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ORIGINAL PAPER

Role of the Residential Environment in Shaping Subjective Well-being

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Abstract
Despite the fact that housing represents a fundamental unit of urban systems where people spend much of their daily lives, little attention has been paid to the structural relationship between residential environments and subjective well-being. In this study, structural equation modeling was used to analyze the structural relationship between residential environment and subjective well-being, controlling for the effects of demographic factors and personality traits. An online survey of 1,001 adult residents in Japan measured subjective well-being and assessed residential environments, consisting of the thermal, acoustic, light, hygiene, safety, and security. The model revealed an important pathway from the residential environment to subjective well-being mediated by life-domain satisfaction. The six environmental components described above all contributed substantially to the latent residential environment construct, with safety and hygiene showing the highest loadings. This study contributes to a more fundamental understanding of the structural relationship between residential environments and subjective well-being. It also provides insights into designing better residential environments that enable everyone to live in healthier and more supportive spaces—an endeavor that is crucial for promoting sustainable and inclusive urban development, particularly in terms of enhancing overall quality of life.

Keywords Well-being · Residential environment · Built environment · Life domain factor · Health · Structural equation modeling

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1 Introduction

Well-being is increasingly attracting attention, as exemplified by the inclusion of well-being in the Sustainable Development Goals (SDGs) as Goal 3: "Ensure healthy lives and promote well-being for all at all ages" (United Nations, 2015). There is substantial evidence that well-being positively influences health and longevity (Diener et al., 2018, Wu 2016). Higher well-being is associated with better job performance, enhanced creativity, stronger immune and cardiovascular systems, healthier behaviors, and longer life expectancy. Socioeconomic factors such as income and marital status have long been recognized as important determinants of subjective well-being. In addition, well-being is increasingly being used as a policy key performance indicator for building a sustainable society, rather than GDP, which is solely an economic indicator (Huppert et al., 2009; Hoekstra, 2019; Coscieme et al., 2020).

Increasing interest in place as a determinant of health suggests that contextual (environmental) and compositional (individual) contributions to health differences across areas must be distinguished (Macintyre et al., 2002). Regarding housing and well-being, the quality of the environment in which people live is crucial because it can exacerbate social inequalities and health disparities (Aretz et al., 2019). Housing is fundamental social infrastructure that supports residents' quality of life (Klepeis et al., 2001). The role of housing as a social, economic, environmental, and cultural determinant of health is increasingly being recognized institutionally (Mansour et al., 2022). The World Health Organization (WHO) Housing and Health Guidelines also underscore the critical importance of housing for health and well-being (WHO, 2018).

Numerous studies have focused on the relationship between housing tenure types (owned vs. renting) and well-being, particularly from a sociological perspective (Kent et al., 2017, Zhang and Zhang, 2019; Alonso & Jacoby, 2022, Zhan et al., 2022; Yu et al., 2023; Sebastian & Timon, 2023; Grimes et al., 2024). In addition, studies have shown the relationship between the quality of housing and neighborhood and subjective well-being (Rolfe et al., 2020; Chan and Wong, 2022; Zhu & Holden, 2023). According to the review of the connection between housing and subjective well-being by Clapham et al. (2018), key aspects have been identified, such as evaluation on physical housing conditions (e.g., dampness, lighting, and noise) and social status associated with housing. They found that poor conditions negatively affect subjective well-being. Huebner et al. (2022) analyzed cross-sectional data from the English Housing Survey to examine the relationship between subjective well-being and factors such as housing and neighborhood characteristics. They found that difficulties in maintaining comfortable indoor temperatures during winter and fuel poverty were significantly associated with lower subjective well-being. Further studies analyzed the relationship between residents' well-being and urban green spaces and that between residents' well-being and environmental perception (Wang et al., 2023; Zhao et al., 2024).

Accumulating evidence suggests a sequential process in residential contexts: residential environments shape domain satisfactions, which in turn predict subjective well-being (residential environment → life domains → subjective well-being). First, residential and neighborhood environments are reflected in specific life domains, such as health, social relationships, leisure, and satisfaction with the home itself (Zalejska-Jonsson and Wilhelmsson 2013; Mouratidis 2019b; Kleeman et al. 2023; Kamata et al., 2024b). Second, links between life domains and subjective well-being are well-established: evaluations of health, social

relationships, leisure, and housing-related domains are consistently associated with overall life satisfaction (Loewe et al., 2014; Diener et al., 2018; Layard & Neve, 2023; Organisation for Economic Cooperation and Development, 2013). Taken together, these findings imply that the residential environment → subjective well-being association is expected to operate largely indirectly via life domains, while allowing for potential direct links in some contexts.

Building on this logic, a pathway framework linking the built environment to subjective well-being through life domains has been synthesized in built environment engineering (Mouratidis, 2020, 2021). The framework has been examined across multiple contexts, including urban scales (Mouratidis, 2020, 2021) and building scales such as office environments (Arata et al. 2025a; Fukawa et al. 2024), suggesting its usefulness for organizing evidence on how environmental exposures translate into domain evaluations and, ultimately, overall subjective well-being.

However, there is a lack of analysis that considers the mediating effects of life domains on well-being in residential environments where people spend a large amount of their time (Brasche & Bischof, 2005). Investigating this relationship also requires an adequate sample size and careful control of confounding factors (Huebner et al., 2022) because reviews of these relationships have highlighted inconsistencies in important findings. Among various factors, personality traits are known to be significant moderators of subjective well-being (Kahneman et al., 1999; Diener & Lucas, 1999; Diener & Seligman, 2002), systematically influencing both domain-specific and overall life evaluations. To account for such complexities, structural equation modeling (SEM) offers an appropriate analytical approach. However, existing SEM studies rarely incorporate personality traits, despite their well-established influence on subjective well-being assessments. Moreover, housing consists of various elements, and incorporating these individual components into the analysis is expected to improve and expand the understanding of the relationship between housing and well-being.

In built environment engineering, well-being is often simplistically used to refer to wellness, happiness, and quality of life, or to comfort and health (Altomonte et al., 2020). Therefore, it is important to define well-being first and then investigate its relationship with the residential environment. To understand the relationship better, an established definition should be used from well-being research of "well-being" as a good mental state, including all of the various evaluations, positive and negative, that people make of their lives and the affective reactions of people to their experiences (Diener, 2007). This definition has also been widely used for many years in global surveys conducted by international organizations (Organisation for Economic Cooperation and Development, 2013). Although a related concept is life-domain satisfaction, which refers to evaluations of specific spheres such as health, social ties, leisure, neighborhood quality, and home, it is conceptually distinct from overall well-being. The two are hierarchically related but empirically distinct; domain evaluations are theorized to act as mediators between environmental inputs and overall subjective well-being (Loewe et al., 2014). By incorporating life-domain satisfaction into the analysis, it becomes possible to better understand how specific aspects of the residential environment contribute to overall well-being through their influence on individual life domains.

Based on the trends and gaps in the literature, the present study investigates how the multidimensional residential environment shapes subjective well-being, and through which life domains, after accounting for demographic and personality traits (Fig. 1). This study

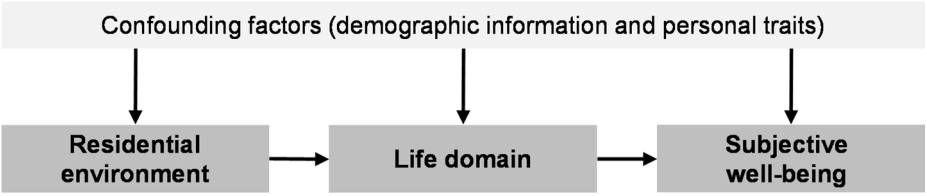

Fig. 1 Hypothesized model of the relationship between the residential environment and subjective well-being

contributes by: adapting an existing pathway model proposed at the urban scale to the residential environment using six objectively verifiable facets—thermal, acoustic, lighting, hygiene, safety, and security; and leveraging a nation-wide sample to benchmark the indirect environmental effect sizes against prominent socio-economic predictors, such as income and marital status.

2 Materials and Methods

2.1 Outline of the Survey

This study collected data on the residential environment and subjective well-being, as well as data on confounding factors, and analyzed their relationships. Because well-being is inherently subjective, analyzing its relationship with the residential environment requires capturing individuals' self-reported perceptions. Questionnaire surveys were used to collect subjective data to provide direct insights into people's subjective well-being. Moreover, to understand the structures underlying this relationship, information was gathered on intermediate variables, such as life domains.

An online questionnaire survey was conducted with adult residents in Japan from March 4 to March 9, 2020, to assess the residential environment and subjective well-being. Demographic information and representative life domain factor data were also collected.

The survey was conducted by a professional research agency, which anonymized all responses before providing the dataset to the researchers. Therefore, the authors had no access to any personally identifiable information. The survey company obtained informed consent from all participants in accordance with its privacy policy.

2.2 Evaluation Data on Residential Environment

Table 1 presents the survey items for residential environment. Data on housing type, ownership, and age of construction were collected. Although measurements of the physical environment hold valuable insights, practical constraints make it challenging to gather such data in large-scale studies. Consequently, the Comprehensive Assessment System for the Built Environment (CASBEE) Residential Health Checklist (Kawakubo et al., 2018) was used to assess the residential environment.

The checklist is part of CASBEE, developed by a committee supported by the Japanese Ministry of Land, Infrastructure, Transport and Tourism. The checklist has been used in

Table 1 Items and scale for residential environment

Items	Response scale
Residence type	(0) detached house, (1) apartment
Residence ownership	(0) owner-occupied, (1) rental
Age of construction	[years]
Residential environment factors (frequency of experiencing objective issues in various residential environment factors)	(0 pt) often, (1 pt) sometimes, (2 pts) rarely, and (3 pts) never Forty-four items from CASBEE residential health checklist (Table 7)

many previous studies as a system for assessment of the residential environment, and these assessments are related to the residents' quality of life, health, and productivity when working from home (Arata & Kawakubo, 2023; Kawakubo et al., 2018, 2022; Kawakubo & Arata, 2022; Kamata et al., 2024a, 2024b; Chen et al., 2023, Chimed-Ochir et al., 2021). The checklist allows residents to assess various residential environment factors by identifying whether there are objective issues. Although the evaluation is inherently subjective, it provides a structured framework for assessing potential issues based on facts.

The checklist consists of 44 items related to potential residential issues. The assessment of the residential environment used in this study includes six environmental components: thermal, acoustic, light, hygiene, safety, and security environment. Table 7 lists the items used to assess the residential environment, originally in Japanese, which have been translated into English. The checklist uses a four-point Likert scale to assess the frequency of each problem as often (0 pt), sometimes (1 pt), rarely (2 pts), or never (3 pts). Scores for the six environmental elements were calculated and used in the analysis for this study.

2.3 Evaluation Data for Subjective Well-being

Residential environmental conditions constitute a chronic exposure that is repeatedly experienced in everyday life, and are therefore expected to relate more directly to residents' reflective appraisals of their lives than to momentary emotional states. In line with the OECD framework distinguishing life evaluation from affect and eudaimonia, the present study focuses on the evaluative component of subjective well-being (OECD, 2013). The Satisfaction with Life Scale (SWLS) was developed to assess global cognitive judgments of life satisfaction, shows temporal stability under relatively unchanged conditions while remaining sensitive to meaningful changes in life circumstances, and demonstrates discriminant validity from affective measures (Diener et al., 1985, 2013). Accordingly, SWLS was adopted as the outcome measure to examine associations between enduring residential environmental conditions and subjective well-being.

The SWLS is widely accepted as a valid measure of well-being and has been used in various fields (Diener et al., 1985, Dowler et al., 2001; Izumi et al., 2021). The questions were asked in Japanese. The SWLS consists of five questions, which are rated on a scale of 1 to 7 (Table 2). The total score is calculated by adding up the scores for each item. The range of possible scores is 5–35. Scores of 5–9 indicate that the respondent is extremely dissatisfied with life; scores of 31–35 indicate that the respondent is extremely satisfied; and a score of 20 is neutral.

Table 2 SWLS items and scale

Statements	Response scale
(1) In most ways my life is close to my ideal. (2) The conditions of my life are excellent. (3) I am satisfied with my life. (4) So far, I have gotten the important things I want in life. (5) If I could live my life over, I would change almost nothing.	(1) strongly disagree, (2) disagree, (3) slightly disagree, (4) neither agree nor disagree, (5) slightly agree, (6) agree, (7) strongly agree

Table 3 Items and scale for demographic information and life domain factors

Items	Response scale
Demographic information	
Age	[years]
Gender	(0) man, (1) woman
Marital status	(0) not married, (1) married
Working status	(0) not working, (1) working
Educational background	(0) below bachelor's degree, (1) bachelor's degree or higher
Annual income (JPY)	(1) < 1 million, (2) < 2 million, (3) < 3 million, (4) < 4 million, (5) < 5 million, (6) < 6 million, (7) < 7 million, (8) < 8 million, (9) < 9 million, (10) < 10 million, (11) < 12 million, (12) < 15 million, (13) < 20 million, (14) ≥ 20 million
Personality traits	TIPI-J (1–7 points) * TIPI-J: Japanese version of the Ten Item Personality Inventory
Life domain factors	
Satisfaction with health	(0) not at all satisfied – (10) completely satisfied
Satisfaction with personal relationships	(0) not at all satisfied – (10) completely satisfied
Satisfaction with the amount of time spent on leisure	(0) not at all satisfied – (10) completely satisfied
Satisfaction with quality of local environment	(0) not at all satisfied – (10) completely satisfied
Satisfaction with residence	(0) not at all satisfied – (10) completely satisfied

2.4 Survey Data on Demographic Information and Life Domain Factors

Table 3 shows the data on demographic information and life domain factors collected. Demographic information included age, gender, marital status, working status, educational background, and annual income. To understand the personality traits of residents, the Japanese version of the Ten Item Personality Inventory (TIPI-J) was used (Gosling et al., 2003; Oshio et al., 2012), which measures the Big Five personality traits of extraversion, agreeableness, openness, conscientiousness, and neuroticism. The TIPI-J contains two items for each trait, for a total of 10 questions, and each item is rated on a 7-point scale, ranging from

1 to 7. Each personality trait is given a rating between 1 and 7 points, which is the average of the two items. A higher score indicates a higher tendency toward each trait.

This study also asked residents to rate life domain factors on an 11-point scale, with 0 indicating not at all satisfied and 10 indicating completely satisfied. These life domain factors were assessed based on the OECD guidelines (2013) and previous studies (Mouratidis 2017, 2019a, 2020, 2021; Layard & Neve, 2023, Marans, 2003).

2.5 Data Analysis

Based on a framework for subjective well-being reported by Mouratidis (2021), SEM was performed. SEM is a powerful multivariate statistical analysis method that can be used to study the complex relationships between observed and latent variables (Hair et al., 2021). Statistically, SEM integrates factor analysis and multiple regression to analyze multiple dependent relationships simultaneously, which is a key advantage of SEM and something with which traditional methods struggle.

The hypothesized model is shown in Fig. 1. Demographic information and personal traits were used as confounding factors. Categorical demographic variables were converted into observed exogenous variables. Binary variables were dummy-coded, whereas annual income was treated as an ordered variable with higher values indicating higher income. The latent variable for personal traits consisted of five observed variables of TIPI-J. Residential environment was treated as a latent variable based on the following observable variables from the CASBEE Residential Health Checklist: (1) thermal environment, (2) acoustic environment, (3) lighting environment, (4) hygiene environment, (5) safety environment, and (6) security environment. Life domains were represented as a latent variable with observed variables of (1) satisfaction with health, (2) satisfaction with personal relationships, (3) satisfaction with amount of time spent on things one likes, (4) satisfaction with quality of local environment, and (5) satisfaction with residence. “Residence” is included in the life domain because of the modeling of the reactions of residents through environmental perception. This approach has been used in a previous study (Marans, 2003). For the covariances between the error terms of observed variables, settings were applied only where significant covariances were confirmed. Finally, subjective well-being was defined as an observed variable of the total SWLS score.

The validity of these models was assessed using specific indices of a root mean square error of approximation (RMSEA) value below 0.08 and goodness-of-fit index (GFI) and comparative fit index (CFI) values above 0.90 (McDonald & Ho, 2002). For the test, the null hypothesis was that the estimates of regression weight are zero, and the level of significance was set at 0.05. An estimate was considered significant if the absolute value of the estimated regression weight divided by its estimated standard error exceeded 1.96.

3 Results

There were 1,001 valid responses to the online survey. This section presents the distribution of data on residential environments. In addition, the distributions of data on subjective well-being, demographic information, and life domain factors of the residents are provided. Then, the results of the SEM analysis are described.

3.1 Resident Demographic Information, Life Domain Factors, and Subjective Well-being

Table 4 summarizes the respondents' demographics and indicates a marked age skew: adults aged 20–39 accounted for only 0.9% of the sample, compared with approximately 24.9% in Japan's population over 20 (Japanese Ministry of Internal Affairs and Communications, 2025). The ratio of men to women was 52:48, 84.1% were married, and approximately 61% were engaged in work, whereas the rest were either homemakers or retired from their

Table 4 Distribution of residents' demographic information and life domain factors

Items	Number	Percentage (%)
Age (years)		
<40	9	0.9
40–49	225	22.5
50–59	338	33.8
60–69	297	29.7
≥70	132	13.2
Gender		
Man	525	52.4
Woman	476	47.6
Marital status		
Married	842	84.1
Unmarried	159	15.9
Working status		
Working	614	61.3
Not working	387	38.7
Educational background		
Bachelor's degree or higher	452	45.2
Associate's degree or lower	549	54.8
Annual income (JPY)		
<1 million	17	1.7
1 million–2 million	30	3.0
2 million–3 million	85	8.5
3 million–4 million	127	12.7
4 million–5 million	142	14.2
5 million–6 million	101	10.1
6 million–7 million	90	9.0
7 million–8 million	97	9.7
8 million–9 million	65	6.5
9 million–10 million	90	9.0
10 million–12 million	67	6.7
12 million–15 million	53	5.3
15 million–20 million	22	2.2
≥20 million	15	1.5
Personal traits		
Extraversion (1–7)	3.70 (avg.)	1.27 (s.d.)
Agreeableness (1–7)	4.95 (avg.)	0.95 (s.d.)
Conscientiousness (1–7)	4.27 (avg.)	1.10 (s.d.)
Neuroticism (1–7)	3.83 (avg.)	1.10 (s.d.)
Openness (1–7)	3.82 (avg.)	1.09 (s.d.)

jobs. The most common annual income was JPY 4–5 million. Because this study collected annual income data in increments of JPY 1 million or more using an ordinal scale, simple comparisons cannot be made, but it is equivalent to the national average of JPY 4.33 million at the time of the survey (National tax agency Japan, 2020). Regarding personality traits, conscientiousness tended to be higher than the reference sample reported by Oshio et al. (2012), whereas neuroticism tended to be lower.

Figure 2 shows the distribution of residents' life domain factor data. The average scores for each life domain factor were around 6 points.

Figure 3 shows the distribution of subjective well-being according to SWLS. The average subjective well-being score was 19.0±6.4 out of 35 points, which was comparable to the national average of 18.9±6.3 (Kitashima et al., 2021).

3.2 Residence Profiles and the Residential Environment

Table 5 shows the residence profiles. The ratio of detached to apartment houses was 42:58. The percentage of owner-occupied houses was 85.4%. The average age of construction was 22.6±13.6 years, with the 10 to 19-year range being the most common, accounting for nearly 40% of the total.

Figure 4 shows the distribution of environmental elements assessed by the CASBEE for Housing Health Checklist, which identifies objective issues in residential environments.

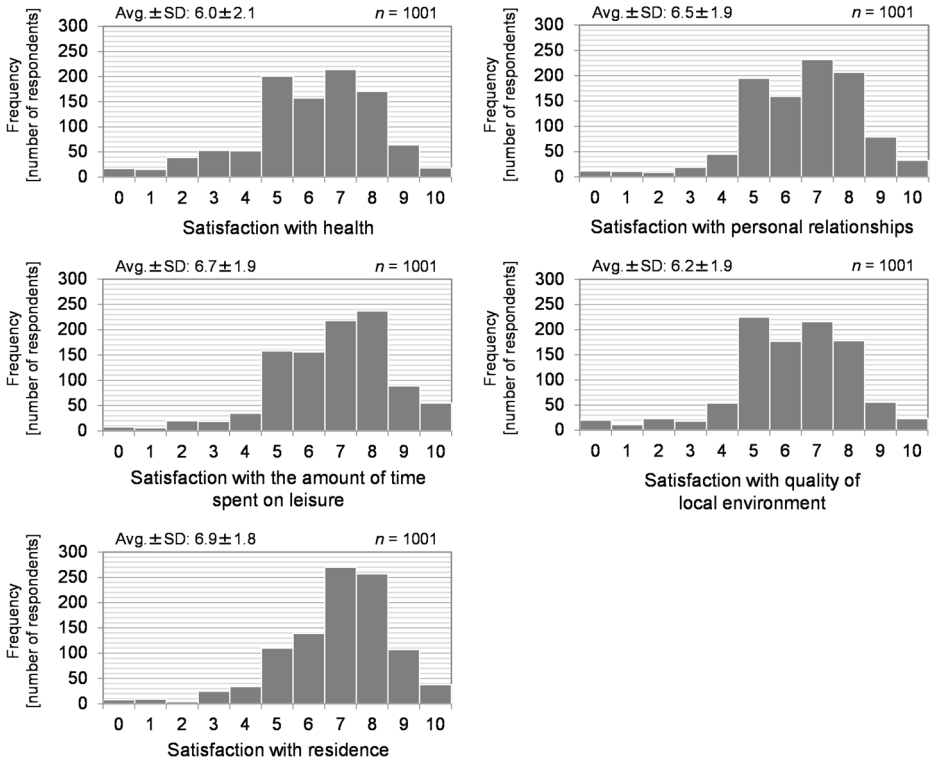

Fig. 2 Distribution of residents' life domain factors

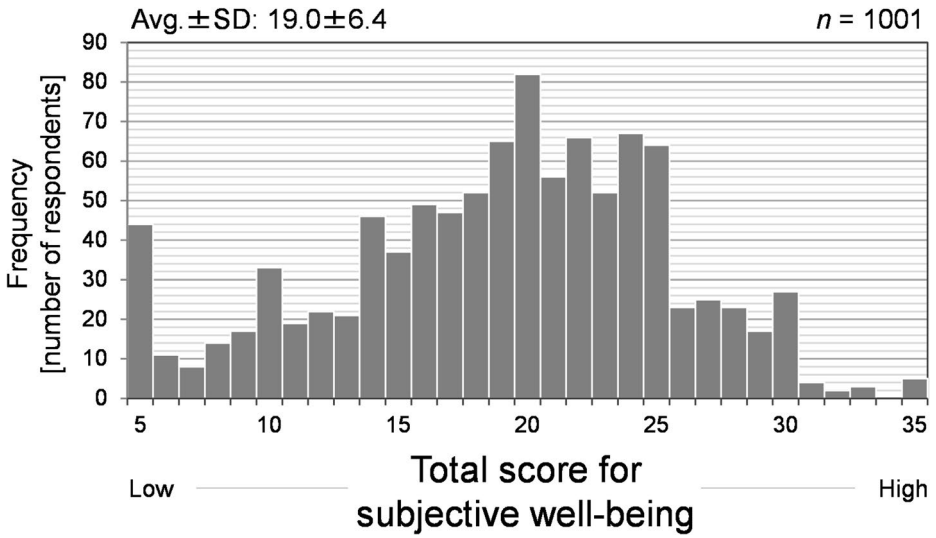

Fig. 3 Distribution of residents' subjective well-being

Table 5 Distribution of residence profiles

Items	Number	Percentage (%)
Residence type		
Detached house	417	41.7
Apartment house	584	58.3
Residence ownership		
Owner-occupied	855	85.4
Rental	146	14.6
Age of construction		
Less than 10 years	69	6.9
10–19	385	38.5
20–29	201	20.1
30–39	262	26.2
More than 40 years	84	8.4

The distribution varied across elements; some resembled a normal distribution, whereas others were skewed to the right. Thermal and hygiene environments showed distributions closer to a normal distribution shape, indicating the presence of both problematic and non-problematic residences. In contrast, the remaining environmental elements showed distributions suggesting that many residences were perceived to have few or no issues.

3.3 Structural Relationships Explaining Subjective Well-being

Figure 5 shows the path model explaining subjective well-being. Detailed results are presented in Table 6 and 8. The coefficients reported in the figure are standardized estimates. Overall, the model showed a good level of fit (RMSEA = 0.056, GFI = 0.938, CFI = 0.933). The R^2 value for subjective well-being was 0.49.

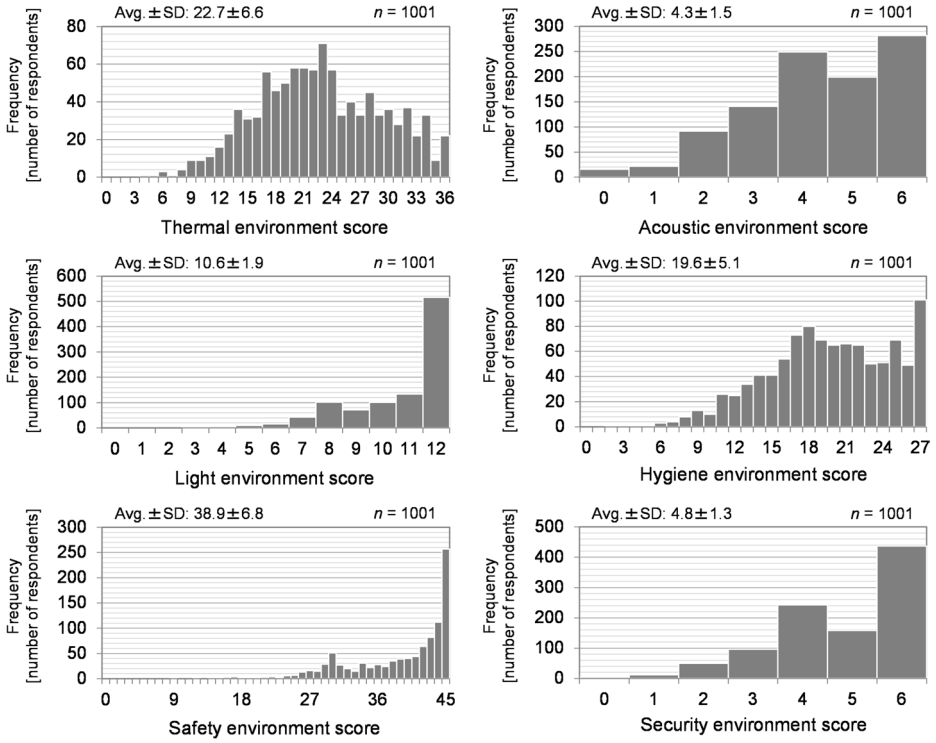

Fig. 4 Distribution of assessment of residential environment

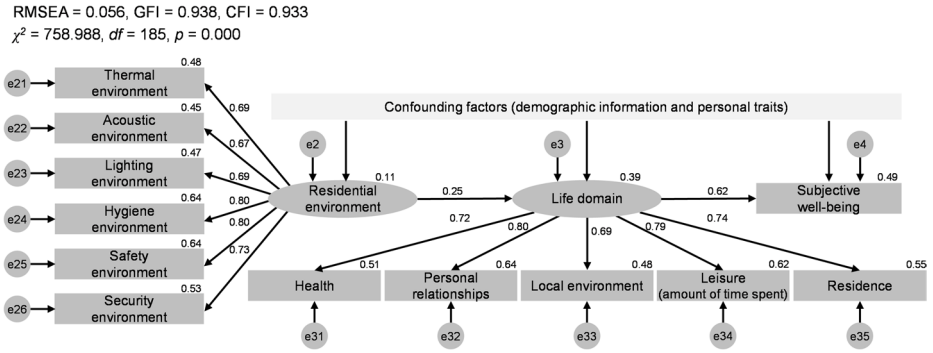

Fig. 5 Path model from SEM explaining the relationship between the residential environment and subjective well-being

Coefficients shown are standardized estimates. Arrows among latent variables indicate structural regression paths. Arrows from latent constructs to observed variables indicate factor loadings in reflective measurement models, meaning that the observed variables are specified as indicators of the latent constructs rather than as separate dependent variables in causal regressions. Thus, the coefficients from residential environment to thermal, acoustic,

Table 6 Path model from SEM explaining the relationship between the residential environment and subjective well-being

Regression path	B	β	SE	Significance
Structural model (latent-to-latent paths)				
Life domain ← residential env.	0.079	0.246	0.012	$p<0.01$
Subjective well-being ← life domain	2.662	0.618	0.175	$p<0.01$
Measurement model: residential environment (factor loadings)				
Thermal env. ← residential env.	1.000	0.690	1.000	$p<0.01$
Acoustic env. ← residential env.	0.217	0.671	0.012	$p<0.01$
Light env. ← residential env.	0.278	0.684	0.016	$p<0.01$
Hygiene env. ← residential env.	0.882	0.798	0.036	$p<0.01$
Safety env. ← residential env.	1.182	0.801	0.058	$p<0.01$
Security env. ← residential env.	0.212	0.729	0.011	$p<0.01$
Measurement model: life domain (factor loadings)				
Health ← life domain	1.000	0.717	1.000	$p<0.01$
Personal relationships ← life domain	1.001	0.802	0.050	$p<0.01$
Local environment ← life domain	0.909	0.695	0.047	$p<0.01$
Leisure ← life domain	1.000	0.789	0.047	$p<0.01$
Residence ← life domain	0.883	0.740	0.044	$p<0.01$
Measurement model: personal traits (factor loadings)				
Extraversion ← personal traits	1.000	0.535	1.000	$p<0.01$
Agreeableness ← personal traits	0.828	0.590	0.102	$p<0.01$
Conscientiousness ← personal traits	0.732	0.453	0.101	$p<0.01$
Neuroticism ← personal traits	−0.965	−0.594	0.111	$p<0.01$
Openness ← personal traits	0.789	0.492	0.091	$p<0.01$
Effects of confounding factors on latent variable of residential environment (control paths)				
Residential env. ← personal traits	0.987	0.293	0.169	$p<0.01$
Residential env. ← gender	−0.053	−0.006	0.317	n.s. ($p=0.867$)
Residential env. ← marital status	0.258	0.021	0.447	n.s. ($p=0.564$)
Residential env. ← age	0.028	0.058	0.018	n.s. ($p=0.134$)
Residential env. ← working status	−1.116	−0.091	0.472	$p<0.05$
Residential env. ← educational background	0.554	0.060	0.314	n.s. ($p=0.077$)
Residential env. ← annual income	0.090	0.061	0.055	n.s. ($p=0.099$)
Effects of confounding factors on latent variable of life domain (control paths)				
Life domain ← personal traits	0.468	0.436	0.067	$p<0.01$
Life domain ← gender	0.469	0.161	0.090	$p<0.01$
Life domain ← marital status	0.324	0.081	0.126	$p<0.05$
Life domain ← age	0.019	0.122	0.005	$p<0.01$
Life domain ← working status	0.159	0.041	0.133	n.s. ($p=0.232$)
Life domain ← educational background	0.114	0.039	0.088	n.s. ($p=0.196$)
Life domain ← annual income	0.048	0.101	0.015	$p<0.01$
Effects of confounding factors on latent variable of subjective well-being (control paths)				
Subjective well-being ← personal traits	0.375	0.081	0.166	$p<0.05$
Subjective well-being ← gender	−0.003	0.000	0.327	n.s. ($p=0.992$)
Subjective well-being ← marital status	1.672	0.097	0.453	$p<0.01$
Subjective well-being ← age	0.001	0.001	0.019	n.s. ($p=0.974$)
Subjective well-being ← working status	−0.637	−0.038	0.473	n.s. ($p=0.178$)

Table 6 (continued)

Regression path	B	β	SE	Significance
Subjective well-being ← educational background	−0.047	−0.004	0.316	n.s. ($p=0.882$)
Subjective well-being ← annual income	0.179	0.088	0.056	$p<0.01$

Estimates correspond to the paths in Fig. 5. Paths are written as dependent variable ← predictor. The structural-model section reports regression coefficients among latent variables. The measurement-model sections report reflective factor loadings of observed indicators on latent constructs; these coefficients indicate how strongly each observed indicator reflects its corresponding latent construct. They should not be interpreted as regression effects among observed variables or as direct effects on subjective well-being

B, Unstandardized coefficients

β, Standardized coefficients

SE, Standard error

n.s., Not significant

lighting, hygiene, safety, and security, from life domain construct to satisfaction with health, personal relationships, the amount of time spent on things one likes, the quality of the local environment, and residence, and from personal traits to the TIPI-J traits are factor loadings, not direct effects on subjective well-being. Gender, age, marital status, working status, educational background, and personality traits were included as confounding factors, each having paths to residential environment, life domains, and subjective well-being. However, these paths are omitted in the diagram for simplicity. Similarly, the covariances of error terms are not displayed. For detailed information, please refer to Table 8.

The trends in SEM revealed that the confounding factors of gender, age, marital status, education level, and annual income significantly influenced life domain evaluations, with marital status also affecting the evaluation of subjective well-being. Being female, older, or married, holding a bachelor's degree or higher, and having a higher annual income were associated with higher life domain evaluations. Working status significantly influenced residential environment evaluations, with unemployed residents and those with a bachelor's degree or higher assessing their residential environment more highly. Furthermore, personality traits significantly affected assessment of the residential environment, life domains, and subjective well-being, functioning effectively as control variables.

A one-unit increase in the assessment of residential environment corresponded to a 0.25 improvement in life domains, and similarly, a one-unit improvement in life domains resulted in a 0.62 increase in subjective well-being. This indicates that improving the residential environment leads to a $0.25 \times 0.62 = 0.15$ increase in subjective well-being through this structural relationship. This effect is larger than the total effect of age (0.09), comparable to the total effect of being married (0.15) and annual income (0.16).

All six observed environmental components loaded substantially on the latent residential environment construct (standardized loadings: $\beta = 0.671$–0.801): safety ($\beta = 0.801$), hygiene ($\beta = 0.798$), security ($\beta = 0.729$), thermal ($\beta = 0.690$), lighting ($\beta = 0.684$), and acoustic environment ($\beta = 0.671$). These coefficients are factor loadings, indicating how strongly each observed component reflects the broader residential environment construct. They should not be interpreted as separate direct effects on subjective well-being or as a strict ranking of independent causal importance.

4 Discussion

4.1 Importance of the Residential Environment for Improving Subjective Well-being

Although built environment engineering studies have often used well-being to refer to comfort and health (Altomonte et al., 2020), the present study defined subjective well-being based on cognitive evaluation of life satisfaction. According to this definition, the relationship between subjective well-being and residential environment was analyzed quantitatively. SEM was used to demonstrate quantitatively the structure through which the residential environment influences subjective well-being via life domains. The explanatory power for subjective well-being is 0.49 in the model. An improvement of one unit in the residential environment leads to an increase of 0.25 in life domains, which, in turn, results in an overall effect of 0.15 on subjective well-being. The magnitude of this effect on subjective well-being is high in this context; for example, it is larger than the total effect of age (0.08), comparable to the total effect of being married (0.15), and smaller than the total effect of annual income (0.16). These comparisons highlight the importance of residential environment as a contributing factor to subjective well-being.

This study makes an important contribution to built environment engineering by demonstrating that the theoretical framework, which was proposed and tested in previous research, linking the built environment to subjective well-being through life domains, is also applicable to residential environments. Although this framework has been validated on urban (Mouratidis 2017, 2019a, 2020, 2021) and building scales, such as office environments (Arata et al. 2025a; Fukawa et al. 2024), the present study extends its applicability to residential settings. These findings highlight the critical role of urban, workplace, and residential environments, which are the environments where individuals spend much of their time, in shaping subjective well-being.

In previous studies, residents' demographic information has been identified as functioning more as a confounding factor rather than a mediator in the relationship between the environment and subjective well-being (Ballas & Tranmer, 2012; Jokela et al., 2015; Morrison & Weckroth, 2018). The present study incorporated these findings into its analysis and evaluating life domains revealed that being female, older, or married, having a bachelor's degree or higher, and having a higher income were associated with higher subjective well-being. Being married and having a higher income were also directly linked to higher subjective well-being. Furthermore, being unemployed was associated with higher evaluations of residential environments. There was no significant relationship between age and subjective well-being, probably because the sample was skewed toward older respondents. Previous studies suggest this relationship may not be linear but U-shaped, with well-being typically lowest in the 40s, though patterns vary by country (Blanchflower & Oswald, 2008).

Personality traits, particularly low neuroticism, positively influenced evaluations of residential environments, life domains, and subjective well-being. This supports prior findings that personality traits are significant moderators of subjective well-being (Kahneman et al., 1999; Diener & Lucas, 1999; Diener & Seligman, 2002). These results emphasize the importance of considering demographic information and personality traits as key moderators when analyzing the relationship between the environment and subjective well-being.

As stated in SDG 3, "Ensure healthy lives and promote well-being for all at all ages," health is closely linked to well-being. The relationship between the quality of the residential environment and health is well-supported by a substantial body of evidence, and the causal effects of residential environment on several diseases have been confirmed (Arata et al. 2025b). The importance of housing in this context has also been consolidated in the WHO's Housing and Health Guidelines (WHO, 2018). Additionally, housing influences leisure and social relationships.

The analysis revealed that the absence of objective issues in the residential environment increases satisfaction with the residence. This relationship aligns with previous research, which suggests that the physical environment influences satisfaction through residents' perceptions (Marans, 2003). Although satisfaction with residence is not a direct component of subjective well-being, a significant portion of the residence's effect on subjective well-being is mediated through satisfaction (Van Praag et al., 2003). In the present study, satisfaction with residence was treated as a life domain, and the results supported this hypothesis. Moreover, satisfaction with the surrounding neighborhood emerged as another crucial factor. Findings from large-scale surveys in the UK have demonstrated that low neighborhood satisfaction and perceptions of insecurity are significantly associated with reduced well-being (Huebner et al., 2022).

According to the Public Health Aspects of Housing report issued by the WHO Committee in 1961, safety is highlighted as a fundamental requirement for a healthy residential environment (WHO, 1961; Asami 2001a, b). Among the six indicators, safety showed the highest standardized loading on the latent residential environment construct. This result probably reflects the foundational principle emphasized in the WHO report, underscoring the importance of safety in fostering a healthy and supportive residential environment. At the same time, the results do not suggest that safety alone explains the residential environment. Hygiene showed a nearly identical loading to safety, and the remaining four components also loaded substantially on the latent construct. This pattern indicates that the residential environment should be understood as a multidimensional condition rather than as a single dominant attribute. In other words, safer, cleaner, more secure, quieter, better-lit, and more thermally appropriate homes jointly characterize the residential environment pathway associated with life-domain satisfaction and, in turn, subjective well-being. Because the six environmental components were specified as indicators of a latent construct in the present SEM, the model does not estimate their separate direct effects on subjective well-being; therefore, the findings should not be interpreted as a strict ranking of independent causal importance.

This study quantified the relationship between precisely defined subjective well-being and the residential environment, demonstrating the significance of the residential environment through SEM. In line with the objectives of SDG 3, the findings demonstrate that to build a sustainable society, it is crucial to optimize residential environments to foster well-being.

The implications of the present study are most appropriately framed at the level of overall residential quality. Accordingly, the findings suggest that residential quality should be considered as a multidimensional construct in housing policy and design practice. Rather than deriving component-specific policy priorities from this model alone, efforts to improve residential environments may need to address safety, hygiene, security, thermal comfort,

acoustic quality, and lighting quality in an integrated manner to support residents' life-domain satisfaction and, in turn, subjective well-being.

4.2 Opportunities for Future Studies

Although this study makes an important contribution by examining the relationship between the residential environment and subjective well-being, the following improvements would further improve understanding of this relationship. The present study assessed only the life evaluation component of subjective well-being, and could not address affective or eudaimonic well-being, which are conceptually distinct components. Because these dimensions can differ in their temporal characteristics, future studies should adopt designs and instruments suited to each component. The remaining half of the model's explanatory power for subjective well-being is unaccounted for, suggesting that factors such as job satisfaction may be significant. The influence of broader environmental factors beyond residential environments, such as non-residential spaces and urban areas where people spend their daily lives, may also contribute to subjective well-being. The inclusion of objective measures would enrich this understanding and provide a more diverse perspective. Sample characteristics also represent an important limitation, as respondents tended to be older on average. Prior research has reported non-linear associations between age and well-being across the life course (Blanchflower & Oswald, 2008); thus, further analyses that more clearly account for age would be informative. Although these results for the Japanese population are a valuable starting point for understanding well-being, examining well-being across different countries and regions would provide comparative insights, identifying cultural and national differences in well-being. Finally, the cross-sectional design of this study lays the groundwork for future research to explore the causality of these relationships in greater depth. Future longitudinal studies will examine the causal effects of the residential environment on subjective well-being, which will provide a better understanding of these relationships.

5 Conclusion

This study highlights the critical role of the residential environment in shaping subjective well-being through life-domain satisfaction. SEM demonstrated that improvements in the residential environment, conceptualized as a multidimensional construct comprising thermal, acoustic, lighting, hygiene, safety, and security conditions, were associated with higher life-domain satisfaction and, in turn, higher subjective well-being. Furthermore, demographic factors, such as age and marital status, and personality traits, such as neuroticism, were confounding factors in these relationships, emphasizing that individual differences should be considered when examining the relationship between residential environment and subjective well-being.

The findings extend previous research by quantifying the effect of residential environments and life domain factors on well-being by adopting a theoretical framework. As societal priorities shift toward sustainability and well-being, the present results offer implications for housing policy and public health by underscoring the importance of treating residential quality as a multidimensional construct. Future research should include longitudinal and cross-cultural studies to explore the causal pathways and global applicability of

these findings further. Incorporating objective environmental measurements and expanding to different population groups will enhance our understanding of how to design residential environments that promote sustainable and fulfilling lives.

Appendix

See Tables 7 and 8.

Table 7 CASBEE Residential Health Checklist questionnaire items

No.	Components	Question item
Living room		
1	Thermal env.	During summer, are there times when you stay in a room with all the windows closed, without switching on an air conditioner or electric fan?
2	Thermal env.	During summer, are there times when you feel hot because the air conditioning for cooling is not effective?
3	Thermal env.	During winter, are there times when you feel cold because the air conditioning for heating is not effective?
4	Acoustic env.	Are there times when you are bothered by indoor/outdoor sounds or vibrations even when the windows and doors are closed?
5	Light env.	At night, are there times when you feel it is dark due to insufficient lighting?
6	Hygiene env.	Are there times when certain smells linger in the room?
7	Safety env.	Are there times when you slip on the floor?
Bedroom		
8	Thermal env.	During summer, are there times when you cannot sleep because it is hot?
9	Thermal env.	During summer or the rainy season, are there times when you cannot sleep because it is humid and damp?
10	Thermal env.	During summer, are there times when you sleep with the windows closed without switching on an air conditioner or electric fan?
11	Thermal env.	During winter, are there times when you cannot sleep because it is cold?
12	Thermal env.	During winter, are there times when your nose/throat is dry when you wake up?
13	Acoustic env.	Are there times when you cannot sleep because you are bothered by indoor/outdoor sounds or vibrations even when the windows and doors are closed?
14	Light env.	At night, are there times when you cannot sleep because your surroundings are too bright?
Kitchen		
15	Hygiene env.	Are there times when steam or smells linger in the room while cooking?
16	Hygiene env.	Is there mold on/around the kitchen counter?
17	Hygiene env.	Are there times when the tap water has a foul smell/taste?
18	Safety env.	Are there times when you have to adopt an unnatural posture due to a poor layout (too narrow, too high, etc.)?
19	Safety env.	Are there times when you feel it is dangerous because you may get burnt?
Bathroom, dressing room		
20	Thermal env.	During winter, are there times when you feel that the dressing room is cold?
21	Thermal env.	Are there times when you feel that the bathroom is cold?
22	Hygiene env.	Is there mold?
23	Hygiene env.	Are there times when you smell foul odors?
24	Safety env.	Are there times when you feel it is dangerous because you may trip over a step?
25	Safety env.	Are there times when you slip on the bathroom floor?

Table 7 (continued)

No.	Components	Question item
26	Safety env.	Are there times when you lose your balance when getting into/out of the bathtub?
Toilet		
27	Thermal env.	During winter, are there times when you feel that the toilet is cold?
28	Hygiene env.	Are there times when you detect foul odors lingering?
29	Safety env.	Are there times when you have to adopt an unnatural posture due to mismatched layouts (e.g., too narrow or too high)?
Entrance		
30	Safety env.	Are there times when you feel it is dangerous because you may trip over a step?
31	Safety env.	Are there times when you lose your balance while putting on your shoes?
32	Light env.	Are there times when you feel it is dark near your feet even when the light is turned on?
Corridors, stairs, and storage		
33	Thermal env.	During winter, are there times when you exit a room and feel cold?
34	Safety env.	Are there times when you stumble over a step while entering or exiting a room?
35	Light env.	Are there times when you feel it is dark near your feet while walking even when the light is turned on?
36	Safety env.	Are there times when you slip while walking?
37	Safety env.	Are there times when you feel it is dangerous because the stairs are too steep?
38	Hygiene env.	Are there times when the storage smells of mold or chemical substances?
39	Hygiene env.	Are there times when insects begin to breed indoors?
Surroundings		
40	Safety env.	Are there times when you slip or stumble around your home?
41	Safety env.	Are there times when you feel it is dangerous while opening/closing the gate, shutters, etc.?
42	Security env.	Are there times when you feel anxious about the precautions against crime?
43	Security env.	Are there times when you are at home and feel that you can be easily seen from outside your house?
44	Safety env.	Are there times when you slip on the floor of the veranda or terrace?

The total score is 132 points (3 × 44 items), with a higher score indicating a better residential environment. Additionally, the total points for each environmental component are as follows: thermal environment at 36 points (3 × 9 items), acoustic environment at 6 points (3 × 2 items), lighting at 12 points (3 × 4 items), hygiene at 27 points (3 × 9 items), safety at 45 points (3 × 15 items), and security at 6 points (3 × 2 items)

Table 8 Results of the covariance matrix

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
1. Gender	90.715																						
2. Marital status	−0.802	0.249																					
3. Age	0.862	−0.008	0.134																				
4. Working status	−1.412	0.047	0.012	0.138																			
5. Educational background	0.298	−0.050	0.016	0.002	0.248																		
6. Annual income	−7.009	−0.054	0.269	0.368	0.321	9.607																	
7. Extraversion	1.831	0.101	0.098	0.126	0.008	1.474	6.401																
8. Agreeableness	3.471	0.022	0.056	−0.011	0.017	0.320	−0.125	3.622															
9. Conscientiousness	4.994	0.025	0.098	−0.017	0.026	0.791	1.239	1.251	4.801														
10. Neuroticism	−4.448	0.117	−0.088	0.029	−0.040	−1.204	−1.341	−1.398	−1.973	4.853													

Table 8 (continued)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
11. Openness	2.579	−0.130	−0.007	−0.032	0.052	0.732	2.049	0.409	1.360	−1.424	4.721												
12. Thermal env.	8.856	0.065	0.203	−0.056	0.043	1.844	3.284	2.065	2.153	−3.068	1.875	44.091											
13. Acoustic env.	2.923	−0.027	0.059	−0.041	0.093	0.301	0.458	0.404	0.362	−0.577	0.224	5.248	2.193										
14. Light env.	1.064	0.041	0.008	−0.025	0.025	0.366	0.399	0.607	0.540	−0.520	0.146	6.206	1.297	3.468									
15. Hygiene env.	8.409	−0.359	0.082	−0.239	0.200	0.713	1.577	1.637	1.552	−1.889	1.466	22.023	3.917	5.101	25.718								
16. Safety env.	1.280	−0.046	0.037	−0.034	0.048	0.326	0.362	0.376	0.370	−0.506	0.331	4.416	0.868	1.077	3.921	1.780							
17. Security env.	0.375	0.082	0.073	−0.034	0.104	1.315	1.271	2.404	1.734	−1.832	0.537	24.581	4.561	9.809	22.522	5.423	45.847						
18. Health	1.877	0.090	0.112	0.091	0.073	1.321	1.208	0.841	0.980	−1.432	0.878	3.260	0.714	0.730	1.984	0.485	2.790	4.254					
19. Personal relationships	3.381	0.093	0.106	0.027	0.011	0.772	1.389	1.191	0.794	−1.148	0.750	3.159	0.672	0.651	2.387	0.470	2.504	1.866	3.433				
20. Local environment	3.335	0.035	0.113	0.004	0.037	0.801	0.943	1.031	0.778	−1.131	0.743	3.300	0.745	0.590	2.269	0.523	2.323	2.072	2.519	3.731			

Table 8 (continued)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
21. Leisure	3.199	0.086	0.091	−0.003	0.068	0.628	1.114	0.979	0.713	−1.094	0.828	2.918	0.680	0.741	2.410	0.462	2.746	2.128	2.403	2.053	3.529		
22. Residence	2.495	0.075	0.111	0.025	0.088	0.901	0.802	0.812	0.570	−0.725	0.427	3.444	0.881	0.915	3.060	0.680	3.736	1.817	1.998	1.965	2.022	3.114	
23. Subjective well-being	9.882	0.176	0.575	0.093	0.231	4.647	4.611	2.594	2.767	−4.503	3.788	9.332	1.968	1.467	6.046	1.262	5.835	7.323	6.400	5.875	7.124	5.562	41.183

Author contributions S.K. supervised the overall project. S.K. and T.K. contributed to the study conceptualization and collected the data . S.A. conducted the data analysis and wrote the main manuscript text. All authors reviewed the manuscript.

Data Availability The datasets generated and analyzed during the current study are not publicly available. The survey data were collected exclusively for this research project and participants did not provide consent for their data to be shared beyond the research team.

Declarations

Competing interests The authors declare no competing interests.

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