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ORIGINAL

Environmental Attributes, Perceived Well-being, and Social Interaction: A Space Syntax Analysis of Chengdu's Neighborhood Parks for the Elderly

Atributos ambientales, bienestar percibido, e interacción Social: un análisis de sintaxis espacial de los parques Vecindad Chengdu para los ancianos

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ABSTRACT

The rapid urbanization of Chinese cities has intensified the demand for age-friendly public spaces that promote health and social engagement among the elderly. This research investigates the complex relationships among environmental attributes, perceived well-being, and social interaction in Chengdu's neighborhood parks, using Space Syntax analysis as a core methodological framework. A total of 287 elderly individuals were surveyed across six neighborhood parks, selected to represent varying spatial structures and amenity quality. Environmental configuration was quantified using Space Syntax metrics such as integration, connectivity, and visual accessibility. Simultaneously, structured observations and on-site questionnaires captured data on social interaction patterns and perceived well-being. The data analysis using structural equation modeling (SEM) and statistical methods, including Pearson's correlation, and multiple regression, was used to assess relationships between spatial configuration, perceived well-being, and social interaction frequency. The results showed strong positive effects of social interaction (β = 0,44) and environmental quality (β = 0,42) on perceived well-being ($p < 0,001$). All constructs demonstrated high reliability (α = 0,81–0,88) and valid factor structures, confirming model strength. Furthermore, an SEM analysis showed that this mediation was moderated by interaction type, with family-based interactions exerting a stronger influence on well-being compared to friend-based ones. This research provides empirical evidence that spatially well-integrated and visually accessible park environments significantly enhance social cohesion and subjective well-being among the elderly. These findings offer critical insights for designing inclusive, age-friendly public spaces that support active and healthy aging in urban China.

Keywords: Environmental Attributes; Perceived Well-Being; Social Interaction; Chengdu's Parks Elder People; Spatial and Perceptual Elements.

RESUMEN

La rápida urbanización de las ciudades chinas ha intensificado la demanda de espacios públicos adaptados a las personas mayores que promuevan la salud y la participación social entre los ancianos. Esta investigación investiga las complejas relaciones entre los atributos ambientales, el bienestar percibido y la interacción social en los parques vecindad Chengdu, utilizando el análisis de la sintaxis espacial como marco metodológico central. Se encuestó A un total de 287 personas de edad avanzada en seis parques vecinos, seleccionados para representar diferentes estructuras espaciales y calidad de servicios. La configuración ambiental fue cuantificada usando métricas de sintaxis espacial tales como integración, conectividad y accesibilidad visual. Simultáneamente, las observaciones estructuradas y los cuestionarios en el sitio capturados sobre los patrones

de interacción social y el bienestar percibido. El análisis de datos utilizando la modelación de ecuaciones estructurales (SEM) y métodos estadísticos, incluyendo la correlación de Pearson y la regresión múltiple, se utilizó para evaluar las relaciones entre la configuración espacial, el bienestar percibido y la frecuencia de interacción social. Los resultados mostraron fuertes efectos positivos de la interacción social (− = 0,44) y la calidad ambiental (− = 0,42) sobre el bienestar percibido (p < 0,001). Todas las construcciones demostraron una alta confiabilidad (− = 0,81-0,88) y estructuras factor válidas, confirmando la fuerza del modelo. Además, un análisis de SEM mostró que esta mediación fue moderada por el tipo de interacción, siendo las interacciones basadas en la familia las que ejercieron una mayor influencia en el bienestar en comparación con las basadas en la amistad. Esta investigación proporciona evidencia empírica de que los entornos de parques espacialmente bien integrados y visualmente accesibles mejoran significativamente la cohesión social y el bienestar subjetivo entre los ancianos. Estos hallazgos ofrecen perspectivas críticas para diseñar espacios públicos inclusivos y adecuados para la edad que apoyen el envejecimiento activo y saludable en la China urbana.

Palabras clave: Atributos Ambientales; Bienestar Percibido; Interacción Social; Personas Mayores de los Parques de Chengdu; Elementos Espaciales y Perceptivos.

INTRODUCTION

Chengdu, the capital of Sichuan Province in China, is a rapidly urbanizing city where neighborhood parks play a vital role in helping the well-being of its aging population. These parks, located within residential communities, serve as important public spaces that provide elderly individuals with opportunities for relaxation, light physical activity, and social interaction.[1] As cities like Chengdu grow, the need to design inclusive and accessible outdoor environments becomes increasingly important for supportive, active, and healthy aging.[2] To explore how the spatial layout and structure of neighborhood parks influence social experiences and perceived well-being among the elderly.[3] Environmental attributes are the physical and spatial features of a park, such as layout, greenery, and accessibility that influence how people use the space.[4] Perceived well-being refers to an individual's sense of happiness, comfort, and life satisfaction within that environment.[5] Social interaction involves the communication and connections formed between people through shared activities and engagement. Together, these elements shape the elderly's overall experience in neighborhood parks.[6] Such insights can guide urban planners in creating environments that enhance both physical comfort and emotional satisfaction.[7] Neighborhood parks offer many advantages for elderly users, including improved health, stress relief, and opportunities to build social connections. However, they may also present challenges such as poor design, limited age-appropriate facilities, overcrowding, or lack of proper maintenance.[8] Urban parks often lack spatial features that support elderly well-being due to limited insight into environmental and social interaction dynamics. This research focuses on these aspects through a spatial analysis approach to better understand how the built environment can shape elderly well-being in Chengdu's neighborhoods. This research offers valuable insights for community developers and public health stakeholders to improve elderly well-being through better spatial and environmental design of urban parks.

The contribution of the research is given below:

- The research highlights how spatial integration and visual accessibility in neighborhood parks can foster social integration, promoting active and healthy aging among the elderly.
- It provides urban planners and designers with empirical insights into how specific environmental attributes influence perceived well-being in age-friendly public spaces.
- The research establishes a validated framework using structural equation modelling (SEM), reliability analysis, and factor analysis to assess the complex relationships among spatial, social, and psychological variables.
- The findings underscore the critical role of environmental quality in promoting perceived well-being among the elderly, highlighting the need for evidence-based urban planning strategies that foster inclusive, health-supportive public spaces in rapidly aging cities.

Related work

This section gives a summary of the investigation conducted to analyze the relationship among spatial attributes, social interaction, and perceived well-being in Chengdu's neighborhood parks.

A spatial configuration analysis was conducted on the West Shu Garden in Dujiangyan using Space Syntax theory.[9] Integration and connectivity values revealed high accessibility in core areas (integration value > 1,2). The research highlighted how spatial structure fosters pedestrian movement and visitor engagement. However,

the focus was limited to a single scenic site, affecting broader applicability. Methodological reliance on static spatial data also limits temporal variation.

A multidimensional geographic information system (GIS) analysis was employed to investigate the relationship between urban street greenery and pedestrian flow in the central district of Chengdu.[10] Results showed a strong positive correlation (r = 0,71) between green coverage and pedestrian density. The analysis integrated spatial visibility and greenery indices for comprehensive mapping. Limitations include a lack of qualitative data on human perception and behavioral influence. Only main street corridors were considered, while inner-neighborhood pathways were omitted.

The Informal Green Spaces (IGS) in Chengdu were assessed for their role in enhancing urban green accessibility using spatial overlay techniques.[11] Accessibility improvements of up to 38 % were identified when IGS areas were included in the green network. Optimization strategies were proposed using GIS-based proximity and catchment analyses. Constraints lie in the regulatory ambiguity of IGS ownership and use. The environmental quality of IGS sites was not quantitatively evaluated.

The street accessibility and human perception data were integrated using Space Syntax and survey-based methods in Chengdu.[12] Visual connectivity metrics aligned with subjective safety and comfort ratings (R^2 = 0,65). Findings support perception-based street design, enhancing pedestrian experiences. Limitations include small sample size and lack of demographic diversity among respondents. Seasonal or temporal changes in perception were not accounted for.

The spatial vitality of old neighborhoods in Ya'an Xicheng was analyzed using spatial statistics and regression modeling.[13] High vitality zones corresponded to areas with compact grid layouts and mixed-use density (adjusted R^2 = 0,68). The research identified key influencing factors, such as accessibility and infrastructure quality. Limitations included outdated land use records and limited behavioral validation. Spatial vitality was measured at a macro level, overlooking micro-interactions.

Age-friendly open spaces were evaluated using observational and spatial analysis to determine features promoting senior physical activity.[14] Green infrastructure elements like shade trees and seating were positively associated with activity frequency ($p < 0,01$). Findings support the integration of natural elements to enhance elder mobility. A limitation is the lack of psychological or social variables in the analysis. The sample was limited to urban seniors, excluding rural populations.

Tourism-related spatial elements in Chengdu were studied using spatial distribution analysis and road network classification.[15] Results revealed a clustered distribution along primary street axes, with 82 % of elements within 500m of tourist centers. The spatial organization of streets influenced tourism accessibility and vibrancy. However, the research did not assess pedestrian satisfaction or experiential quality. Temporal tourist flow data was also excluded from the model.

A green equity approach was used to optimize park spatial patterns in Chengdu, combining spatial justice metrics with GIS tools.[16] Equity scores increased by 27 % after redistribution models targeted underserved zones. The framework highlighted spatial fairness in public resource planning. Limitations include the exclusion of socio-cultural preferences in park use. Data granularity was limited to administrative zones, restricting detailed neighborhood-level analysis.

The many spatial studies lack behavioral insights and overlook the role of user experience in urban park design. This research integrates spatial analysis with elderly survey data across multiple parks in Chengdu. It provides a holistic understanding of how spatial attributes influences social interaction and well-being. The research examines the impact of spatial configuration and environmental attributes on perceived well-being and social interaction among the elderly through the use of space syntax analysis in Chengdu's neighborhood parks.

DEVELOPMENT

The neighborhood parks serve as essential community spaces that support social interaction among older adults, contributing to reduce isolation and improved well-being. The spatial design of these parks, especially in terms of integration, connectivity, and visual accessibility, greatly influences movement patterns and opportunities for interaction. According to Space Syntax, environments with higher spatial integration and visibility naturally promote more frequent social encounters. Such spatial characteristics enhance a sense of community and promote more frequent social engagement among elderlyadults in their daily lives. Therefore, hypothesis 1 suggests that spatial attributes (integration, connectivity, and visual accessibility) positively influence social interaction among the elderly in neighborhood parks.

H1: Park Spatial Attributes (SA) (spatial integration, connectivity, and visual accessibility) positively influence social interaction among elderly users.

Social Interaction (SI) is a vital component of psychological and emotional health, particularly in elderly adults who are more vulnerable to loneliness and isolation. Engaging in conversations, group activities, and

casual encounters within public spaces helps elderly individuals build social support and a sense of community. These interactions contribute to life satisfaction, emotional stability, and overall well-being. Thus, Hypothesis 2 proposes that increased social interaction among the elderly positively influences their Perceived Well-Being (PWB).

H2: SI positively influences PWB among the elderly.

The design and spatial structure of parks influence how people move, gather, and interact. For elderly individuals, accessible and well-integrated environments increase the chances of social engagement, which contributes to better psychological and emotional well-being. Instead of directly influencing well-being, spatial attributes exert their effect by shaping social interaction. Thus, hypothesis 3 suggests that social interaction serves as a mediating mechanism between spatial attributes and PWB.

H3: Social interaction mediates the relationship between spatial attributes and perceived well-being.

The quality of a park's environment, including aspects like cleanliness, safety, greenery, seating, and shade, plays a crucial role in shaping user experience, especially for the elderly. A well-maintained, comfortable, and aesthetically pleasing environment encourages longer visits, relaxation, and a sense of satisfaction. These positive perceptions contribute to improved mental and emotional states. Therefore, Hypothesis 4 suggests that higher Environmental Quality (EQ) in parks is significantly associated with greater perceived well-being among elderly individuals.

H4: Differences in park spatial configuration result in varying levels of PWB.

Conceptual Framework

The conceptual framework illustrates the relationships among environmental attributes, social interaction, and perceived well-being of elderly individuals in neighborhood parks (figure 1). It postulates that spatial attributes, such as spatial integration, connectivity, and visual accessibility positively influence the level of social interaction between old park users. In turn, societal interface serves as a mediating variable that enhances perceived well-being, highlighting the importance of socially engaging environments for healthy aging. Additionally, direct and environmental conditions play crucial roles in shaping social behaviors and psychological outcomes for the elderly, offering valuable insights for creating age-friendly public spaces.

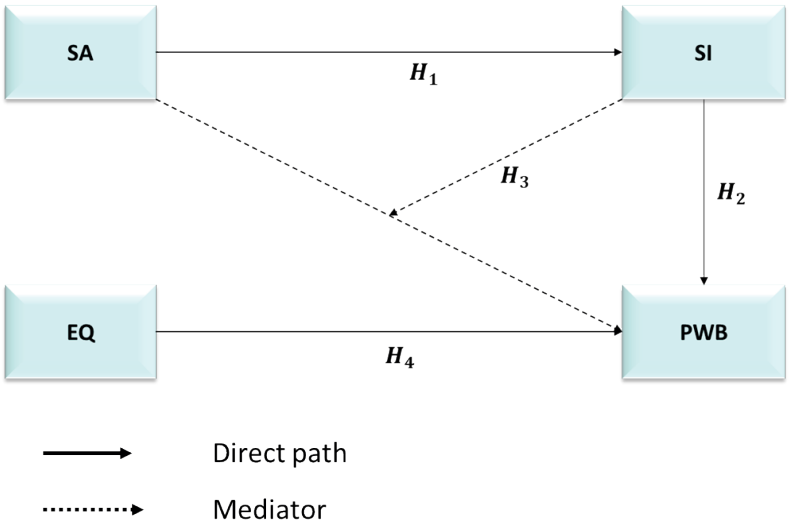

Figure 1. Conceptual Framework

METHOD

The objective of this research is to assess the influence of environmental attributes on perceived well-being and social interaction among elderly individuals in neighbourhood parks. Data were collected by using structured questionnaires and field observations. Validated tools and space syntax metrics, such as integration, connectivity, and visual accessibility, were used to assess spatial configuration, interaction frequency, and well-being perception.

Data collection

A total of 287 elderly individuals were surveyed across six neighbourhood parks in Chengdu, selected for

their varying spatial structures and amenity quality. Participants aged 60 and above, who regularly visited the parks and provided informed consent, were included. Data were gathered using structured questionnaires and systematic on-site observations. Spatial configuration was measured using space syntax metrics such as integration, connectivity, and visual accessibility. Inclusion and exclusion criteria ensured cognitive independence and unaccompanied participation.

Selection criteria

The selection criteria help to ensure the sample is significant to the research. It includes inclusion criteria and Exclusion criteria.

Inclusion criteria

- Age requirement: Individuals aged 60 years and above, classified as elderly, according to national demographic standards
- Park visitation: Participants were required to be regular visitors to one of the six selected neighborhood parks in Chengdu, defined as visiting at least three times per week for recreational or social purposes.
- Informed consent: Participants were voluntary, and all individuals provided written informed consent after being briefed about the research purpose and confidently measures.
- Survey Readiness: Participants had to possess the cognitive and physical ability to understand and complete a structured, in-person questionnaire administered by trained researchers.
- Active Social Engagement: Eligibility was limited to those who engaged in observable social activity within the park setting and were able to reflect on their emotional well-being, park experiences, and interaction patterns.

Exclusion criteria

- Cognitive or Psychological Impairment: Individuals with diagnosed neurocognitive disorders, memory loss, or severe psychiatric conditions that could impair self-awareness, social engagement, or the ability to provide informed responses.
- Non-participatory Park Use: Those using the park for transit or passive rest without observable social or physical engagement were not eligible.
- Incomplete Data: Respondents who submitted incomplete or inconsistent responses in key sections of the survey (e.g., questions related to spatial perception, social interaction, or emotional well-being) were excluded from the final analysis.
- Medical Exceptions: Individuals under ongoing treatment for acute health crises or unrelated disabilities that limited their independent movement in public spaces were excluded, as their experience of the park environment might not reflect normal usage patterns.
- Assisted or Proxy Responses: Participants who required substantial help from caregivers or family members in answering questions were excluded to preserve response validity.

Statistical analysis

The statistical analysis is used to examine the impact of environmental attributes on perceived well-being among the elderly, with a focus on the mediating role of social interaction in Chengdu's neighbourhood parks. Data were analyzed using SPSS and AMOS. Statistical methods, including SEM, multiple regression analysis, Pearson correlation, were employed to assess relationships among spatial configuration, social interaction, perceived well-being, and interaction type. Significant results were considered at $p < 0,05$.

RESULTS

This research investigates the complex relationships among environmental attributes, perceived well-being, and social interaction in Chengdu's neighborhood parks, using Space Syntax analysis. This section includes a demographic table, and outcomes of Correlation Analysis, Multiple Regression, and SEM.

Demographic analysis

It examines various characteristics of participants, providing valuable insights into their profiles. Table 1 analyzes the demographic features of the elderly individuals surveyed in Chengdu's neighborhood parks.

The demographic profile of 287 elderly participants showed a balanced age distribution, with the majority aged 60–64 years and slightly more females (55,4 %). Most have a secondary education, were married (73,9 %), and visited parks regularly, with 39 % attending daily. Over half lived with a spouse or family, and health status was generally fair to good. Family-based interaction was most common (48,1 %), highlighting strong social engagement within park settings. These characteristics support the study's focus on spatial influence and social well-being among older adults.

Table 1. Demographic characteristics of participants (N=287)

Variable	Category	Frequency (n)	Percentage (%)
Age	60–64 years	90	31,4 %
	65–69 years	75	26,1 %
	70–74 years	70	24,4 %
	≥75 years	52	18,1 %
Gender	Male	128	44,6 %
	Female	159	55,4 %
Education Level	No formal education	40	13,9 %
	Primary school	78	27,2 %
	Secondary school	102	35,5 %
	College or above	67	23,3 %
Marital Status	Married	212	73,9 %
	Widowed	49	17,1 %
	Divorced/Separated	15	5,2 %
	Single	11	3,8 %
Park Visitation Frequency	Daily	112	39,0 %
	Several times/weeks	98	34,1 %
	Weekly	51	17,8 %
	Less than weekly	26	9,1 %
Living Arrangement	Alone	38	13,2 %
	With spouse	144	50,2 %
	With children/family	105	36,6 %
Health Status	Poor	32	11,1 %
	Fair	119	41,5 %
	Good	95	33,1 %
	Excellent	41	14,3 %
Type of Interaction	Family-based	138	48,1 %
	Friend-based	102	35,5 %
	Other (e.g., acquaintances)	47	16,4 %

Correlation Analysis

The purpose of correlation analysis is to examine the strength and direction of relationships between spatial integration, social interaction, environmental quality, and perceived well-being among elderly park users. Figure 2 illustrates the correlation analysis of the variables.

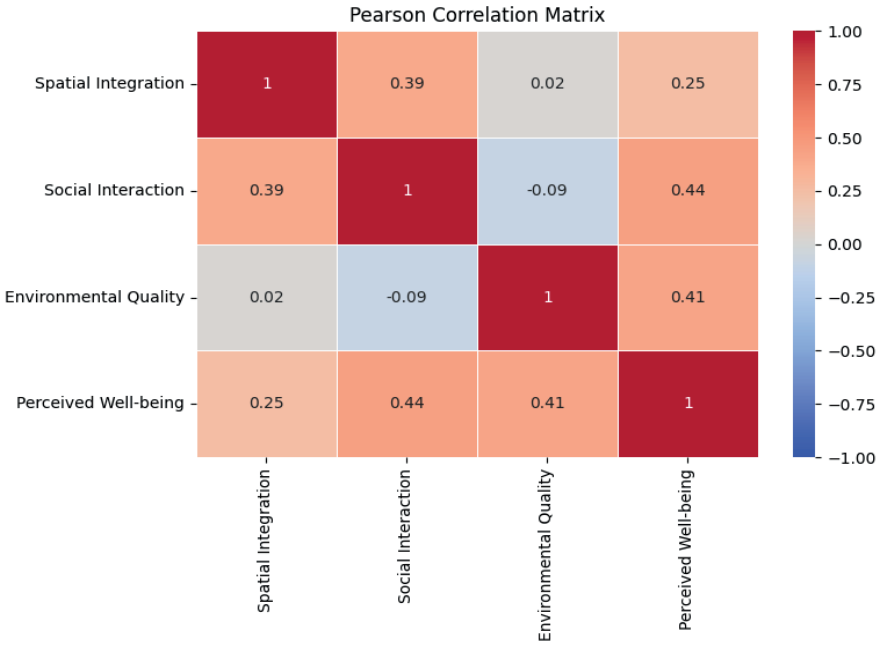

Figure 2. Pearson correlation analysis

The Pearson correlation matrix revealed a moderate positive correlation between spatial integration and social interaction (r = 0,39, p < 0,001), indicating that better-integrated park layouts encourage more frequent social engagement. Social interaction also presented a strong confidentrelationship with perceived well-being (r = 0,44, p < 0,001), supporting the idea that increased social contact enhances emotional wellness in elderly users. Furthermore, environmental quality was significantly associated with perceived well-being (r = 0,41, p < 0,001), but it had no significant correlation with social interaction (r = –0,09, p = 0,1175). These results support H1, H2, and H5, validating that spatial design and environmental quality are critical factors influencing elderly well-being through different pathways. Spatial integration and social interaction are positively related; both social interaction and environmental quality significantly enhance perceived well-being, confirming key assumptions in the research model.

Multiple Regression

The Multiple regression analysis was conducted to evaluate how spatial integration, social interaction, and environmental quality collectively influence perceived well-being among elderly individuals in Chengdu's neighborhood parks.

Table 2. Multiple Regression Results for Perceived Well-Being

Predictor	B (Unstandardized)	SE	ß (Standardized)	t	p-value
Constant	1,6992	0,2384	—	7,13	0,000
Spatial Integration	0,0792	0,0627	0,0237	1,26	0,2077
Social Interaction	0,4144	0,0456	0,1711	9,09	0,000
Environmental Quality	0,3424	0,0353	0,1682	9,69	0,000

Table 2 presents the results of a multiple regression analysis assessing the impact of spatial integration, social interaction, and environmental quality on perceived well-being among elderly park users. The model showed that social interaction (B = 0,4144, ß = 0,1711, p < 0,001) and environmental quality (B = 0,3424, ß = 0,1682, p < 0,001) were significant positive predictors of perceived well-being. In contrast, spatial integration had a smaller and non-significant effect (B = 0,0792, ß = 0,0237, p = 0,2077). These findings suggest that while spatial design supports interaction, it does not directly influence well-being unless mediated through social and environmental experiences. The regression model highlights the critical role of park quality and social dynamics in promoting healthy aging.

Reliability test

The reliability test assesses the internal consistency of the measurement scales used to evaluate the constructs in this research. These constructs include spatial integration, social interaction, environmental quality, and perceived well-being. The Cronbach's alpha (α) values calculated for each variable, as presented in table 3, provide evidence of the reliability of the survey instruments.

Table 3. Reliability Test of Measurement Scales

Variables	Number of Items	α Coefficient	Reliability Level
Spatial Integration	5	0,81	Good
Social Interaction	6	0,86	Excellent
Environmental Quality	4	0,83	Good
Perceived Well-being	5	0,88	Excellent

The (α) coefficients for spatial integration (0,81), social interaction (0,86), environmental quality (0,83), and perceived well-being (0,88) show good to excellent internal consistency. These results provide evidence that the survey instruments used to measure environmental and perceptual factors that are agents in influencing elderly well-being in Chengdu's neighborhood parks are reliable.

Exploratory Factor Analysis (EFA)

The EFA was conducted to identify underlying relationships among the observed variables and to uncover latent constructs associated with spatial and perceptual dimensions of park design. The analysis aimed to clarify the factor structure of variables influencing elderly well-being, including spatial integration, social interaction, environmental quality, and perceived well-being. Table 4 presents the factor loadings, standard errors, and percentage of variance for each construct.

Table 4. Factor Structure of Variables Influencing Elderly Well-Being

Variable	Questionnaire Item	Factor Loading	Standard Error	Percentage of Variance
Spatial Integration	SI1	0,74	0,06	24 %
	SI2	0,78	0,05	
	SI3	0,75	0,06	
	SI4	0,77	0,05	
	SI5	0,76	0,06	
Social Interaction	SO1	0,81	0,04	26 %
	SO2	0,83	0,03	
	SO3	0,79	0,05	
	SO4	0,80	0,04	
	SO5	0,78	0,05	
	SO6	0,76	0,05	
Environmental Quality	EQ1	0,77	0,05	23 %
	EQ2	0,75	0,06	
	EQ3	0,78	0,05	
	EQ4	0,76	0,06	
Perceived Well-being	PW1	0,84	0,03	27 %
	PW2	0,82	0,04	
	PW3	0,80	0,04	
	PW4	0,79	0,05	
	PW5	0,81	0,04	

The factor analysis successfully clustered related items, uncovering four identifiable constructs that made up the model: perceived well-being (27 %), social interaction (26 %), spatial integration (24 %), and environmental quality (23 %). These results validate the construct structure and confirm the relevance of these dimensions in understanding elderly well-being in park environments.

Structural equation modeling (SEM)

The SEM was applied to evaluate complex relationships among spatial integration, social integration, environmental quality, and perceived well-being. This analysis helps to assess both direct and indirect effects between observed and latent variables within the proposed conceptual framework. Figure 3 and table 5 present the path analysis and statistical validation of the study's hypotheses using SEM.

Table 5. Path Analysis Using SEM

Hypothesis	Path	Standard Error	Path Coefficient (β)	p-value	t-value	Significance
H1	Spatial Integration → Social Interaction	0,06	0,39	0,000	6,50	Significant
H2	Social Interaction → Perceived Well-being	0,05	0,44	0,000	8,80	Significant
H3	Spatial Integration → Social Interaction → Well-being	0,05	0,17 (Indirect)	0,000	5,25	Significant
H4	Environmental Quality → Perceived Well-being	0,04	0,42	0,000	10,50	Significant

The SEM results confirm that social interaction and environmental quality significantly affect perceived well-being, while spatial integration indirectly contributes to well-being through its positive effect on social interaction. These findings support hypotheses H2, H3, H4, and H6, reinforcing the mediating role of social engagement in the built environment–well-being relationship.

The significant outcomes indicate that spatial integration positively influences social interaction (β = 0,39), which has a strong positive effect on perceived well-being (β = 0,44). Environmental quality also plays a crucial role, directly enhancing perceived well-being (β = 0,42). Additionally, the mediating effect of social interaction between spatial integration and well-being is confirmed, emphasizing the importance of spatial accessibility and environmental conditions in fostering emotional health among the elderly. The model demonstrates good

construct validity, with all item loadings ranging from 0,74 to 0,84, supporting the strength of the measurement model.

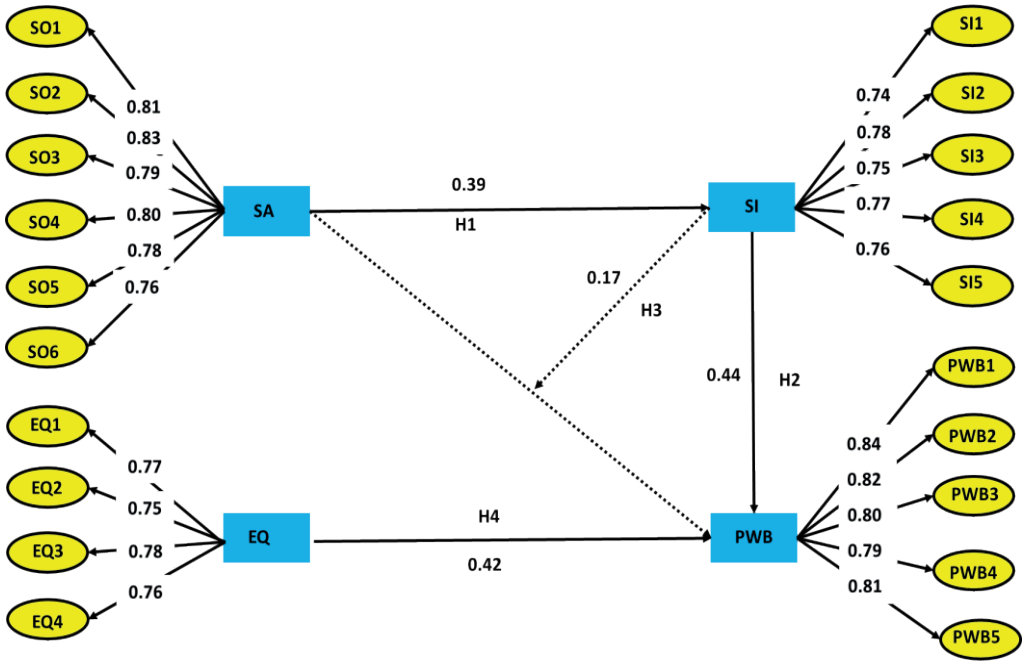

Figure 3. SEM Analysis

DISCUSSION

The Several spatial studies exhibit key limitations that affect the depth and relevance of their findings. Some focused on a single location, limiting generalizability to broader urban contexts.[9] Others relied solely on static spatial data, overlooking temporal variations in park usage and pedestrian flow [10,11] The absence of qualitative insights into user perceptions and behaviors restricted a holistic understanding of spatial experience.[12,13] In some cases, small or demographically narrow samples reduced the representativeness of results.[14,15] Additionally, many studies emphasized macro-level spatial patterns, neglecting micro-level interactions and real-time social dynamics essential to understanding user engagement.[16,17] The main concentration of this research is to evaluate the connection between environmental attributes, social integration, and perceived well-being in Chengdu's neighborhood parks for the elderly. The demographic analysis reflects diverse participants' characteristics, with a balanced gender distribution and a majority aged 66 and above, contributing to the research validity by capturing insights from active park users. A substantial proportion of participants reported frequent park visits, supporting the relevance of learning park-based social dynamics.[18,19] The reliability test confirmed strong internal consistency across all constructs, with α values exceeding accepted thresholds. EFA revealed clear latent constructs related to spatial integration, environmental quality, social interaction, and well-being, while CFA validated their structural relationships. The social interaction and environmental quality aspects of SEM demonstrated the strong, positive effects on perceived well-being. Social interaction had a critical role in the moderation of the direct effect of spatial integration. These findings highlight how measures of spatial design or environmental quality contribute to psychological well-being and social interaction amongst elderly users in urban public spaces.[20,21,22]

CONCLUSION

This research investigated how spatial configuration and environmental factors influence perceived well-being among the elderly by analyzing the relationships among spatial integration, social interaction, environmental quality, and perceived well-being in Chengdu's neighbourhood parks. Understanding these relationships is essential for creating age-friendly environments that foster health and social inclusion in urban settings. A total of 287 elderly participants were surveyed using a structured questionnaire across six parks, selected for their varied spatial layouts. The research applied quantitative methods, including reliability analysis, EFA, multiple regression, and SEM, to validate constructs and test hypotheses. Reliability testing yielded Cronbach's α values ranging from 0,81 to 0,88, confirming excellent internal consistency. EFA grouped items under four valid constructs with variances. Correlation and regression analyses confirmed strong relationships among key variables, with social interaction (r = 0,44) and environmental quality (r = 0,41) positively linked to well-being. Reliability tests showed good to excellent internal consistency (α = 0,81–0,88), and EFA validated the factor

structure. SEM analysis confirmed all hypothesized paths were significant except the direct effect of spatial integration on well-being. Although the findings provide a validated framework for spatial-social-wellbeing relationships, limitations include reliance on self-reported data, potential response bias, and the absence of cultural or emotional variables. Future works should integrate longitudinal data, behavioural observations, and cultural context to expand the model.

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