166	0.338	0.082	0.347	0.065	0.335
	Barrier-free facilities	-0.647*	0.345	-0.496	0.354	-0.345	0.342
	Housing quality	0.451	0.349	0.870**	0.359	0.033	0.346
	Landscape	0.899**	0.422	0.329	0.433	0.635	0.418
	Sanitary	0.091	0.358	0.489	0.367	-0.113	0.355
Pop. Structure	Old population proportion	0.267	0.414	0.044	0.425	0.146	0.411
Community service	Organizations/Activities	-0.159	0.339	0.125	0.348	0.663**	0.336
	Property management	-1.072***	0.372	-1.034***	0.382	-0.440	0.369
Community cohesion	Neighborhood Atmosphere	0.586	0.560	0.836	0.575	0.456	0.556
	Trust	-0.278	0.591	-0.101	0.607	0.714	0.587
	Community identity	0.347	0.461	0.384	0.473	0.900**	0.457
Age		0.089*	0.047	0.120**	0.048	0.068	0.046
Education Level	Primary School or Below	0.000	--	0.000	--	0.000	--
	Junior High School	1.333	0.829	0.065	0.852	0.823	0.823
	Senior High School / Technical School	1.356	0.977	0.767	1.004	1.486	0.969
	Junior College	1.644	1.448	0.739	1.487	1.014	1.436
	Bachelor's Degree or Above	3.390**	1.705	2.100	1.750	1.784	1.691
Pre-retirement occupation	Management Staff of Enterprises	0.000	--	0.000	--	0.000	--
	Government Staff	-1.643	1.283	-2.642**	1.317	-3.610***	1.272
	Professional Staff (Doctors, Teachers, Lawyers, etc.)	-1.273	1.031	-1.080	1.059	-2.055**	1.023
	Self-employed	2.271	1.479	1.385	1.518	-0.025	1.467
	Commercial/Service Industry Workers	0.948	1.326	-0.946	1.361	-1.167	1.315
	Migrant Workers	1.667	1.203	1.298	1.235	0.375	1.193
	Unemployed	-1.656	1.814	-2.710	1.863	-2.127	1.799
	Other Occupations	-0.244	1.806	-2.245	1.855	-2.239	1.792
Living Arrangement	Alone	0.000	--	0.000	--	0.000	--
	With Spouse	4.354***	0.827	2.302***	0.849	2.265***	0.820
	With Children	6.774***	0.953	5.377***	0.978	2.109**	0.945
	With Spouse and Children	5.712***	1.189	4.320***	1.221	2.741**	1.179
	Other	-0.084	2.942	0.451	3.021	-2.671	2.918
Monthly Income(Pension)	Below 2k	0.000	--	0.000	--	0.000	--
	2k-5k	0.281	0.928	0.853	0.953	0.194	0.921
	5k-10k	2.730**	1.265	2.818**	1.299	1.271	1.255
	10k-30k	0.906	3.453	4.472	3.546	6.684	3.425
Online Social Frequency	Never	0.000	--	0.000	--	0.000	--
	Rarely	1.152	0.983	0.938	1.010	0.870	0.975
	Once a Month	-0.051	1.876	-0.678	1.926	-3.826**	1.860
	Weekly or More Frequently	0.468	0.867	0.203	0.890	1.104	0.860
Physical Limitations	Limited Outdoor Walking	-0.044	1.281	-0.353	1.316	-1.718	1.271
	Limited Use of Public Transport	0.261	1.090	-1.674	1.120	-1.859*	1.082
	Limited Outdoor Socializing	0.062	1.566	0.680	1.608	-2.167	1.553
Length of Residence		-0.009	0.024	-0.007	0.024	0.039*	0.024
Community Type		2.338***	0.806	1.365*	0.827	1.194	0.799

*p<0.1(weak correlation), **p<0.05(moderate correlation), ***p<0.01(strong correlation)

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT in order to improve language. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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