Research Paper

Analysis of the influencing factors of urban street space on the health of people of all ages

Based on partial least squares structural equation model

Kai ZHANG, School of Architecture and Design, Harbin Institute of Technology, Key Laboratory of Cold Region Urban and Rural Human Settlement Environment Science and Technology, Ministry of Industry and Information Technology, China

Yushuang TANG, School of Architecture and Design, Harbin Institute of Technology, China

Xinrou HUANG, School of Architecture and Design, Harbin Institute of Technology, China

Lingran TAO, School of Architecture and Design, Harbin Institute of Technology, China

Yibo LIU, School of Architecture and Design, Harbin Institute of Technology, Key Laboratory of Cold Region Urban and Rural Human Settlement Environment Science and Technology, Ministry of Industry and Information Technology, China

Abstract

The positive impact of urban spatial environment on residents' health has increasingly become an important topic in the field of urban planning and design. Although existing research has extensively explored how urban spatial environments can meet the needs of residents of different age groups, a more in-depth analysis of the relationship between urban spatial environmental elements and the health of residents of different age groups is still lacking. This paper aims to fill this research gap by using the partial least squares structural equation model (PLS-SEM) to establish an evaluation system for creating health-friendly spaces for children, youth, and the elderly from the perspective of urban spatial environmental elements. The research results indicate that for children, creating a health-friendly urban street space should focus on landscape environment, site environment, transportation and nature, facilities and crowds. For the youth population, the design of health-friendly spaces should emphasize public facilities, landscape facilities, sports facilities, recreational facilities, transportation and cultural facilities. And for the elderly population, focusing on outdoor environments and infrastructure is crucial for creating a suitable urban spatial environment for their living and activities. These findings provide scientific basis and practical guidance on how to promote health-friendly spatial environments for residents of different age groups, especially in urban planning and design, and are of great significance for improving the overall well-being and quality of life of urban residents.

Keywords

Urban governance, Resident survey, Personal demand, Quantitative analysis

1. Introduction

The health level of urban residents is receiving increasing attention, with numerous countries and organizations successively implementing relevant policies(World Health Organization, 1986; Ministry of health, 2000; Healthy China Action Promotion Committee, 2019). Research has shown that the urban environment significantly affects residents' health, encompassing both physical(Cao, Handy and Mokhtarian, 2006; Boone-Heinonen *et al.*, 2010) and mental aspects(van den Berg et al., 2016; Rojas-Rueda et al., 2019; Birch, Rishbeth and Payne, 2020) . Although many scholars have conducted research on this issue from multiple perspectives, there are still shortcomings in the existing results. From a spatial perspective, most studies have focused on cities or residential areas as units of analysis regarding the impact of the environment on residents' health(Wang *et al.*, 2016; Gruebner *et al.*, 2017), lacking specific investigation into urban streets. Urban streets play a crucial role in facilitating various activities for residents, such as social interactions and exercise, and are one of the essential types of public space within cities(Tang and Long, 2019).

In terms of targeted groups, existing studies often focus on specific vulnerable populations, such as children or the elderly(Fitrinitia, 2019; Hsu and Bai, 2021), addressing only a subset of residents' health needs concerning the urban environment. However, health needs related to the urban environment can differ across age groups, and urban development should not solely prioritize the health needs of one particular group but should consider the health requirements of residents across multiple age brackets.

Surveys, as a method for gathering subjective feelings and opinions from respondents, are frequently employed in the fields of medicine and health(Duracinsky et al., 2007; Mikhail et al., 2020. This paper uses questionnaires to obtain feedback on health needs related to the urban environment from residents of different age groups—namely children, youth, and the elderly. Employing the PLS-SEM method, we construct separate evaluation frameworks for health-friendly urban street spaces tailored to each age group. This study aims to provide insights into residents' true health needs concerning urban street spaces, thereby assisting urban managers in improving the health levels of street environments.

2. Data and methods

2.1.Selection of evaluation indicators

This study is based on the population classification standards from the United Nations Population Division's World Population Report and combines general patterns of physical development and psychological characteristics. It defines childhood as the stage for individuals under 14 years old, youth as those aged 15 to 40 years, and old age as individuals over 60 years old(United Nations, 2024). The research focuses on the impact of material elements of urban street space on residents' health, thus selecting material factors related to residents' health as evaluation indicators. The selection of indicators adheres to the principles of scientific rigor, representativeness, and operability, with specific evaluation indicators chosen for children, youth, and elderly residents. This study conducts a preliminary screening of the material elements of urban street space from five main aspects: basic facilities, ecological environment, public space, traffic environment, and cultural environment. However, due to the differences in physical development and psychological characteristics among children, youth, and the elderly, the evaluation indicators after preliminary screening vary accordingly.

Child health-friendly street space refers to street environments that are considerate of children and attentive to their health. After expert preliminary screening, this study has identified a total of 21 indicators (Table 1).

Table 1 Pre-screening evaluation indicators of street space in children's health-friendly cities. Source:Author. Year:2024.

First Level Indicator	*Secondary Indicator*	*Symbol*
Basic Facilities	Seats	BF1
	Rails	BF2
	Electronic Screens	BF3
	Sunshade Tents	BF4
	Public Interactive Devices	BF5
	Bookcases	BF6
Ecological Environment	Green land	EE1
	Water Areas	EE2
	Animals	EE3
	Mountains	EE4
	Flowers and Vegetation	EE5
Public Space	Running tracks	PS1
	Event Venues	PS3
	Sports Facilities	PS2
	Swimming Pools	PS5
	Bike Lanes	PS4
Traffic Environment	Roads	TE1
	Traffic Lights	TE2
	Buses	TE3
Cultural Environment	Decorative Landscapes	CE2
	Crowds	CE1

Youth health-friendly street space focus on meeting the needs of young people. After expert preliminary screening, this study has identified a total of 27 indicators (Table 2).

Table 2 Pre-screening evaluation indicators of street space in youth health-friendly cities. Source:Author. Year:2024.

First Level Indicator	*Secondary Indicator*	*Symbol*
Basic Facilities	Seats	BF1
	Public Conveniences	BF7

	Electronic Screens	BF3
	Sunshade Tents	BF4
	Trash Cans	BF8
	Monitoring	BF9
	Kiosks	BF10
Ecological Environment	Green Land	EE1
	Sky	EE6
	Water Areas	EE2
	Mountains	EE4
	Green Plants	EE7
	Flower Beds	EE8
	Fountains	EE9
Public Space	Running tracks	PS1
	Bike Lanes	PS4
	Event Venues	PS3
	Sports Facilities	PS2
Traffic Environment	Roads	TE1
	Traffic Lights	TE2
	Buses	TE3
	Cars	TE4
Cultural Environment	Plaques and Flags	CE6
	Sculptures	CE3
	Street Graffiti	CE4
	Tall Buildings	CE5
	Crowds	CE1

Elderly health-friendly street space refers to an environment that caters to the needs of the elderly. After expert preliminary screening, this study has identified a total of 20 indicators (Table 3).

Table 3 Pre-screening evaluation indicators of street space in health-friendly cities for the elderly. Source:Author. Year:2024.

First Level Indicator	*Secondary Indicator*	*Symbol*
Basic Facilities	Seats	BF1

	Rails	BF2
	Public Conveniences	BF7
	Sunshade Tents	BF4
	Trash Cans	BF8
	Escalators	BF11
Ecological Environment	Green Land	EE1
	Sky	EE6
	Flower Beds	EE8
	Tree Shade	EE10
Public Space	Event Venues	PS3
	Sports Facilities	PS2
	Animals	PS6
Traffic Environment	Roads	TE1
	Traffic Lights	TE2
	Buses	TE3
	Bicycles	TE5
Cultural Environment	Plaques and Flags	CE6
	Sculptures	CE3
	Crowds	CE1

2.2.Data Sources and Data Processing Principles

This study collected data through the distribution of questionnaires, creating three distinct sets of surveys tailored for children, youth, and elderly residents. Each set of questionnaires consists of two main parts: the first part gathers background information about the respondents, measured using categorical scales. The second part investigates the respondents' health needs regarding the pre-screened material elements of urban space, measured using a five-point Likert scale. And the article only uses AI tools for language translation work(OpenAI, 2023).

2.3.Research Methods

(1) Questionnaire Survey Method

The questionnaire survey method enables the rapid acquisition of firsthand information from respondents at a relatively low cost in terms of time, money, and human resources(Lu J.Y., Xu J.H. and Sun X., 2024). This study aims to gather the direct preferences of children, youth, and elderly residents regarding the factors influencing health-friendly urban street spaces. Therefore, separate evaluation questionnaires for health-friendly urban street spaces were developed for children, youth, and elderly individuals.

(2) Exploratory Factor Analysis

Exploratory factor analysis is used to study the internal structure of items within a scale and can group highly correlated items(Zhang C, Xu Y and Chen P, 2007). Since the evaluation indicators selected in this study are derived from existing research and may not fully represent the true preferences of residents, exploratory factor analysis was employed to analyze the questionnaires. This method helps identify the indicators that reflect residents' preferences and groups them accordingly.

(3) Partial Least Squares Structural Equation Modeling (PLS-SEM)

Partial Least Squares Structural Equation Modeling (PLS-SEM) can measure the structure, correlation, and weight of indicators, and can also reflect the strength of the influence of factors on the research object, it has advantages in handling small sample sizes and non-normally distributed data, making it suitable for causal research questions(Wold and Herman, 1982; Chin and Wynne W, 1998; Wang Y.X., 2019.Given the relatively small data size obtained through the questionnaires in this study, and the goal of quantifying the impact intensity of material elements of urban spatial environments on residents' health, the use of PLS-SEM is appropriate for constructing an evaluation indicator system for health-friendly urban street spaces for children, youth, and the elderly.

3. Constructing an Evaluation System for Age-Friendly Health in Urban Street Spaces

3.1.Statistical Analysis of Questionnaire Results

A total of 150 questionnaires were distributed and 150 valid responses were collected, with 50 responses each from children, youth, and elderly individuals. The background distribution of the respondents was found to be reasonable and meets the requirements for data analysis.

(1) Reliability Test of Data

A Cronbach's Alpha value greater than 0.70 indicates high reliability, making the data suitable for subsequent research(Li Q., 2023). The Cronbach's Alpha values for the children, youth, and elderly questionnaires were 0.927, 0.940, and 0.747, respectively, all exceeding 0.7, indicating that the questionnaires can be used for further research.

(2) Validity Test of Data

A KMO value closer to 0 indicates lower validity, while a value closer to 1 indicates higher validity(Wu Q.X. *et al.*, 2023). As shown in Table 4, the KMO values for the children, youth, and elderly questionnaires are all greater than 0.6, and Bartlett's test is less than 0.05, indicating that each questionnaire has high validity and is suitable for constructing a structural equation model.

Table 4 Questionnaire KMO and Bartlett's test. Source:Author. Year:2024.

Questionnaire type	*KMO and Bartlett's test*	*KMO value*	*Bartlett sphericity test*	*Degrees of Freedom (df)*	*Significant value (P-value)*
Child Health Friendly	Value	0.714	741.361	210	0.000
Youth Health Friendly	Value	0.762	1172.047	351	0.000
Elderly Health Friendly	Value	0.610	353.457	190	0.000

3.2.PLS-SEM Model Construction

The results of the exploratory factor analysis indicate that the health-friendly evaluation indicators for children should be divided into 4 categories, while those for youth can be categorized into 5 categories, and the indicators for the elderly can be divided into 4 categories.

This study uses the findings from the exploratory factor analysis as a reference and makes minor adjustments to the classification results based on existing literature. Consequently, separate models are established for the evaluation systems of health-friendly urban street spaces for children, youth, and the elderly (as illustrated in Figures 1, 2, and 3).

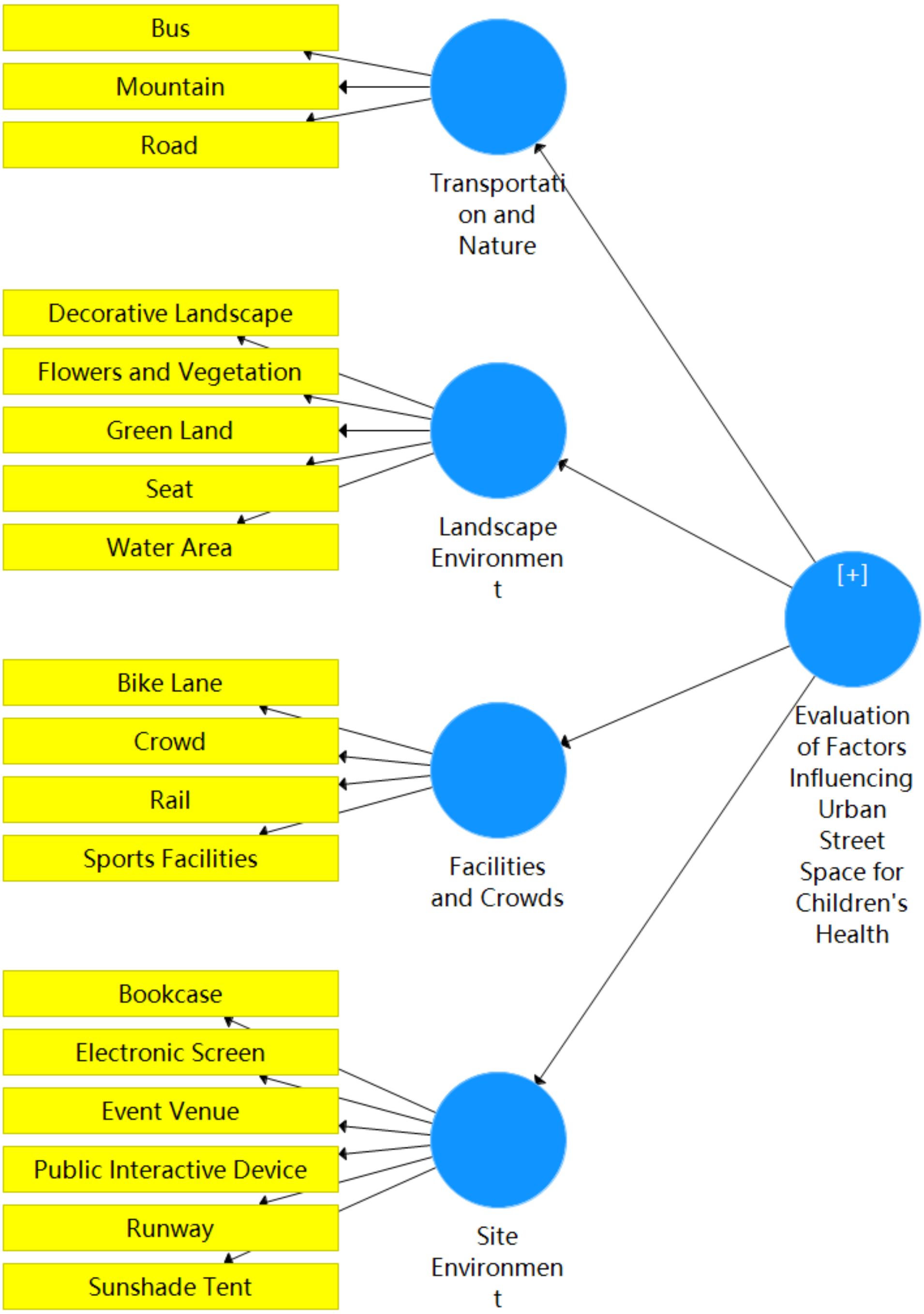

Figure 1. Evaluation System Model for Street Space in Children's Health Friendly Cities

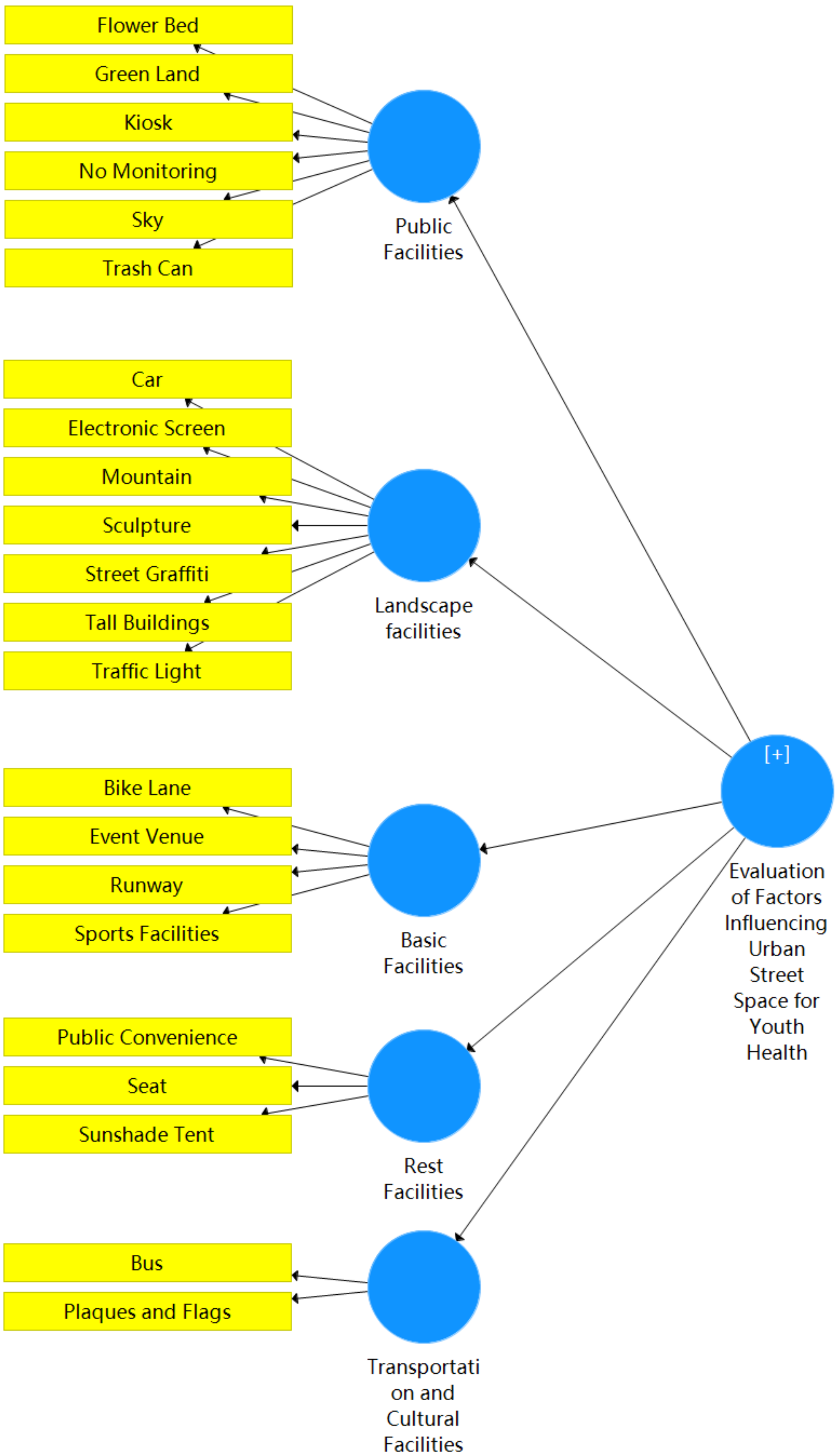

Figure 2. Evaluation System Model for Street Space in Youth Health Friendly Cities

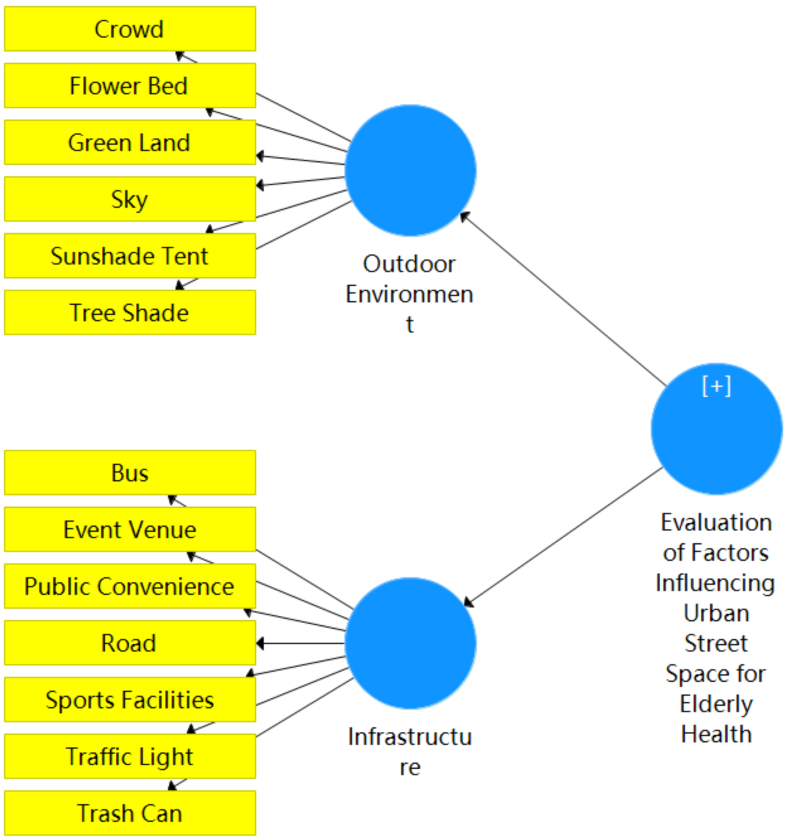

Figure 3. Evaluation System Model for Street Space in Elderly Health Friendly Cities

First, this study primarily evaluates the reliability of the scales using internal consistency testing. Internal consistency is assessed through Composite Reliability (CR) values, where a CR value greater than 0.7 is considered indicative of internal consistency, thus making the data suitable for further research(Holmbeck and Devine, 2009). Additionally, an Outer Loading value greater than 0.5 is also considered a supportive criterion for reliability testing(Hulland, 1999). Secondly, this study employs multicollinearity statistics (Variance Inflation Factor, VIF) as a measure to evaluate the collinearity among variables in order to eliminate the impact of linear relationships between the evaluation indicators on the model's interpretability. VIF is a positive indicator, where larger values indicate higher levels of collinearity. Generally, a VIF value less than 5 can pass the multicollinearity test (Hair *et al.*, 2016).Finally, this study uses R^2 to assess the goodness of fit of the explanatory variables to the outcome variables, indicating how well the observed variables explain the latent variables. An R^2 value greater than 0.26 is considered indicative of a model with strong explanatory power(Cohen, 2013).

Table 5 displays the Composite Reliability (CR), Average Variance Extracted (AVE), Outer Loading, and R^2 values for the theoretical models of health-friendly urban street space evaluation systems for children, youth, and the elderly. The results show that the VIF values for the health-friendly urban street space evaluation models for children, youth, and the elderly are all 1. Furthermore, it can be observed that the CR, AVE, Outer Loading, and R^2 values for all three theoretical models meet the required criteria, indicating that all three evaluation system theoretical models are reliable.

Table 5. Theoretical Model of Street Space Evaluation System for Children, Youth, and Elderly Health Friendly Cities: CR, Loading, R^2 . Source:Author. Year:2024.

Model type	*Construct*	*Loading*	*Item*	*Composite reliability (CR)*	*Loading*	*R^2*
Children Health Friendly Type	Facilities and Crowds	0.904	Bike Lanes	0.829	0.722	0.584
			Crowds		0.791	
			Rails		0.61	
			Sports Facilities		0.828	
	Site Environment	0.887	Bookcases	0.862	0.876	0.817
			Electronic Screens		0.726	
			Event Venues		0.725	
			Public Interactive Devices		0.83	
			Running Tracks		0.849	
			Sunshade Tents		0.84	
	Transportation and Nature	0.764	Buses	0.929	0.848	0.517
			Mountains		0.829	
			Roads		0.789	
	Landscape Environment	0.719	Decorative Landscapes	0.929	0.89	0.786
			Flowers and Vegetation		0.86	
			Green Land		0.89	
			Seats		0.80	
			Water Areas		0.81	
Youth Health Friendly Type	Public Facilities	0.769	Green Land	0.924	0.880	0.591
			No Monitoring		0.794	
			Sky		0.773	
			Flower Beds		0.836	
			Trash Cans		0.786	
			Kiosks		0.834	
	Landscape Facilities	0.876	Tall Buildings	0.926	0.855	0.768
			Electronic Screens		0.849	
			Traffic Lights		0.791	
			Cars		0.768	

			Sculptures		0.81	
			Street Graffiti		0.75	
			Mountains		0.783	
	Basic Facilities	0.85	Bike Lanes	0.897	0.808	0.722
			Sports Facilities		0.894	
			Running Tracks		0.833	
			Event Venues		0.774	
	Rest Facilities	0.561	Sunshade Tents	0.874	0.889	0.315
			Public Conveniences		0.84	
			Seats		0.774	
	Transportation and Cultural Facilities	0.705	Buses	0.922	0.906	0.496
			Plagues and Flags		0.943	
Elderly Health Friendly Type	Outdoor Environment	0.903	Sky	0.808	0.618	0.815
			Tree Shade		0.739	
			Green Land		0.809	
			Flower Beds		0.828	
			Sunshade Tents		0.551	
			Crowds		0.222	
	Infrastructure	0.888	Public Conveniences	0.785	0.732	0.789
			Trash Cans		0.502	
			Event Venues		0.507	
			Traffic Lights		0.779	
			Roads		0.543	
			Sports Facilities		0.503	
			Buses		0.503	

3.3.Evaluation System Construction

The Loading values derived from PLS-SEM represent the impact relationships among variables. In this study, these values were normalized to obtain the weights of the secondary evaluation indicators (as shown in Formula 1).

$$w_i = \frac{LD_i}{\sum_{n=1} LD_n} \quad (1)$$

In this context, w_i is the weight of the second level (first level) evaluation indicator i, LD_i represents the loading value of i, and LD_n is the sum of the loading values of all evaluation indicators in the upper level classification of i.

(1) Health-Friendly for Children

According to the results of the health-friendly urban street space evaluation system for children (Table 6), the secondary indicators related to children's health identified by children and their guardians include seats, water areas, green land, among others, totaling 18 items. Conversely, the three secondary indicators anticipated by the researchers—animals(EE3), swimming pools(PS5), and traffic lights(TE2)—do not align with the preferences of children and their guardians, resulting in an accuracy rate of approximately 85.7%.

Furthermore, the construction of health-friendly urban street spaces for children can be categorized into four aspects: landscape environment, site environment, transportation and nature, and facilities and crowds. Among these, the site environment and facilities and crowds aspects have the most significant impact on spatial development.

Table 6. Evaluation System for Street Space in Children's Health Friendly Cities. Source:Author. Year:2024.

First Level Indicator	*Weight*	*Secondary Indicator*	*Symbol*	*Weight*
Landscape Environment	0.22	Seats	BF1	0.19
		Green Land	EE1	0.21
		Water Areas	EE2	0.19
		Flowers and Vegetation	EE5	0.20
		Decorative Landscapes	CE2	0.21
Site Environment	0.28	Electronic Screens	BF3	0.15
		Sunshade Tents	BF4	0.17
		Public Interactive Devices	BF5	0.17
		Bookcases	BF6	0.18
		Running Tracks	PS1	0.18
		Event Venues	PS3	0.15
Transportation and Nature	0.23	Mountains	EE4	0.34
		Roads	TE1	0.32
		Buses	TE3	0.34
Facilities and Crowds	0.27	Rails	BF2	0.21
		Sports Facilities	PS2	0.28
		Bike Lanes	PS4	0.24

	Crowds	CE1	0.27

(2) Health-Friendly for Youth

According to the results of the health-friendly urban street space evaluation system for youth (Table 7), the secondary indicators identified by the youth group as related to their own health include seats, event venues, buses, among others, totaling 22 items. In contrast, the five secondary indicators anticipated by the researchers—water areas(EE2), fountains(EE9), green plants (EE7), roads(TE1), and crowds(CE1)—do not align with the preferences of the youth group, resulting in an accuracy rate of approximately 81.5%.

Moreover, the construction of health-friendly urban street spaces for youth can be categorized into five aspects: public facilities, landscape facilities, basic facilities, rest facilities, transportation and cultural facilities. Among these, basic facilities and transportation and cultural facilities have the most significant impact on spatial development, followed by recreational facilities.

Table 7. Evaluation System for Street Space of Youth Health Friendly Cities. Source:Author. Year:2024.

First Level Indicator	*Weight*	*Secondary Indicator*	*Symbol*	*Weight*
Public Facilities	0.20	Green Land	EE1	0.18
		No Monitoring	BF9	0.16
		Sky	EE6	0.16
		Flower Beds	EE8	0.17
		Trash Cans	BF8	0.16
		Kiosks	BF10	0.17
Landscape Facilities	0.23	Tall Buildings	CE5	0.15
		Electronic Screens	BF3	0.15
		Traffic Lights	TE2	0.14
		Cars	TE4	0.14
		Sculptures	CE3	0.14
		Street Graffiti	CE4	0.13
		Mountains	EE4	0.15
Basic Facilities	0.85	Bike Lanes	PS4	0.24
		Sports Facilities	PS2	0.28
		Running Tracks	PS1	0.25
		Event Venues	PS3	0.23
Rest Facilities	0.561	Sunshade Tents	BF4	0.36
		Public Conveniences	BF7	0.34
		Seats	BF1	0.30

Transportation and Cultural Facilities	0.705	Buses	TE3	0.49
		Plaques and Flags	CE6	0.51

(3) Health-Friendly for the Elderly

According to the results of the health-friendly urban street space evaluation system for the elderly (Table 8), the secondary indicators identified by the elderly population as relevant to their health include flower beds, green land, public conveniences, among others, totaling 13 items. However, the researchers expected that a total of 7 secondary indicators, including animals(EE3), rails(BF2), seats(BF1), escalators(BF11), bicycles(TE5), Plaque and flags(CE6), and sculptures(CE3), did not meet the wishes of the elderly population, resulting in an accuracy rate of 65%.

The PLS-SEM model, based on survey questionnaire results, regrouped the secondary indicators according to their internal logic. The construction of health-friendly urban street spaces for the elderly can be broadly categorized into two aspects: outdoor environment and infrastructure, both of which have a significant and comparable impact.

Table 8. Evaluation System for Street Space in Elderly Health Friendly Cities. Source:Author. Year:2024.

First level indicator	*Weight*	*Secondary Indicator*	*Symbol*	*Weight*
Outdoor Environment	0.50	Sky	EE6	0.16
		Tree Shade	EE10	0.20
		Green Land	EE1	0.21
		Flower Beds	EE8	0.22
		Sunshade Tents	BF4	0.15
		Crowds	CE1	0.06
Infrastructure	0.50	Public Conveniences	BF7	0.18
		Trash Cans	BF8	0.12
		Event Venues	PS3	0.13
		Traffic Lights	TE2	0.19
		Roads	TE1	0.14
		Sports Facilities	PS2	0.12
		Buses	TE3	0.12

Comparing the three evaluation systems, it can be observed that the health-friendly urban street space evaluation system for youth has the highest number of indicators, totaling 22, while the evaluation system for the elderly has the fewest indicators, with only 13. Additionally, all three evaluation systems include some common evaluation indicators, specifically green land(EE1), sunshade tents(BF4), buses(TE3), event venues(PS3), and sports facilities(PS2), while each evaluation system also has its own unique indicators.

4. Conclusion

This study proposes a method based on PLS-SEM to quantify the relationships between the material elements of urban street spaces and the health impacts on children, youth, and elderly residents from the residents' perspective, addressing the personalized needs of these demographic groups. Health-friendly urban street space evaluation systems for children, youth, and the elderly have been constructed. The results provide a bridge for interdisciplinary research in urban planning, urban design, and public health, offering urban managers insights into enhancing the health needs of children, youth, and the elderly.

The study concludes the following: (1) The health-friendly urban street space evaluation system for children encompasses four aspects: landscape and environment, site environment, transportation and nature, and facilities and crowds, all of which have significant positive impacts, swith the site environment having the greatest effect. (2) The health-friendly urban street space evaluation system for youth includes five aspects: public facilities, landscape facilities, basic facilities, rest facilities, transportation and cultural facilities, all of which exert significant positive impacts, with landscape facilities and sports facilities having the most substantial influence. (3) The health-friendly urban street space evaluation system for the elderly consists of two aspects: outdoor environment and infrastructure, both of which have significant positive influences, and their impacts are comparable. (4) There is a gap between the health-related factors pre-screened by experts and those recognized by residents. (5) Among the three evaluation systems, the youth health-friendly urban street space evaluation system involves the most types of material spatial elements, while the system for the elderly involves the fewest. (6) All three evaluation systems include some common material spatial elements, specifically green land(EE1), sunshade tents(BF4), buses(TE3), event venues(PS3), and sports facilities(PS2). However, each evaluation system also contains personalized material spatial elements unique to its demographic focus.

5. References

van den Berg, M. *et al.* (2016) 'Visiting green space is associated with mental health and vitality: A cross-sectional study in four european cities', *Health & Place*, 38, pp. 8–15. Available at: https://doi.org/10.1016/j.healthplace.2016.01.003.

Birch, J., Rishbeth, C. and Payne, S.R. (2020) 'Nature doesn't judge you – how urban nature supports young people's mental health and wellbeing in a diverse UK city', *Health and Place*, 62. Available at: https://doi.org/10.1016/j.healthplace.2020.102296.

Boone-Heinonen, J. *et al.* (2010) *Residential self-selection bias in the estimation of built environment effects on physical activity between adolescence and young adulthood*. Available at: http://www.ijbnpa.org/content/7/1/70.

Cao, X., Handy, S.L. and Mokhtarian, P.L. (2006) 'The Influences of the Built Environment and Residential Self-Selection on Pedestrian Behavior: Evidence from Austin, TX', *Transportation*, 33(1), pp. 1–20. Available at: https://doi.org/10.1007/s11116-005-7027-2.

Chin and Wynne W (1998) 'The partial least squares approach to structural equation modeling', *Modern methods for business research*, 295, pp. 295–336.

Cohen, J. (2013) *Statistical Power Analysis for the Behavioral Sciences*. Routledge. Available at: https://doi.org/10.4324/9780203771587.

Duracinsky, M. *et al.* (2007) 'Literature Review of Questionnaires Assessing Vertigo and Dizziness, and Their Impact on Patients' Quality of Life', *Value in Health*, 10(4), pp. 273–284. Available at: https://doi.org/10.1111/j.1524-4733.2007.00182.x.

Fitrinitia, I.S. (2019) 'INTEGRATION OF SPATIAL CHARACTERISTIC TO HEALTH SERVICES FOR IMPROVEMENT OF CHILDREN HEALTH', *International Journal of GEOMATE*, 17(61). Available at: https://doi.org/10.21660/2019.61.8267.

Gruebner, O. *et al.* (2017) 'Cities and Mental Health', *Deutsches Ärzteblatt international* [Preprint]. Available at: https://doi.org/10.3238/arztebl.2017.0121.

Hair, Jr., J.F. *et al.* (2016) 'Identifying and treating unobserved heterogeneity with FIMIX-PLS: part I – method', *European Business Review*, 28(1), pp. 63–76. Available at: https://doi.org/10.1108/EBR-09-2015-0094.

Healthy China Action Promotion Committee (2019) *Healthy China Action (2019-2030)*, *https://www.gov.cn/xinwen/2019-07/15/content_5409694.htm*.

Holmbeck, G.N. and Devine, K.A. (2009) 'Editorial: An Author's Checklist for Measure Development and Validation Manuscripts', *Journal of Pediatric Psychology*, 34(7), pp. 691–696. Available at: https://doi.org/10.1093/jpepsy/jsp046.

Hsu, H.-C. and Bai, C.-H. (2021) 'Social and Built Environments Related to Cognitive Function of Older Adults: A Multi-Level Analysis Study in Taiwan', *International Journal of Environmental Research and Public Health*, 18(6), p. 2820. Available at: https://doi.org/10.3390/ijerph18062820.

Hulland, J. (1999) 'Use of partial least squares (PLS) in strategic management research: a review of four recent studies', *Strategic Management Journal*, 20(2), pp. 195–204. Available at: https://doi.org/10.1002/(SICI)1097-0266(199902)20:2<195::AID-SMJ13>3.0.CO;2-7.

Li Q. (2023) *Analysis of factors influencing China's rare earth trade security based on PLS-SEM model* . Jiangxi university of science and technoligy.

Lu J.Y., Xu J.H. and Sun X. (2024) 'Design and Implementation of Questionnaire Surveys and Their Normative Application in the Field of Library Science', *Library and Information Service*, 68(11), pp. 4–13.

Mikhail, E. *et al.* (2020) 'Questionnaires Assessing the Quality of Life of Ocular Allergy Patients', *The Journal of Allergy and Clinical Immunology: In Practice*, 8(9), pp. 2945–2952. Available at: https://doi.org/10.1016/j.jaip.2020.04.023.

Ministry of health (2000) *Health Japan 21*, *https://www.mhlw.go.jp/www1/topics/kenko21_11/s0.html*.

OpenAI (2023) *ChatGPT*, *https://www.openai.com/chatgpt*.

Rojas-Rueda, D. *et al.* (2019) 'Green spaces and mortality: a systematic review and meta-analysis of cohort studies', *The Lancet Planetary Health*, 3(11), pp. e469–e477. Available at: https://doi.org/10.1016/S2542-5196(19)30215-3.

Tang, J. and Long, Y. (2019) 'Measuring visual quality of street space and its temporal variation: Methodology and its application in the Hutong area in Beijing', *Landscape and Urban Planning*, 191, p. 103436. Available at: https://doi.org/10.1016/j.landurbplan.2018.09.015.

United Nations (2024) *World Population Prospects - Population Division - United Nations*, *URL https://population.un.org/wpp/*.

Wang, Y. *et al.* (2016) 'A review on the effects of physical built environment attributes on enhancing walking and cycling activity levels within residential neighborhoods', *Cities*, 50, pp. 1–15. Available at: https://doi.org/10.1016/j.cities.2015.08.004.

Wang Y.X. (2019) *Research on the influence factors of urban and rural integration development in Xinjiang based on PLS path model*. Xinjiang university of finance & economics.

Wold and Herman (1982) 'Soft modeling: the basic design and some extensions', *Systems under indirect observation, Part II*, 2, pp. 36–37.

World Health Organization (1986) *Creating healthy cities*, *https://www.who.int/activities/creating-healthy-cities*.

Wu Q.X. *et al.* (2023) 'Analysis of factors influencing carbon emissions of urban rail transit projects based on partial least squares structural equation modeling', *Environmental Engineering*, 41(10), pp. 133–140.

Zhang C, Xu Y and Chen P (2007) 'Comparison and application of exploratory factor analysis and confirmatory factor analysis in scale researc', *J. South Med. Univ*, 27(3).