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A Study on the Impact of Perceived Built Environment on Elderly Communication Activities in Old Communities

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Abstract

China is entering an aging society, and social interaction activities can improve the physical health quality of the elderly, maintain an optimistic and positive attitude towards life, and also contribute to the creation of an atmosphere of neighborhood integration in residential areas. As the main gathering place for middle-aged and elderly people in cities, a deep understanding of the impact of the built environment of old communities on their social activities is an important way to promote the physical and mental health of the elderly. Based on domestic and foreign literature, multiple evaluation indicators of built environment factors affecting elderly activities were selected. Two typical old communities with high community vitality in Mianyang City were used as research samples to conduct a questionnaire survey on the elderly population in the community. The results of 300 phenotypic questionnaires were obtained as the data basis, and SPSS and Amos software were used for data analysis to construct a Structural Equation Model (SEM) model. The research results indicate that the built environment has a positive impact on the communication activities of elderly people through dynamic and static communication activities.

Subject Areas

Sociology

Keywords

Old Community, Perceiving the Built Environment, Elderly People, SEM, Social Activities

1. Research Background

According to the main data of the 7th National Population Census, China has a population of 264 million people aged 60 and above, accounting for 18.7%, and a population of 190 million people aged 65 and above, accounting for 13.5%. The proportion of elderly people is still increasing year by year, and population aging is an inevitable trend in China's social development, and China will also be in this stage for a long time. Under the high concentration of urban elderly population, communities are the main places for elderly people to engage in daily life and social activities. The old communities built in the 1980s and 1990s have a large number and area, forming the most basic functional unit of the city. However, over time, on the one hand, the physical environment of the community has generally begun to age, and in the early stages of its construction, the configuration standards of elderly care service facilities are also low, and their supporting functions are no longer able to meet the needs of contemporary elderly urban life. Old communities are the main gathering places for middle-aged and elderly people in cities, and strengthening the construction of the old community environment is an important way to promote social and physical activities for the elderly, and improve their physical and mental health. Existing theories suggest that community-built environments have become important determinants of social activities and health for elderly people, as their physical functions decline, their social adaptability declines, and they become more vulnerable to external environments.

Early empirical studies often used simple linear regression models to explore the impact of built environment on physical activity. Internationally, research represented by North America, Europe, and Australia has focused on the impact of different built environment characteristics on various activities. The built environment characteristics related to elderly activities mainly include residential areas, accessibility to various places, walking environment, population density, public transportation, etc. Research has shown that the shorter the distance between the departure and destination, the more beneficial it is to increase the opportunities for elderly people to engage in physical activity 13 [1], and it is easier to meet the opportunities for physical activity. The accessibility of community centers [2], parks and water areas, sports facilities, and other places can affect residents, especially elderly people [3], in terms of willingness and frequency to engage in activities [4]. Domestic scholars have conducted a certain degree of research on factors such as the configuration and form of outdoor public spaces that affect elderly activities. Scholars such as Chen Xiaowei [5] have found through their research on the environmental elements of urban park construction that the form and layout of activity spaces, the configuration of public facilities, and the quality of physical environment are the most important influencing factors for elderly activities. Jiang Yuqian [6] explored the impact of lifestyle streets on social interaction activities from both time and space perspectives, and found that 17:00 to 19:00 at night and 11:00 to 13:00 at noon were the most active periods, with gathering points easily formed at entrances and near facilities. Dong Hexuan [7] compared and analyzed three residential areas in Wuhan, and based on typology and structural equation models, studied and analyzed the characteristics of urban elderly communication behavior and spatial environment, as well as the correlation between the two. He believed that the landscape environment, service facilities, and spatial location of the activity space had a strong positive correlation with elderly communication activities. Li Jingwei [8] and others investigated the impact of a community-built environment on elderly communication activities from five dimensions: community location, accessibility, pedestrian environment, population density, and public transportation.

2. Overview of Research Samples

2.1. Study Sample Selection

The old community defined in this article refers to a certain range of old communities that were built earlier, had incomplete basic functions, lacked supporting facilities, had a dilapidated green environment, and had renewal value. After on-site research and investigation, Tieniujie Community and Yuebei Community were selected as research samples. Tieniu Square and Wuyi Square are the most popular public activity venues in the community, often gathering a large number of elderly people for social activities. Although there are significant differences in land area and population size between these two communities, the aim of this study is to explore the degree of correlation between elderly interaction activities and various built environment factors, as well as the relationship between various variables. The size of the research sample will not have an impact on the research results. In addition, the two research samples have good positive feedback on natural landscape, infrastructure, and the number of elderly population, and are the main places for urban residents in the region.

2.2. Research Scope

The built environment differs from the natural environment in that it is composed of various buildings and places designed and constructed by humans. It is a combination of land use patterns, transportation systems, and a series of elements related to urban design. It can affect the physical activities of residents and is closely related to their quality of life. The impact of community-built environment elements on physical or social activities of the elderly population can be divided into objective indicators of built environment and subjective perception variables from a research perspective. The objective built environment includes facility diversity, road connectivity, location reachability and density. Subjectively perceived built environment includes comfort, safety, aesthetics, reachability, etc. Based on existing research foundations, research on community-built environments related to elderly activities mainly focuses on behavioral feature analysis and identification of influencing factors, and focuses on the impact of objective built environments on elderly behavior and activities, lacking subjective environmental perception of the elderly. In terms of element selection, this study starts from the perceptible factors of the built environment of the old community, which is divided into five aspects: safety, comfort, aesthetics, reachability, and facility completeness. It explores the impact of the built environment of the old community on the communication activities of the elderly from a multi-dimensional perception perspective.

3. Research Design

3.1. Model Indicator Selection

Jon Lang believes that there is a dynamic interaction process driven by human needs between humans and the environment, where the environment creates the possibility of behavior by providing 'supply'. The behavioral activities of the elderly are constrained and influenced by various elements of the built environment. The behavioral characteristics of the elderly population are dependent variables, while the built environment elements are independent variables (Table 1). The study sorts and analyzes relevant key literature at home and abroad, summarizes the classification of the environmental impact of park construction, and extracts evaluation indicators for characterization variables. According to existing studies, the impact of built environment on the activities of the elderly can be classified into reachability, comfort, safety, aesthetic perception (attractiveness), and each evaluation indicator corresponds to one or more impact classifications. Community public space is the most important usage space for the middle-aged and elderly population in cities, and the form, scale, and venue function of public activity space will have an impact on the outdoor activities of the elderly. Based on previous literature review and field research, this paper divides the perceptible elements of the built environment into five aspects: safety, comfort, aesthetics, reachability and facility completeness, and selects five secondary indicators under each primary indicator as observation variables to explore the impact of the built environment of the old community on the communication activities of the elderly. The questionnaire is based on literature review and field research.

3.2. Model Construction

Based on the general consensus that the more suitable the allocation of community building environment elements, the higher the satisfaction of elderly groups with activities, this study proposes multiple theoretical hypotheses for the model, and the designed related variables all belong to a positive correlation relationship. On this basis, this article proposes an initial structural equation model to evaluate the impact of environmental factors on the behavior of the elderly population in old communities, as shown in Figure 1.

3.3. Questionnaire Design and Collection

The questionnaire design is divided into two parts. The first part is the statistics of the basic characteristics of the surveyed elderly population, including gender, age, travel frequency, activity duration, etc. The second part is the evaluation of environmental factors and activity satisfaction in the construction of old

Table 1. Evaluation indicators of environmental factors for the construction of old communities.

Latent variable	observation variable
Safety	A1 lighting level
	A2 Community Security
	A3 road surface smoothness
	A4 Motor Vehicle Flow
	A5 pedestrian and vehicle diversion
Comfort	B1 Pedestrian Road Width
	B2 pavement
	B3 Activity Area
	B4 Air quality
	B5 noise
Aesthetics	C1 Plant richness
	C2 color saturation
	C3 Environmental Hygiene
	C4 Cultural Landscape
	C5 Piece Quantity
Reachability	D1 sidewalk connectivity
	D2 Number of entrances and exits
	D3 reachability of entertainment places
	D4 reachability of traffic stops
	D5 reachability of public service facilities
Facility completeness	F1 fitness equipment
	F2 recreational facilities
	F3trash can
	F4 Toilet
	F5 sunshade and rain shelter facilities
Dynamic Communication Activity	G1 Group Dance
	G2 Ball Games
	G3 Walking and Running
	G4 equipment exercise
Static Communication Activity	P1 Chess and Card
	P2 Chat
	P3 onlookers
	P4 Use of Electronic Products

Continued

Subjective Happiness	Q1 Full of fun in communication Q2 Relieve stress after socializing Q3 Feeling relatively comfortable after socializing Q4 Communication makes me feel satisfied with life Q5 I will recommend this place for social activities to others

Source: author's own drawings.

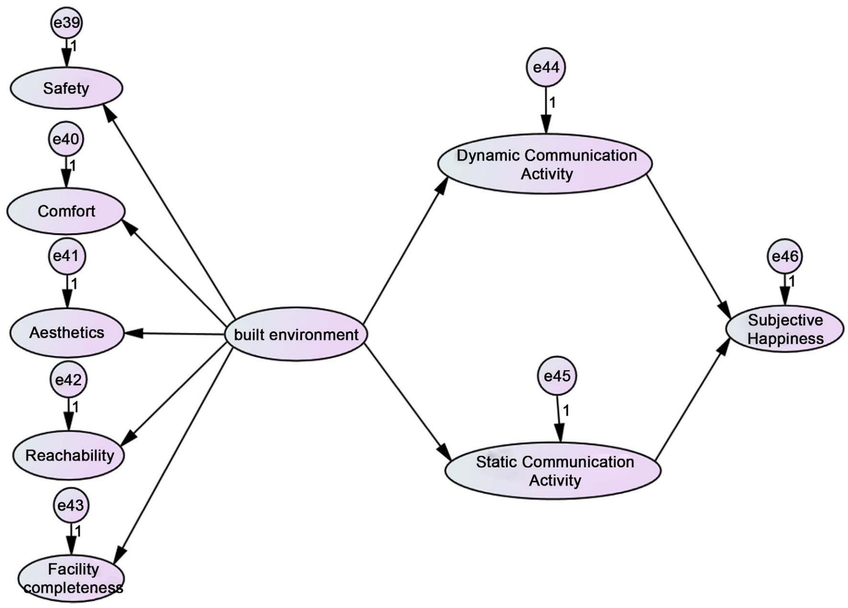

Figure 1. Theoretical initial model.

communities, including 5 items, a total of 25 items, corresponding to the observation indicators in the table above; The second part is the scale title, using the Likert 5-level scale format. In order to ensure the effectiveness of the questionnaire and take into account the cultural limitations and physical factors of some elderly people, most of them directly communicated with the elderly through questionnaire interviews. From April to May 2023, on-site questionnaire interviews were conducted in the sample communities. It is planned to collect 150 questionnaires from each community, and a total of 283 questionnaires were actually collected.

4. Result Analysis

4.1. Analysis of Population Characteristics

Analyze and statistically analyze the population characteristics of the collected questionnaire results from four aspects: age, gender, activity frequency, and activity purpose. More than half of the elderly with a balanced gender ratio in the surveyed population are in the age range of 60 - 70 years old. At this stage, the physical function of the elderly has not significantly deteriorated and most of them are in retirement. They have more energy and time to engage in outdoor activities. Community public space is their main activity place; According to statistics, more than half of the elderly go to community public spaces every day for entertainment, fitness and other social activities. The proportion of elderly people who take walks, runs, and other activities is the highest, at 53.92%, followed by ball games, indicating that elderly people now pay more attention to physical health. (Table 2)

4.2. Reliability and Validity Testing

Reliability refers to the consistency, stability, and reliability of measurement results, that is, whether the measurement tool can stably and reliably measure the measured object or variable; Validity refers to the effectiveness of a measurement tool, which refers to the degree to which a questionnaire scale used as a measurement tool can accurately measure the subject variable. Before conducting confirmatory silver analysis using structural equations in this study, it is necessary to conduct reliability and validity tests on the questionnaire scale. This study uses the Cronbach's alpha to judge the reliability of the questionnaire. Cronbach's alpha coefficient is positively correlated with the internal reliability of the questionnaire. SPSS software is used to analyze each variable. The overall Cronbach's alpha coefficient is 0.933. It can be seen from Table 3 that the Cronbach's alpha coefficients of safety, comfort, aesthetics, reachability, facility completeness, dynamic communication activities, static communication activities and the subjective well-being of the elderly are 0.864, 0.902, 0.841, 0.860, 0.873 and 0.788 respectively. The reliability test results of all indicators in the questionnaire are greater than the standard of 0.7, indicating that the recovered scale data have good internal consistency, further analysis is possible.

Validity analysis used principal component analysis and maximum variance rotation method to extract common factors for each measurement item. Based on KMO test and Bartlett's spherical test for variables (Table 4), factor load was used as a measure of structural validity. From Table 5 it can be seen that the factor load of each measurement item is greater than 0.5 of the extraction standard, indicating that the model has good structural validity and has been further validated.

4.3. Confirmatory Factor Analysis of Built Environment Elements

Use Amos software to conduct confirmatory factor analysis on the dimensional composition of built environment elements. The standardized factor load of each measurement index of safety, comfort, aesthetics, reachability and facility completeness is more than 0.6, and the combined reliability (CR) of each variable is between 0.842 - 0.902, indicating that the variable settings are reasonable and the internal consistency of the measurement results is good, and the average variance extraction (AVE) is more than 0.5, which proves that each variable has good convergence validity, as shown in Table 6.

Table 2. Basic characteristics of the elderly.

Indicators	Category	Category	Percentage
Sex	Male	195	51.05%
	Female	187	48.95%
Age	60 - 69 years old	142	37.33%
	70 - 79 years old	121	31.76%
	80 - 85 years old	71	18.36%
	Over 85 years old	48	12.66%
Education level	Can't read	9	2.23%
	Primary or junior high school	171	44.91%
	High School or vocational school	154	40.2%
	College degree or above	48	12.66%
Family structure	Living alone	7	1.74%
	Couples cohabit	267	69.98%
	Two generations living together	62	16.13%
	Three generations living together	46	12.16%
Monthly income	Below $2000	114	29.53%
	2000 - 4000 yuan	193	50.62%
	4000 - 6000 yuan	54	14.14%
	6000 - 8000 yuan	15	3.97%
	Over $8000	6	1.74%
Self-rated health	Very bad	12	3.23%
	Bad	35	9.18%
	General	99	25.56%
	Relatively healthy	155	40.69%
	Very healthy	81	21.34%
Years of residence	Within 1 year	6	1.49%
	1 - 5 years	23	5.96%
	5 - 10 years	179	46.9%
	10 - 20 years	124	32.51%
	More than 20 years	50	13.15%
Types of communication activities	Group Dance	259	64.27%
	ball game	130	32.26%
	Walk, run	361	89.58%
	Mechanical movement	193	47.89%
	Chess and cards	194	48.14%
	Chat	205	50.87%

Continued

Types of communication activities	Watch	211	52.36%
	SIT still	255	63.28%
	Other	4	0.99%
Frequency of contact	Once a day	14	3.47%
	Many times a day	48	12.66%
	Once a week	174	45.66%
	Several times a week	146	38.21%
Length of association	Less than 10 minutes	37	9.68%
	10 - 30 minutes	157	41.19%
	30 - 60 minutes	134	34.99%
	More than 60 minutes	54	14.14%
Time for socializing	5:00 - 9:00	44	10.92%
	9:00 - 12:00	363	90.07%
	12:00 - 15:00	94	23.33%
	15:00 - 18:00	157	38.96%
	18:00 - 21:00	305	75.68%

Table 3. Reliability analysis.

Dimension	Question items	CITC	Cronbach's alpha after project deletion	Cronbach's alpha
Safety	A1	0.724	0.886	0.901
	A2	0.759	0.878	
	A3	0.748	0.880	
	A4	0.766	0.876	
	A5	0.772	0.876	
Comfort	B1	0.706	0.846	0.874
	B2	0.699	0.848	
	B3	0.706	0.846	
	B4	0.725	0.842	
	B5	0.675	0.854	
Aesthetics	C1	0.687	0.848	0.872
	C2	0.696	0.846	
	C3	0.696	0.846	
	C4	0.730	0.838	
	C5	0.687	0.848	
Reachability	D1	0.757	0.859	0.889
	D2	0.715	0.869	
	D3	0.717	0.869	

Continued

Reachability	D4	0.728	0.866	0.889
	D5	0.737	0.864	
Facility completeness	F1	0.745	0.859	0.887
	F2	0.726	0.863	
	F3	0.711	0.866	
	F4	0.769	0.854	
	F5	0.691	0.872	
Dynamic Communication Activity	G1	0.704	0.806	0.852
	G2	0.658	0.826	
	G3	0.688	0.813	
	G4	0.718	0.800	
Static Communication Activity	P1	0.662	0.805	0.841
	P2	0.681	0.796	
	P3	0.684	0.796	
	P4	0.676	0.799	
Subjective Happiness	Q1	0.670	0.847	0.868
	Q2	0.701	0.838	
	Q3	0.706	0.837	
	Q4	0.697	0.840	
	Q5	0.689	0.842	

Table 4. KMO and Bartlett's test.

KMO sampling suitability quantity		0.923
Bartlett test of sphericity	Approximate Chi square	8429.310
	df	703
	Sig.	0.000

Table 5. Exploratory factor analysis.

Component	Question items	Factor load	Eigenvalue	Variance percentage	Accumulated %
Accessibility	D5	0.802	11.090	29.184	29.184
	D1	0.802			
	D4	0.783			
	D3	0.773			
	D2	0.765			
Facility completeness	F1	0.806	2.873	7.561	36.746
	F3	0.800			
	F4	0.797			
	F2	0.792			
	F5	0.763			

Continued

Comfort	B4	0.797	2.756	7.254	43.999
	B1	0.781			
	B2	0.778			
	B3	0.770			
	B5	0.766			
Subjective Happiness	Q3	0.778	2.323	6.112	50.111
	Q2	0.777			
	Q4	0.775			
	Q5	0.758			
	Q1	0.752			
Aesthetics	C4	0.800	2.192	5.768	55.880
	C5	0.761			
	C1	0.758			
	C3	0.749			
	C2	0.738			
Safety	A3	0.731	1.883	4.956	60.835
	A4	0.728			
	A5	0.723			
	A2	0.716			
	A1	0.692			
Dynamic Communication Activity	G1	0.811	1.668	4.389	65.225
	G4	0.792			
	G2	0.785			
	G3	0.778			
Static Communication Activity	P3	0.786	1.396	3.674	68.898
	P1	0.785			
	P4	0.770			
	P2	0.751			

Table 6. Confirmatory factor analysis results.

Latent Variable	Question items	Factor load	CR	AVE
Safety	A5	0.823	0.902	0.647
	A4	0.817		
	A3	0.795		
	A2	0.813		
	A1	0.774		

Continued

Comfort	B5	0.729	0.875	0.583
	B4	0.788		
	B3	0.776		
	B2	0.755		
	B1	0.767		
Aesthetics	C5	0.744	0.873	0.579
	C4	0.790		
	C3	0.762		
	C2	0.760		
	C1	0.749		
Accessibility	D5	0.789	0.890	0.618
	D4	0.782		
	D3	0.770		
	D2	0.772		
	D1	0.817		
Facility completeness	F5	0.738	0.889	0.616
	F4	0.839		
	F3	0.752		
	F2	0.783		
	F1	0.807		
Dynamic Communication Activity	G1	0.784	0.852	0.590
	G2	0.715		
	G3	0.758		
	G4	0.813		
Static Communication Activity	P4	0.758	0.842	0.571
	P3	0.761		
	P2	0.776		
	P1	0.727		
Subjective Happiness	Q1	0.726	0.869	0.571
	Q2	0.769		
	Q3	0.773		
	Q4	0.754		
	Q5	0.754		

4.4. Regression Analysis of Built Environment Elements

The Amos structural equation model was used to verify and analyze the causal relationship between the environmental factors of old communities and the satisfaction of elderly population activities. The overall fit index was used to test the suitability of the hypothesis model and sample data. From Table 7, it can be seen that the CMIN/DF is 1.070, below the standard of 3, and the GFI statistical value is 0.922, above 0.8. Within an acceptable range, the IFI, TLI, and CFI all meet the standard of 0.9 or above, The RMR is 0.07 less than 0.08, and the RMSEA is 0.022 less than 0.05. All fitting indicators meet rational standards, so it can be considered that this model has a good fit.

Using AMOS23.0 to perform calculations and using the maximum likelihood method for estimation, the results are shown in Figure 2: various built environment factors directly affect the activity level of the elderly, and the factors interact with each other. The built environment has an impact on the subjective well-being of elderly people through dynamic and static communication activities.

Table 7. Model fit test results.

Model fitting indicators	Optimal standard value	Statistical value	Fitting situation
CMIN/DF	<3	1.070	Good adaptation
RMR	<0.08	0.037	Good adaptation
GFI	>0.8	0.922	Good adaptation
AGFI	>0.8	0.909	Good adaptation
IFI	>0.9	0.994	Good adaptation
TLI	>0.9	0.994	Good adaptation
CFI	>0.9	0.994	Good adaptation
RMSEA	<0.05	0.013	Good adaptation

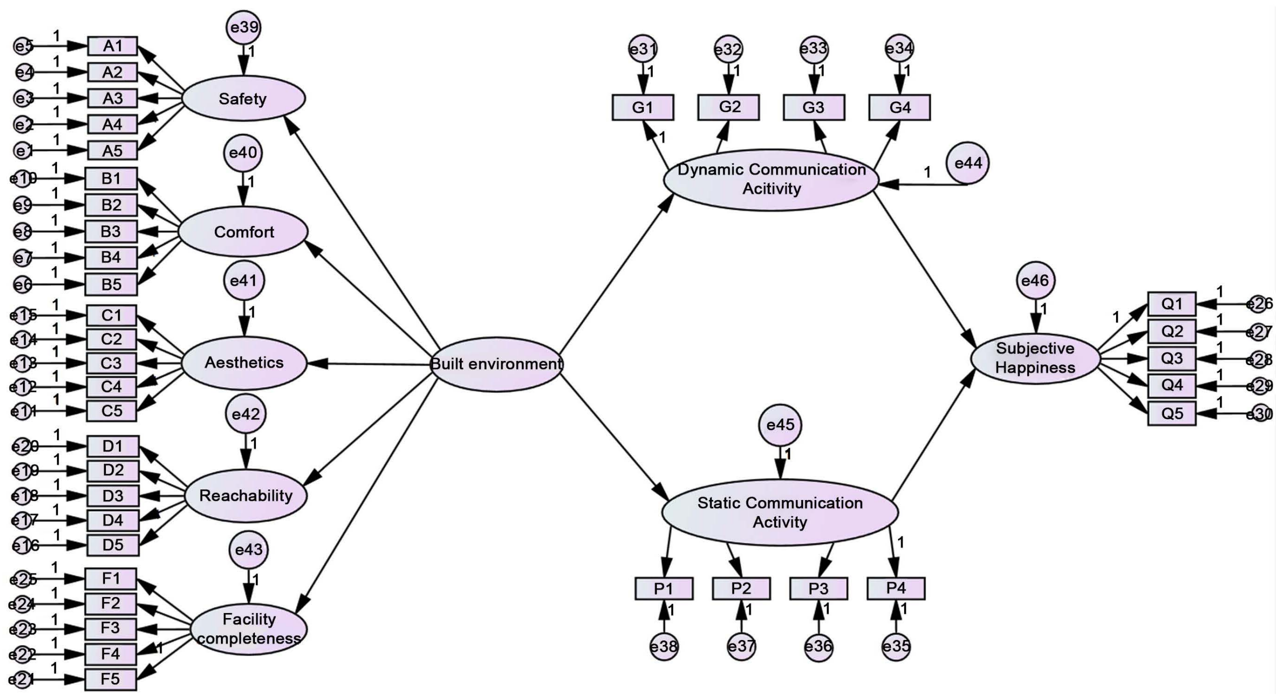

Figure 2. Model standardization path coefficient diagram.

1) The built environment has a significant positive direct impact on dynamic communication activities, with a path coefficient of 0.57. The correlation degree of each element of the built environment to the dynamic communication activities is: safety > aesthetics > reachability > facility completeness > comfort. The elderly have high requirements for the safety of places due to the decline of physical functions. Many elderly people choose to engage in social activities in safer places for their own health and to avoid causing trouble for their children.

2) The built environment has a significant positive direct impact on the static interaction activities of the elderly, with a path coefficient of 0.61. From this, it can be seen that elderly people are more inclined to engage in static social activities such as chess and cards, chatting, etc. However, static social activities are more likely to generate subjective happiness for elderly people.

5. Conclusion

The research on the relationship between the built environment and the level of residents' communication activities has become a hot topic in the world. In the face of increasingly severe population aging challenges, how to make use of built environment elements to actively intervene in the health of the elderly is an urgent problem to be solved in urban construction. Based on the literature review, 25 built environment factors related to the activities of the elderly were screened out in 5 categories. Two old communities in Mianyang were selected as research samples, based on nearly 300 questionnaires, this paper explores and analyzes the relationship between the subjective well-being of the elderly and the factors of the built environment, the influencing ways and the influencing relations among the variables, and then puts forward some countermeasures and suggestions for optimizing the built environment of the old community, the aim is to provide scientific and reasonable research support for the aging construction of the old community. The findings of this study confirm that the built environment of the old community has an impact on the level of social interaction activities of the elderly. First, the government and Urban Planning Departments should pay attention to the top-level design of community-built environment, building a safe, comfortable and convenient community environment; Finally, to create a safe and comfortable walking environment, improve the walking facilities in the community and increase the initial travel of the elderly, it is of great significance to improve the social interaction and physical and mental health of the elderly. In addition, attention should be paid to the needs of elderly groups and targeted optimization of the built environment should be carried out to improve the transformation of old communities.

Conflicts of Interest

The author declares no conflicts of interest.

References

[1] Troped, P.J., Tamura, K., Mcdonough, M.H., *et al.* (2017) Direct and Indirect Asso-

ciations between the Built Environment and Leisure and Utilitarian Walking in Older Women. *Annals of Behavioral Medicine*, **51**, 282-291. https://doi.org/10.1007/s12160-016-9852-2

[2] Perchoux, C., Kestens, Y., Brondeel, R., *et al.* (2015) Accounting for the Daily Locations Visited in the Study of the Built Environment Correlates of Recreational Walking. *Preventive Medicine*, **81**, 142-149. https://doi.org/10.1016/j.ypmed.2015.08.010

[3] Chen, P., Zhou, J.P. and Sun, F.Y. (2017) Built Environment Determinants of Bicycle Volume: A Longitudinal Analysis. *Journal of Transport & Land Use*, **10**, 655-674. https://doi.org/10.5198/jtlu.2017.892

[4] Nyunt, M.Z., Shuvo, F.K., Eng, J.Y., *et al.* (2015) Objective and Subjective Measures of Neighborhood Environment (NE): Relationships with Transportation Physical Activity among Older Persons. *International Journal of Behavioral Nutrition and Physical Activity*, **12**, Article No. 108. https://doi.org/10.1186/s12966-015-0276-3

[5] Chen, X.W., Liu, W.F. and Yang, C.H. (2022) Research on the Influence of Urban Park Built Environment Elements on the Activities of the Elderly. *South Architecture*, No. 12, 93-103. (In Chinese)

[6] Jiang, Y.Q. (2020) The Impact of Built Environment of Livable Streets on Social Interaction Activities: A Study. Master's Thesis, Harbin Institute of Technology, Harbin. (In Chinese) https://doi.org/10.27061/d.cnki.ghgdu.2020.005580

[7] Dong, H.X., Liu, X.M. and Pan, H.H. (2018) Analysis of Influences of Space Elements in Community Parks on Aging Communication and Design Adjustments Based on SEM—Taking Jiangbei Park in Jilin City as an Example. *Journal of Human Settlements in West China*, **33**, 18-26. (In Chinese) https://doi.org/10.13791/j.cnki.hsfwest.20180404

[8] Li, J.W., Fan, C.J. and Tian, L., *et al.* (2021) Study on the Impact of Neighborhood Built Environment on Social Activities of Elderly. *Human Geography*, **36**, 56-65. (In Chinese) https://doi.org/10.13959/j.issn.1003-2398.2021.01.008