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Article

Structural Model for Evaluating Spatial Health Indicators of Public Spaces in Iraq

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Abstract: Public spaces are strategic hotspots and energy centers that shape urban life through various activities that can be invested in creating urban vitality and social interaction, leading to healthy urban environments. The importance of public places is at the forefront of sustainable development goals. However, there were few studies that focused on public spaces as the urban starting point for achieving healthy, vibrant, and active environments. Its descriptive case study approach came to assess the most known indicators of healthy public places using Smart partial least squares software (SmartPLS 4) and build a structural model that can determine the importance and the most influential factor on the quality of healthy urban life, from the point of view of a random questionnaire sample in the study area of Hay Al-Wahda neighborhood and its open area on the Rusafa side of Baghdad. We applied Standardized Root Mean Square Residual (SRMR) and the squared Euclidean distance (d_ULS) statistics to ensure the reliability and validity of the observed and the expected co-relationships of the indicators and structured model fit, respectively. As for the results, the structural model explains why, despite varied uses and activities, social communication fails in some public spaces. It was shown that uses and activities indicators exert a positive and statistically significant impact on spatial health, with the highest result for the path coefficient (0.331). In the meantime, the open area has the most negative path coefficient (−0.305) for the street level sociability indicators with the most significant p and t-statistics; thus, it cannot be credited as a healthy environment for residents' interaction.

Keywords: public places; healthy environments; spatial indicators; SmartPLS; urban sustainability

1. Introduction

Urbanization has intensified, with rising population, increased city dwellers, worsening health, and urban density problems in urban settings. Health, once defined as the absence of disease, now includes spatial, social, and psychological well-being. Research demonstrates that health outcomes are governed by a variety of factors including (but not limited to): individual physiology; type, timing, and quantity of healthy behaviors; urban land use; intensity of development; transportation systems; and quality of the built environment (Stefansdottir, Næss & Ihlebæk, 2019; Hasan & Abaas, 2020). Improved ecological urban designs have been associated with increased physical activity, reduced exposure to pollution, and overall better health (Zhong et al., 2022; Majeed & Abaas, 2021). Healthy places are curated for social life, and indications of vibrancy are connected to relationships (Al-Azzawi & Abaas, 2023a).

In 2012, UN-Habitat launched the Healthy Public Space program to advance urban public health and livability (Scruggs, 2020; Abdul-Sahib, Abaas, & Alshammaa, 2021). These initiatives considered inclusive public space designs that helped to promote diverse age groups and disabilities. resulted that, the progress fosters physical activity and mental health improvements (De Leeuw & Simos, 2017). Global efforts highlight socially inclusive, human-centered urban designs to support holistic well-being (Khalid & Abaas, 2020; Abaas, 2021).

Several basic considerations are made in the design of healthy public spaces according to Jankovič Grobelšek (2015) that which include: ecological sustainability, use and users, accessibility, comfort and safety, amenities and activities (Jankovič Grobelšek, 2015; Al-Azzawi & Abaas, 2023b). Gehl also lists key components of all pervading healthy environments and classifies them into four categories: public space quality, accessibility, the use and users, and safety and security (ApS, 2022). In the aforementioned study, the quality of five fundamental indicators: *comfort and image, access and linkages, uses and activities, sociability, and ecology and sustainability metrics* were used to analyze the quality of healthy places sorted.

Comfort and urban image indicators empower user experiences in urban spaces. It factors in aspects related to stimuli such as green areas, water features, cleanliness, maintenance, and public amenities such as playgrounds and kiosks that contribute to enriching the pedestrian experiences. The presence of signals of warning and indication help the place be understandable and lead to spatial and visual legibility, which, consequently, contribute to make the user feel comfortable and satisfied (Salingaros, 2003; Whyte, 1980). Taken together, these conditions form exciting, interactive spaces that promote urban well-being.

As such, urban design can consider the healthy cities that directly work to assist **access and linkage** indicators and promote active mobility, diversity, and density. Walkable urban spaces affect health, with the factors grouped into safety, functionality, destination, aesthetics, and comfort (Al-Rikabi & Budairi, 2023; Radha, Mohammed-Amin & Ali, 2020). Short paths and outdoor exercises are vital to both enjoyment and security (Sugiyama, Thompson & Alves, 2008). Visualization of a sustainable environment needs cities with high connectivity that ensure seamless transportation, integration of land use with other sectors, and accessibility to basic services. Connectivity, permeability, and coherence are necessary factors of accessible health environments (Al-Obeidy, Dabdoob & Sedeeq, 2019; Abaas & Khalid, 2023).

Uses and activities promoted spatial health by stimulating active public space, improving visual continuity, and creating defined functional zones through the use of active edges, organized facades, and urban hierarchy. The opposite includes commercial activity, open public space and some degree of mixed used space, making these areas walkable, socially communicative, and environmentally active provide a sense of community and accessibility space. (Mak and Koh, 2021; Zhong et al., 2022).

Healthy communities indorse **sociability** through social interaction events and activities, and the spaces between places where those social opportunities happen are interconnected for economic and recreational purposes. Particularly diversity of the urban fabrics like land uses, transportation modes, buildings, and architecture styles help achieving sustainability, economic development, and quality of life (Hasa, Altalib and Alzubaidy, 2017; Abaas, 2020; Khalid, Abaas, & Fadhil, 2021). Pedestrian movement in green spaces is affected by accessibility and visibility (Fan et al., 2022; Majeed & Abaas, 2023). while enclosure refers to the shape of that to create urban areas' identity and safe experiences and belonging (Salingaros & Pagliardini, 2016).

Local urban ecology relies on **ecological indicators and sustainability metrics**. Ecological indicators in urban conditions work on promoting biodiversity through the conservation of diverse living organisms and natural habitat. They play a role in maintaining environmental balance, reducing pollution, and improving human health. On the other hand, urban sustainability metrics are based on green instillation such as green infrastructure (roofs, facades, ponds, etc.) or eco-friendly building material (wood, stone, etc.) (Jabbar, Yusoff & Shafie, 2021; Abaas, 2013). Also, they might include sustainable irrigation systems that recycle water and the use of renewable energy sources such as solar cells and energy-efficient lights that reduce environmental impact, stimulate tourism, and increase the value of real estate (Ghazi & Abaas, 2019; Salih & Abaas, 2022). From the above explanation study indicators can include primary and secondary indicators as seen in Figure 1.

In this research, we conducted a descriptive field study surveying 100 urban residents using a five-point Likert scale to assess spatial health characteristics. We analyzed the survey's results through structural equation modeling in SmartPLS to evaluate the influence of urban health quality on public spaces and validate the research model. This methodology supports spatial planning and urban sustainability.

In the study's introduction, we emphasized urban health's role in fostering social interaction. Subsequent sections detailed urban health indicators, developed research hypotheses, and described statistical methods. The findings included measurement, structural, and bootstrap model analyses and discussions, concluding with identified limitations.

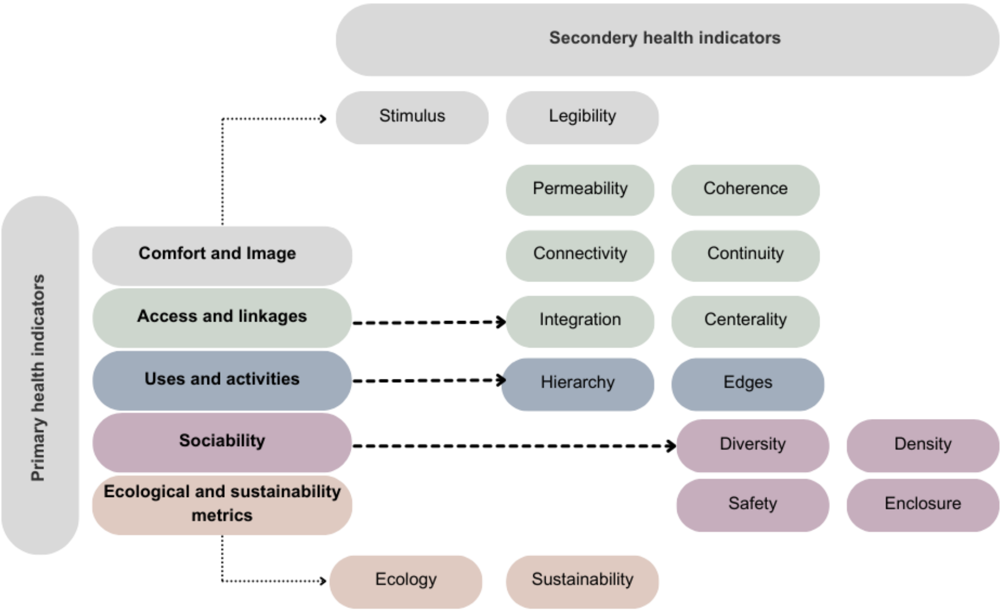

Figure 1. Study indicators. Source: Developed by Authors.

2. Model Hypotheses

Consequently, indicators of healthy places focus on assessing and arranging variables in the research area based on the perspectives of Iraqi citizens in the study area. So, and as seen in Figure 2, the research assumes a positive and statistically significant impact of each indicator on spatial health in public spaces as followed:

Hypothesis1 (H1): Comfort and image indicators have a positive and statistically significant impact on spatial health in public spaces.

Hypothesis2 (H2): Access & linkages indicators have a positive and statistically significant impact on spatial health in public spaces.

Hypothesis3 (H3): Uses & activities indicators have a positive and statistically significant impact on spatial health in public spaces.

Hypothesis4 (H4): Sociability indicators have a positive and statistically significant impact on spatial health in public spaces.

Hypothesis5 (H5): Ecological and sustainability metrics indicators have a positive and statistically significant impact on spatial health in public spaces.

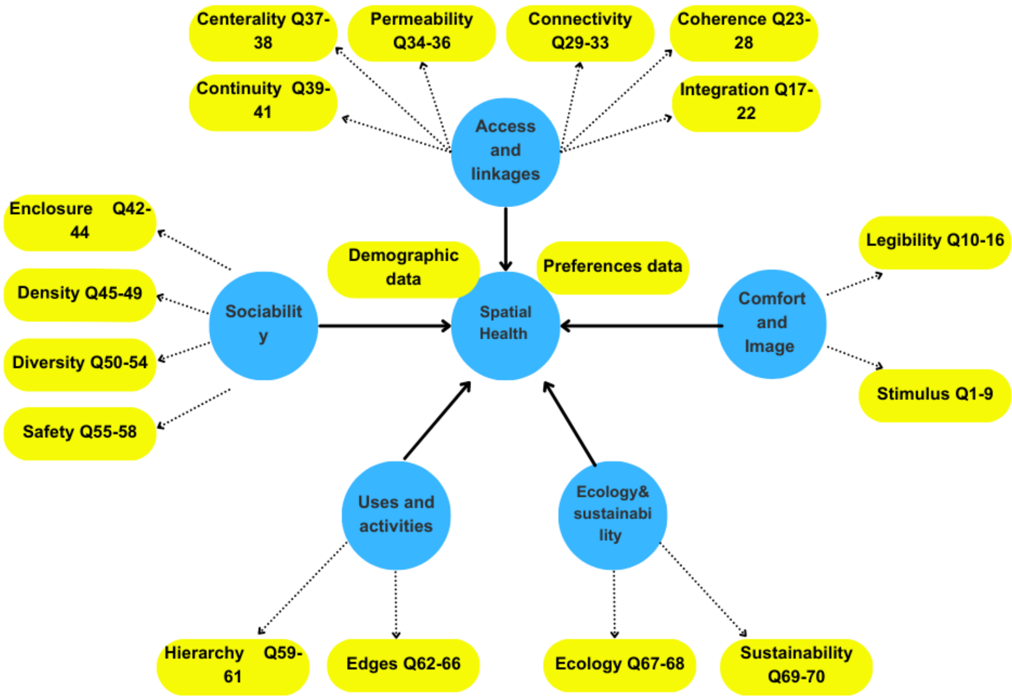

Figure 2. Research hypotheses as conceptualized in the SmartPLS program. Source: Developed by Authors.

3. Methodology

The present study applied descriptive quantitative design with a five-point Likert scale tool to measure spatial health. One hundred participants filled out a Google Form (link to form) [1] rating the statements from strongly agree (5) to strongly disagree (1). Demographics and preference data from the 70-question survey are summarized in *Supplementary Material (1),* while averages, standard deviations, and weighted averages of the findings of urban health indicators are presented in *Supplementary Material (2)*.

The survey was conducted from July 13 to July 19, 2023, targeting individuals within 500 meters of an open space in Baghdad's Al-Wahda neighborhood, known for its green spaces, residential areas, restaurants, shops, and medical facilities. Al-Wathiq Square, a focal point of the area, was renovated during a citywide project (2017–2018) to include features like playgrounds, shaded areas, and upgraded pathways, making it ideal for assessing spatial health indicators (Abaas, 2021; Majeed and Abaas, 2023). Figure 3 illustrates the site's characteristics.

[1] The questionnaire was originally part of a study conducted by the researcher as part of her master's degree in the Department of Architecture at the University of Baghdad. However, the current research builds on this work by advancing the objectives, hypotheses, and results. In this stage, the researchers developed an analytical structural model to address whether the open space functions as a spatial health space within the residential area and to identify which health indicators are most effective in the context of this local area. https://docs.google.com/forms/d/1rfrF1OrJIklhfWiZHDztCJ7aMZVLgz4U1zlU0G30UU/viewform?edit_requested=true.

Figure 3. depicts the boundary and the land uses in the neighborhood of Hay Al-Wahda- Al-Karrada Municipality. Source: Developed by Authors using AutoCAD and Photoshop software).

PLS-SEM Method in SmartPLS 4

Structural Equation Modeling (SEM) is a statistical approach to structural model that helps in identifying relationships between the input variables. It explores the relationships among independent and dependent variables through the use of both latent (unobserved) and observed variables (Hair et al., 2014). Partial least squares structural equation modeling (PLS-SEM) encompasses a two-component model: the measurement model and the structural model. Pairwise correlations or regression coefficients between individual pairs of variables for a hypothetical model are often displayed through a path model which visually represents the different hypotheses and relationships between them for further analysis, often in SmartPLS or similar endeavor (Khan et al., 2019). One key technique in SEM is bootstrapping, which generates multiple subsamples from the original data to assess the accuracy and reliability of model estimates. This enhances confidence in the results. (Mooney, Duval and Duvall, 1993; Hair Jr. et al., 2021).

Our structural SmartPLS 4 model for public healthy spaces is illustrated in Figure 4, where spatial health is the dependent variable, while five independent indicators are the outcome variables. The questions are grouped by specificity in the sub-indicators like comfort and image (e.g., stimulus and legibility). Other factors are access and linkages (integration, coherence, connection, permeability, centrality, and continuity) and sociability indicators (enclosure, density, diversity, and safety). Other indicators include uses and activities (Active edges and hierarchy) and Ecology and sustainability metrics.

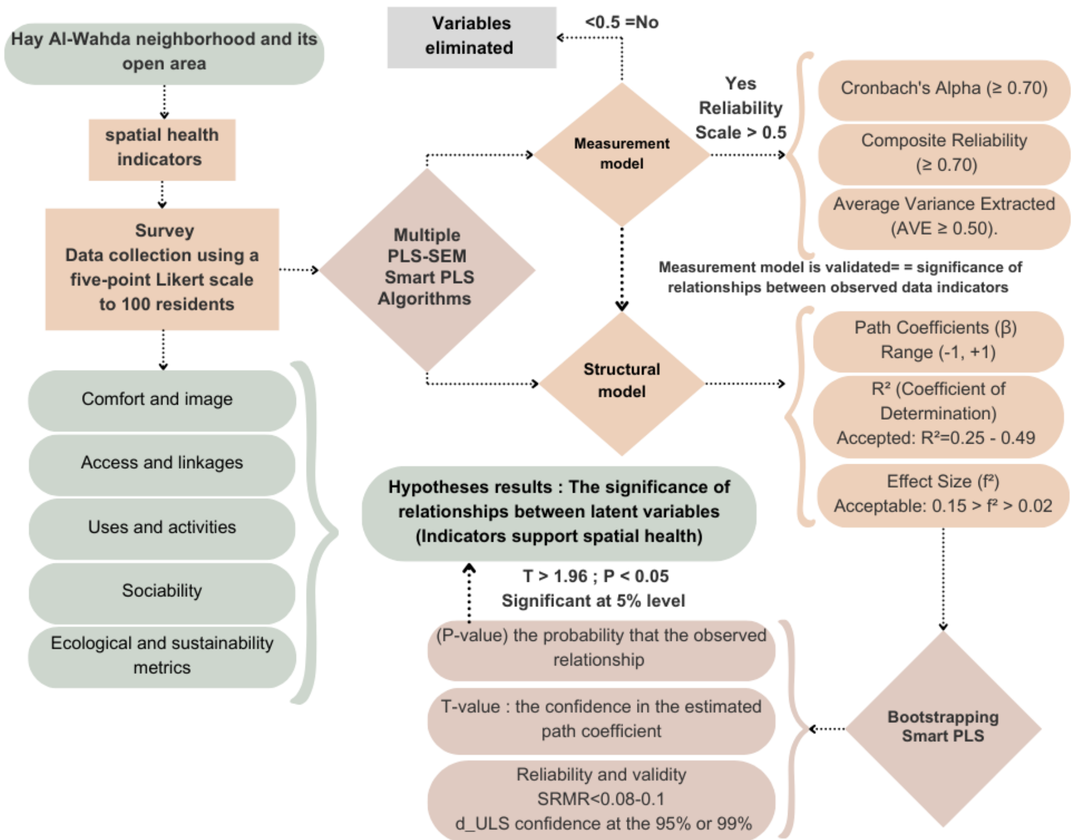

Figure 4. A framework for the structural SmartPLS 4 model and the Initial path mode. Source: Developed by Authors.

4. Data Analysis and Results

4.1. Measurement Model

4.1.1. Reliability and Validity of Observable Variables (Outer Loadings)

To test the measurement model, we checked the outer loadings of the indicators in the questionnaire. Following Hair et al. (2016), parametric values were determined as acceptable loadings using a threshold of (0.5). Items with loadings lower than the cut-off were omitted to have a good relationship between all the items and its underlying latent variable. (Hair Joe F et al., 2016). Cronbach Alpha and Composite Reliability were used to assess Internal consistency. Consistent with Hair et al. (2016) suggested values greater than (0.7) for both measures, indicating high reliability of each construct.

Convergent validity was assessed using the Average Variance Extracted (AVE). Following Richter et al. (2016) and Hair et al. (2017), an AVE value exceeding (0.5) was considered necessary for each construct. Values below this threshold indicate inadequate representation of the construct and may require item refinement or removal. (Richter et al., 2016; Hair et al., 2017). The results of all three steps performed with SmartPLS software are detailed in Supplementary Material (2)

The Average Variance Extracted (AVE) was used to assess convergent validity. Following Richter et al. (2016) and Hair et al. (2017), a threshold of > (0.5) for AVE value of each construct was determined as mandatory (some research accepts even 0.45 and we did). Values below this test indicate insufficient representation of the construct and warrant item refinement or removal. (Richter et al., 2016; Hair et al., 2017, see Table 1.

Table 1. Outer loadings of research indicators with values 0.5 or higher (Questions), Construct reliability and validity (Source: Authors; 2024 by PLS software).

Indicators	**Sub-Indicators**	**Accepted & potential Question**	**Factor loading**	**Final F loading**	**Cronbach Alpha**	**Composite reliability**	**AVE**
Spatial Health	Preferences data		**0.750**				
	Demographic data		**0.790**				
Comfort & Image	**Q1Stimulus**	Q1: The open space's attractions and reputation justify its aims.	0.511	-	0.786	0.844	0.524
	Q2Stimulus	Q2: The area is comfortable.	0.612	0.683			
	Q6Stimulus	Q6: The furniture (seats, umbrellas, lights, and garbage cans) is intact.	0.558	0.684			
	Q7Stimulus	Q7: The area has relaxation factors (sitting and shading areas).	0.704	0.886			
	Q9Stimulus	Q9: There is continuous attention to maintenance and hygiene in the place.	0.530	0.710			
	Q16Legibility	Q16: You have clear contact points for pedestrians and vehicles	0.503	0.629			
Access & Linkes	**Q19Integration**	Q19: There is a movement most of the time, especially in the evening.	0.544	0.593	0.732	0.806	0.458
	Q20Integration	Q20: There is diversity in buildings' types and uses.	0.620	0.658			
	Q21Integration	Q21: It offers a wide range of events and activities.	0.407	-			
	Q24Coherence	Q24: There is a convergence in places of activities to achieve walkability.	0.436	-			
	Q27Coherence	Q27: There is a visual continuity for the facades and the elements used.	0.448	-			
	Q29Connectivity	Q29: There is justice in access and equal opportunities.	0.674	0.834			
	Q31Connectivity	Q31: Confirmed of visual intercession.	0.498	0.683			
	Q33Connectivity	Q33: There Is private and/or public transportation	0.450	0.587			
Uses & Activities	**Q59Hierarchy**	Q59: Spaces exhibit gradients	0.548	-	0.703	0.803	0.512
	Q60Hierarchy	Q60: You are attracted to a grade of spatial privacy.	0.786	0.847			
	Q61Hierarchy	Q61: Multiple Measurements.	0.672	0.797			
	Q63Edges	Q63: There are various commercial activities.	0.435	-			
	Q65Edges	Q65: There are amount of pollution and noise	0.643	0.569			
	Q66Edges	Q66: There is some environmental interaction.	0.696	0.608			
Sociability	**Q49Density**	Q49: There are people in that open space, whether it's for bicyclists or pedestrians.	0.551	0.744	0.615	0.794	0.563
	Q52Diversity	Q52: You were attracted by the variety of materials used and the color and visual texture of the area	0.441	0.741			
	Q53Diversity	Q53: There is a variety of sitting areas to rest	0.410	0.766			
Ecological & sustainability	**Q68Ecology**	Q68: There are nature, grass, fountains, and water.	0.424	0.578	0.078	0.645	0.482
	Q69Sustainability	Q69: The presence of green infrastructure and/or wildlife conservation.	0.758	0.794			

4.2. Structural Model Analysis

The structural model accounts for the hypothetical causal connections between study variables and depicts the direction and magnitude of relationships between independent (predictor) and dependent variables. These relationships are measured by path coefficients and the predictive capacity of the model is assessed by R^2 and F^2. Figure 5 presents the SEM_PLS process followed by the bootstrapping process. Repeating the SEM-PLS process to simulate the R^2, the coefficient of determination helps explain how much of the variance of the dependent variable an independent variable is able to explain. Cohen (1988) offers rules of thumb for interpreting R^2 values that categorize small, medium and large effect sizes (Cohen, 1988; Ghansah, Chen and Lu, 2022). F^2 is the effect size based on how much the independent variable contributes uniquely to the dependent variable in a regression equation. According to Hair et al.

(2013), F^2 can also be characterized into no, small, medium and large effect sizes (Hair, Ringle & Sarstedt, 2013; Hair Jr. et al., 2021). The structural model along with its parameters is shown in Figure 5.

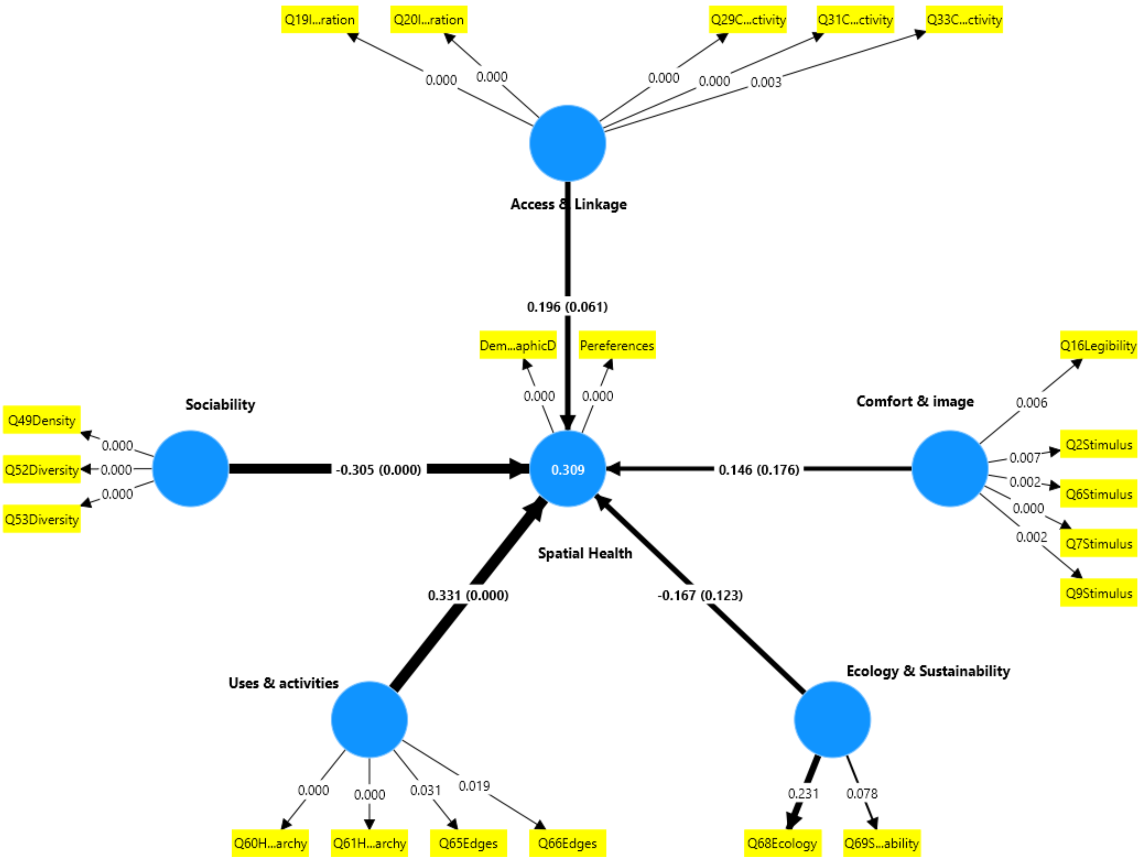

Figure 5. The Results of the Research Bootstrapping Model (the third Step) Source: Authors (2024); (Generated by SmartPLS program).

4.3. Bootstrapping

This study uses bootstrapping as the resampling method to test the significance of path coefficients, outer loadings, and other important indicators in the measurement and structural models. SmartPLS performs bootstrapping to calculate the *p*-values and t-values for path coefficients in order to examine the statistical significance of the path coefficients. The t-distribution shows how many standard deviations the path coefficient is away from zero informative of the confidence of the estimated coefficient, while the *p*-value signifies the probability of observing the relationship within the sample assuming the selected no true relationship in the population. For two-tailed tests critical thresholds are defined as: t > 2.58, (*p* 1.96 (*p* 1.65 ($p < 0.10$) significance at 10% level. There is a direct relationship that high t-values will mean low p-values and therefore significance and that low t-values mean high p-values and therefore insignificance. The relationships between latent variables were examined, and t-values greater than 1.69 are considered significant at a 95% confidence interval (Hogg, Tanis, & Zimmerman, 2015). After the SEM_PLS process we applied the bootstrapping process as seen in Figure 5. Total results are applied in supplementary material (2).

5. Discussion

The present paper adopts a case study approach for the identification of healthy urban vitality indicators and identifying the most superior factor using designed structural model. Five hypotheses are examined using PLS-SEM, measurement, structural analysis, and bootstrapping. As stated in Table 2 the following results were reviled:

Table 2. Path Coefficients along with their bootstrap values and 'T, P, F^2' Values. (Source: Authors; 2024 by SmartPLS software).

Factors	Path Coefficients	T Statistics (|O/STERR|)	*p*-Value	F-square	Hypothesis Remark
H1: Comfort & image > Spatial Health	0.146	1.353	0.176	0.025	Insignificant
H2: Access & Linkage > Spatial Health	0.196	1.873	0.061	0.042	Partially significant
H3: Uses & activities > Spatial Health	0.331	3.746	0.000	0.137	Strongly significant
H4: Sociability > Spatial Health	−0.305	3.748	0.000	0.122	Strongly contradicts significant
H5: Ecology & Sustainability > Spatial Health	−0.167	1.543	0.123	0.038	Insignificant

With respect to the first-mentioned hypothesis... The results showed a positive relationship, albeit not statistically significant, between Comfort & Image indicators and the spatial aspect of health in the context of public places. A positive correlation was noted, as the AVE value of 0.524 demonstrates that the Comfort & Image has adequate convergent validity. Although the path coefficient was 0.146, the correlation was however weak ($p = 0.176$, t = 1.353). Sums up the percentage of the variability of spatial health which the model was able to explain, R-squared. While the model explained a moderate amount of variability in spatial health (R-squared = 0.309), the effect size for the Comfort & Image factors was small (F-square = 0.025). These small impacts may be due to the argument that measures such as the Comfort & Image sub-indicators that include stimulus (e.g., furniture comfort, relaxation components, and maintenance) and legibility (e.g., clear contact points for pedestrians and vehicles) enhance spatial health to a limited extent.

The second hypothesis, which claimed the positive contribution of Access & Linkage indicators on public spatial health, was partially supported as well. The path estimate provided a measure of 0.196, which was found to be positive though moderate (F-square = 0.042). But the p-value, which was equal to 0.061, gets very close to the statistical significance at the 0.05 level, but it does not reach it. This is indicative of vulnerability against the dataset claims already made. linking access indicators on the contribution towards spatial health. Successful sub-indicators, such as integration (evidenced by diverse movement patterns and varied building types) and connectivity (demonstrated by equitable access, clear visual connections, and accessible public and private transportation), confirmed the expectations in theory that effective linkages and access would positively improve the spatial health. Even though access and linkages were marginal, the positive relationship, which was seen much more consistently, predominated and appeared to be reasonable within the proposed theoretical framework, indicating that these personal, needed aspects of public spaces, if deepened, should add to the health perception.

The analysis strongly confirms the third hypothesis, which states that Uses & Activities indicators have positive and statistically significant effects on spatial health in the context of public places. It was established that there exists a strong positive relationship with regards to the path coefficient (0.331) with an accompanying highly significant *p*-value ($p < 0.001$) and a considerable t-statistic (t = 3.746). The F-square value of 0.137 also indicates moderate effect size, which implies that variations in uses & activities indicators account for a moderate amount of the variation in the spatial health. The moderate model fit ($R^2 = 0.309$) and good construct validity (AVE = 0.563) also corroborate the strength of these results. Successful indicators, such as hierarchy (evidenced by privacy graduations and multiple measurements of space usage) and edges (evidenced by diverse commercial clusters and appropriate linkages to the adjacent zones), were consistent with the hypothesis, which anticipated that a range of uses and activities within the areas would improve the perception of the spatial health of the public spaces. This strongly implies that the maintenance of a healthy mix of uses and activities in the public areas is necessary to achieve desirable spatial health among populations.

Fourth hypothesis to analyze: the analysis of the hypothesis that indicators of Sociability have a positive and statistically significant effect on spatial health in public spaces is refuted very strongly. Rather than finding a positive relationship, we observed a strong negative relationship (path coefficient = −0.305), with a highly significant *p* value ($p < 0.001$) and substantial t-statistic (t = 3.748). The value of 0.122 for F-square indicates a moderate effect size, implying that Sociability indicators account for a moderate amount of the variance in the spatial health model. Although in the reverse direction of the hypothesized relationship. Further evidence for the robustness of this negative finding includes moderate model fit (R-squared = 0.309) and strong construct validity (AVE = 0.563). Even if the expected positive correlation with successful indicators was found with density (appropriate levels of pedestrian activity or cyclist activity) and diversity (different facade materials, visual texture, and different forms of furniture), in all cases the results consistently showed a negative association of sociability indicators with perceived spatial health.

The findings also did not support the fifth hypothesis that Ecology & Sustainability factors positively and significantly contribute to spatial health. A negative relationship was, however, seen between the two variables (path coefficient = −0.167), although this way remained insignificant ($p = 0.123$). These indicator's F-square value of 0.038 means that (size of the effect) these indicators have a very minimal effect on spatial health. Spatial Health's Structural Equation Model (SEM) provided an overall model with a predictive power of 40% with R-square = 0.309. Ecology & Sustainability factors contributed, however, very little to such a measure. Noteworthy is the fact that despite the positive predictive power of indicators such as ecology, which deals with vegetation, water bodies, fountains, and nature in general, the sample registered strongly negative sentiments on the adoption of the technologies that support sustainable development, such as waste recycling or conservation of fauna and flora. The analytical model did record an inverse relationship between those factors and health that was perceived in a geographical context. The empirical evidence about the study in focus may not lend internal purposes very firmly, with the evidence currently available. As we mentioned, there is great demand on the places of these open recreation areas, but due to housing scarcity, they are more of the time overridden.

6. Reliability and Validity

The final bootstrapping model results show good fit of the structural model to the data. As seen in Table 3. The SRMR was 0.0139, well below the relatively standard threshold of 0.08, indicating a good fit between whether the observed and the expected co-relationships. Moreover, the SRMR confidence intervals (95% upper bound: 0.124, 99% upper bound: 0.158) indicate that our observed value is very much lower than these upper values, which provides a further argument for the quality of the model fit. The unweighted least squares discrepancy (d_ULS) value was 4.378. Its value is well within the confidence intervals (95%: 3.540, 99%: 5.795), confirming that the fit of our bootstrapping model complies to the expectations and does not show overtly aberrant figures. Collectively, these fit indices demonstrate that the structural model provides an excellent representation of the data, affirming its validity and reliability.

Table 3. Reliability and validity values (source: Authors; 2024 by SmartPLS software).

	ORIGINAL SAMPLE (O)	SAMPLE MEAN (M)	95%	99%
SRMR saturated estimated &model	0.0139	0.090	0.124	0.158
D_ULS saturated estimated &model	4.378	1.946	3.540	5.795

7. Conclusion

This descriptive study aimed to identify the main determinants of a healthy urban atmosphere of open space in Al-Wathiq Square and a dense urban environment represented by the highly populated Hay Al-Wahda neighborhood. This neighborhood was chosen for its central location in Baghdad and due to the increased accessibility for the locals to facilities that promote healthy living. The hypothesis that "Uses and activities indicators have a positive and statistically significant impact on spatial health in public spaces" was very supported by the given data. It is because promoting spatial health among citizenry involves the conservation of a balanced array of utilizations and activities in such public spaces. On the other hand, the hypothesis for "Access & Linkage indicators" was only partially supported, suggesting some susceptibility of the linkage dataset claims. A larger sample size or other questions may be needed to draw a more conclusive result. In contrast, the Access & Linkage indicators hypothesis was supported partially; highlighting the vulnerability of accessing claims data in linkage datasets and the shortage of permeability. We would need more information or a larger sample size to come to a more conclusive answer. Statistical analysis of "Comfort & Image indicators" failed to meet the hypothesis threshold, so it was rejected. Additional analysis is essential to uncover the extent to which other variables, such as socioeconomic factors and vehicular noise and air pollution, affect spatial public health. Furthermore, the hypothesis regarding "Sociability indicators" was strongly refuted by the analysis, showing a notable negative correlation. Despite the favorable conditions and convenient access, the site was not heavily visited, with mainly university students and nearby institutions rather than local residents from the Al-Wahda neighborhood frequenting the area. Finally, the analysis did not support the hypothesis that "Ecology & Sustainability" indicators influence spatial health. The data collected relies on assumptions which do not correlate very well with this aims of the study from an internal aspect. The shortage of housing space ultimately leaves less open recreational spaces, despite high demand for it. Considering these difficulties to practically execute sustainability on the local field, the relevant part may need to be reconsidered about the relevance and appropriateness of applied indicators.

As consequently, the variation of urban uses and diverse activities in the Hay Al-Wahda neighborhood have the greatest impact on the quality of healthy urban living. However, just two of the five primary indicators surpass the threshold of the constructed structural program, meaning it still failed to meet all of the spatial health indicators. Thus, by identifying the strengths and weaknesses of the spatial indicators and estimating what interventions are required to attain sustainable urban health, Structural Equation Modeling (SEM) could be used as a standard scale to improve the local areas.

8. Future Research

Creating an urban environment that encourages social contact and physical exercise is one of the key goals of urban designers. To improve the structural link between independent and dependent variables, the model suggested adding a few more indicators. One of the crucial elements that the study has not examined but that still has a major role in promoting healthy urban settings is political considerations. Additionally, because historical and heritage locations offer spatial features that encourage walking and generate ecologically friendly surroundings, it is equally crucial to emphasize the possibilities of repurposing these spaces in accordance with the idea of healthy environments.

Author Contributions

Zaynab Radi Abaas: Conceptualization, Data curation, Scientific and statistical analysis, Methodology, Software, Project administration, Funding, Investigation, Supervision, Resources, Validation, Visualization, Writing—review & editing. Sabreen Mohammed: Conceptualization, Data curation, Scientific and statistical analysis, Methodology, Software, Project administration, Survey and interview, Investigation, Resources, Validation, Visualization, Writing original draft. All authors have read and agreed to the published version of the manuscript.

Conflict of Interest Statement

The authors have no competing interests to declare.

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