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# Older Adults' Health in Nursing Homes and Therapeutic Environments: The Mediating Role of Psychological Recovery

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**ABSTRACT:**
Secondary processes in hospitals are causing a major part of hospitals' carbon footprint. At the same Population ageing has increased the need to improve nursing home environments that support older adults' psychological recovery, restorative experience, and health. Although therapeutic landscapes have been widely linked to well-being, limited research has explained how nursing home landscapes influence older adults through psychological mechanisms in long-term care settings. This study examines how therapeutic landscapes influence psychological recovery, restorative experience, and health among older adults in nursing homes. Psychological recovery is positioned as the main mediating mechanism tested in this study, while other psychological and social processes are acknowledged as potential pathways for future research. Data were collected from 385 residents in two nursing homes in Haikou, China, and analyzed using PLS-SEM. The results show that therapeutic landscapes positively influenced all three outcomes. Psychological recovery also mediated the relationships between therapeutic landscapes and both restorative experience and health. Gender moderated the therapeutic landscape–restorative experience path and the psychological recovery–health path. The conditional indirect effects indicated that psychological recovery mediated the relationship between therapeutic landscapes and health more strongly for male residents than for female residents. This study identifies psychological recovery as a key mechanism and highlights the need for gender-sensitive nursing home landscape design.

*Keywords: Keywords: Therapeutic Landscape; Restorative Experience; Psychological Recovery; Health; Nursing Homes; Older Adults; Gender Moderation*

## 1. Introduction

With population ageing accelerating worldwide, the design of supportive care environments has become an important issue in later-life health research. This concern is particularly significant in China, where people aged 60 years and older are expected to number about 402 million by 2040, representing nearly 28% of the country's total population (WHO, 2021; Tiantian Yu, 2022). As longevity increases, older adults' needs are no longer limited to medical care; they also include functional ability, mental health, emotional stability, and quality of life (T. Tang et al., 2022). In this context, nursing homes are not only care facilities but also long-term living environments that shape residents' daily routines, social contact, emotional adjustment, and health-related experiences (Hsieh et al., 2022 ; Marques et al., 2019). Therefore, the environmental quality of nursing homes

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should be examined as part of healthy ageing, especially when outdoor spaces, natural elements, and accessible landscapes may support residents' psychological and physical well-being (Collins et al., 2016; Yu et al., 2021).

From the perspective of therapeutic landscape theory, healing is shaped by the combined influence of material environments, social relationships, and meanings attached to place (Gesler, 1993a). In nursing homes, this perspective is particularly important because residents do not visit landscapes temporarily; they live with the same spaces repeatedly over time. This study therefore does not treat nursing home landscapes as decorative green areas, but as everyday living environments that may support psychological recovery, restorative experience, and health. Natural elements, walkable routes, shaded seating, quiet areas, social spaces, and place meanings may help residents reduce stress, feel emotionally supported, and form a stronger connection with their living environment (Mossabir et al., 2021; Townshend, 2015). However, the restorative value of landscape is not automatic. Green spaces may fail to support older adults if they are inaccessible, unsafe, poorly maintained, or detached from residents' daily needs (Bu & Wang, 2023; Sun & Lyu, 2020; Yang et al., 2020).

Although psychological recovery is positioned as the central mediating mechanism in this study, other psychological and social processes may also operate alongside recovery. Place attachment may shape residents' emotional bonds with the nursing home environment, perceived safety may influence their willingness to use outdoor and shared spaces, and social connectedness may affect how they experience everyday interaction and belonging. However, this study focuses on psychological recovery because it directly reflects residents' emotional relief, stress reduction, and mental restoration in daily institutional life (Emmerson, 2019; Jiang, 2014; Wang & Tzortzi, 2022). Limited research has examined how therapeutic landscapes promote psychological recovery and how this recovery process further shapes restorative experience and health. This gap is important because psychological recovery may explain how supportive landscapes help residents feel calmer, less stressed, and more emotionally stable. In this study, psychological recovery is positioned as the mediating mechanism, while restorative experience and health are treated as two endogenous outcomes at different levels.

A further gap concerns gender differences in older adults' responses to therapeutic landscapes. Nursing home residents are often treated as a homogeneous group, although men and women may differ in spatial perception, mobility, perceived safety, social interaction, environmental preference, and health-related needs (Barrett & Toothman, 2016; Fernández Núñez et al., 2022; Li et al., 2020; J. Yu et al., 2021). These differences may also be shaped by social and cultural factors, including gendered activity patterns, previous family and work roles, willingness to use outdoor spaces, and different expectations of safety, privacy, and social contact. For example, some residents may benefit more from walking routes and activity areas, whereas others may place greater value on quiet, safe, and socially supportive spaces. Gender may therefore act as a boundary condition in the therapeutic landscape mechanism rather than only as a demographic variable (Bell et al., 2018; Vilhelmson & Thulin, 2022; J. Xu et al., 2025). To address these gaps, this study examines how therapeutic landscapes influence psychological recovery, restorative experience, and health among older adults living in nursing homes in Haikou, China. It also tests whether gender moderates selected

relationships in the model and whether the indirect effect of therapeutic landscapes on health through psychological recovery differs by gender. By doing so, this study extends therapeutic landscape theory to nursing home contexts and provides evidence for designing nursing home landscapes as lived, restorative, and gender-sensitive environments.

### 1.1 Therapeutic Landscapes and Psychological Recovery

Therapeutic landscape theory suggests that healing environments are shaped by the interplay among physical settings, social relationships, and symbolic meanings (Gesler, 1992, 1993a). In nursing homes, this view is especially relevant because residents do not temporarily visit landscapes but repeatedly live with them as part of daily life (Mossabir et al., 2021). Their routines, outdoor access, social contact, and emotional adjustment are therefore shaped by the care-home environment (Hsieh et al., 2022; Marques et al., 2019).

The relationship between therapeutic landscapes and psychological recovery can be explained through Attention Restoration Theory and Stress Recovery Theory. Attention Restoration Theory suggests that natural environments support recovery by providing being away, fascination, extent, and compatibility (R. Kaplan & Kaplan, 1989; S. Kaplan, 1995). Stress Recovery Theory further suggests that contact with supportive natural environments can alleviate stress and facilitate emotional and physiological restoration (Ulrich, 1983; Ulrich et al., 1991a). For older adults in nursing homes, these mechanisms are not abstract. Accessible greenery shaded outdoor areas, comfortable walking spaces, and quiet social spaces may help reduce mental fatigue, ease emotional tension, and support psychological recovery (Liljegren et al., 2024).

Recent studies further indicate that the benefits of outdoor and green environments depend on how residents use and perceive them. Garden quality, outdoor contact, social participation, and place attachment have been linked to well-being and self-rated health among older adults (Guo et al., 2024; Liljegren et al., 2024). Yet the restorative value of green space is not automatic. A landscape may contain natural elements, but it may fail to support recovery if it is unsafe, inaccessible, poorly maintained, or detached from residents' daily needs (Zuo et al., 2024a). Therefore, therapeutic landscapes in nursing homes should be examined as lived environments rather than as visual green spaces alone. Based on this reasoning, the following hypothesis is proposed:

H1: Therapeutic landscapes have a positive impact on the psychological recovery of older adults in nursing homes.

### 1.2 Psychological Recovery as a Predictor of Restorative Experience and Health

Psychological recovery and restorative experience are related but conceptually distinct constructs. Psychological recovery refers to an internal state of reduced stress, emotional stability, and mental clarity, whereas restorative experience refers to residents' perceived experience of the environment as restorative, including being away, compatibility, relaxation, and environmental comfort (K. M. Korpela, 2002; Malekinezhad et al., 2020). In this study, psychological recovery is treated as an internal psychological mechanism, while restorative experience is treated as a recovery-related outcome.

In nursing homes, psychological recovery may influence how older adults perceive and respond to their surrounding environment. When residents feel calmer, safer, and

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emotionally relieved, they may become more receptive to greenery, outdoor spaces, sensory comfort, and social interaction (Hjort et al., 2023; Martínez-Soto et al., 2014; Pratiwi et al., 2022). This psychological state may strengthen their sense of distance from daily concerns and improve perceived environmental compatibility. Previous studies also suggest that restorative environments can support restoration, mood, and subjective well-being, while plant landscapes may provide health benefits through restorative experience, especially through being away and compatibility (Xian et al., 2024).

Psychological recovery may also contribute to health. In long-term care settings, health is shaped not only by medical conditions or physical function, but also by emotional stability, stress reduction, social engagement, and perceived control over daily life (Wei & Zhang, 2020). Residents who experience psychological recovery may report better health because they feel less emotionally burdened and more able to engage with their living environment. This view aligns with previous studies indicating that green environments may enhance older adults' mental health through psychological and social mechanisms (Guo et al., 2024; Zuo et al., 2024b ; Zhou et al., 2024).

Therapeutic landscapes may also directly shape restorative experience. This experience does not arise from green space alone, but depends on whether the environment is accessible, safe, comfortable, meaningful, and suitable for daily use (Sibarani et al., 2023; R. Tang et al., 2024). For this study, restorative experience and health are both endogenous outcomes but are positioned at different levels. Restorative experience is treated as a proximal experiential outcome, while health is treated as a distal health-related outcome. Therefore, restorative experience is not used as the main mediator, but it is expected to further contribute to health. Therefore, the following hypotheses are proposed:

H2: Therapeutic landscapes are positively associated with restorative experience among nursing home residents.

H3: Psychological recovery is positively related to residents' restorative experience in nursing homes.

H4: Psychological recovery is positively related to residents' health in nursing homes.

H5: Restorative experience is positively associated with residents' health in nursing homes.

### 1.3 Direct and Mediating Effects of Therapeutic Landscapes

Therapeutic landscapes may also have a direct effect on health. Within therapeutic landscape theory, place can provide emotional, social, and material resources that support recovery and well-being (Allison Williams, 1999; Duff, 2016). In nursing homes, these resources may appear as greenery, activity spaces, walking routes, shaded seating, social areas, and meaningful environmental symbols. These spaces may encourage light movement, reduce stress, support social interaction, and strengthen a sense of belonging. However, these effects may not operate through psychological recovery alone. Place attachment, perceived safety, and social connectedness may also form complementary pathways through which therapeutic landscapes influence residents' restorative experience and health. In the present study, psychological recovery is tested as the main mediating

mechanism, but these additional processes help explain why nursing home landscapes may have broader effects on residents' daily adaptation and well-being.

This mechanism is consistent with studies on restorative environments, healing gardens, and green care settings. Previous research shows that restorative environments can reduce mental fatigue, support emotional regulation, and improve well-being through perceived restrictiveness and environmental comfort (Malekinezhad et al., 2020; Sibarani et al., 2023). Studies on healing gardens and care-related outdoor spaces also suggest that natural contact, accessible gardens, and outdoor activities can promote relaxation, social interaction, and perceived health among older adults and care residents (Hsieh et al., 2022; Jiang, 2014; Liljegren et al., 2024). However, nursing homes differ from parks or short-term healing spaces because residents repeatedly experience the same physical, social, and symbolic landscapes in daily life. Therefore, supportive landscape conditions may first enhance psychological recovery by fostering safety, calmness, and emotional stability, and this recovery process may then extend to restorative experience and health. Based on this theoretical and empirical basis, the following hypotheses are proposed:

H6: Therapeutic landscapes are positively associated with residents' health in nursing homes.

H7a: Psychological recovery mediates the link between therapeutic landscapes and restorative experience among nursing home residents.

H7b: Psychological recovery mediates the link between therapeutic landscapes and residents' health.

### 1.4 Gender as a Moderating Variable

Gender may shape how older adults perceive and respond to therapeutic landscapes. In environmental gerontology, place effects are shaped not only by physical features, but also by mobility, perceived safety, activity habits, social roles, and health conditions. Existing studies have shown gender differences in the relationships between green space, built environment, physical activity, subjective well-being, and mental health (Feng & Zheng, 2024; Fernández Núñez et al., 2022; Li et al., 2020; J. Yu et al., 2021). This suggests that male and female residents may not obtain the same restorative benefits from similar environmental conditions.

Therapeutic landscapes are also shaped by personal experience, bodily perception, social relations, cultural identity, and gendered roles. Gastaldo et al. (2004) argued that healing experiences are relational and embedded in identity, belonging, and everyday place meanings. This view is particularly relevant in nursing homes, where residents experience the same environment over time. Men and women may differ in outdoor space use, social needs, safety perceptions, and health-related responses (Chauhan et al., 2023; Davila et al., 2022; H. Xu & Wang, 2021). Therefore, gender can be examined as a boundary condition in the therapeutic landscape mechanism.

In this study, gender is expected to moderate the relationship between therapeutic landscapes and restorative experience because restorative experience depends on residents' perception, use, and emotional response to the environment. Gender may also moderate the relationship between psychological recovery and health, as psychological recovery may not translate into equal health benefits for all residents. Recent evidence suggests that gender can influence physiological and psychological responses to natural environments

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(Bornioli et al., 2024; Z. Zhang et al., 2023). Based on this theoretical and empirical basis, the following hypothesis is proposed:

H8a: Gender moderates the relationship between therapeutic landscapes and restorative experience among older adults in nursing homes.

H8b: Gender moderates the relationship between psychological recovery and health among older adults in nursing homes.

### 1.5 Moderated Mediation

Since psychological recovery is the mediator tested in this study, the moderated mediation logic focuses on the indirect path from therapeutic landscapes to health through psychological recovery. If gender changes the strength of the relationship between psychological recovery and health, then the indirect effect of therapeutic landscapes on health through psychological recovery may also differ between male and female residents (Shi et al., 2024). This means that gender does not simply affect the level of health. It may change the extent to which psychological recovery is translated into health benefits.

Recent studies on restorative environments increasingly show that environmental health pathways may depend on individual or contextual conditions. For example, Zhou et al. (2024) showed that positive emotions and restorative experiences helped explain the health effects of urban forest parks. Z. Zhang et al. (2023) also reported that exposure to forest landscapes produced different physical and psychological restoration responses across gender groups. Although their model differs from the present study, it supports the broader logic that environment–health pathways may operate through psychological mechanisms and conditional processes. Therefore, the indirect effect of therapeutic landscapes on perceived health through psychological recovery is expected to be conditional on gender. Therefore, the indirect pathway from therapeutic landscapes to health through psychological recovery is expected to vary by gender.

H9: Gender moderates the indirect relationship between therapeutic landscapes and health through psychological recovery.

### 1.6 Conceptual Framework

Drawing on the above literature, this study develops a moderated mediation framework to explain how therapeutic landscapes influence older adults' restorative experience and health in nursing homes. Therapeutic landscape theory frames nursing home environments as physical, social, and symbolic spaces, while Attention Restoration Theory and Stress Recovery Theory explain how supportive environments promote restoration, psychological recovery, and health. In this framework, psychological recovery mediates the effects of therapeutic landscapes on restorative experience and health. Restorative experience is treated as a proximal experiential outcome, whereas health is positioned as a distal health-related outcome. Gender is introduced as a moderator of the therapeutic landscape–restorative experience path and the psychological recovery–health path. The framework also examines whether the indirect effect of therapeutic landscapes on health through psychological recovery differs by gender. The proposed framework is shown in **Figure 1**.

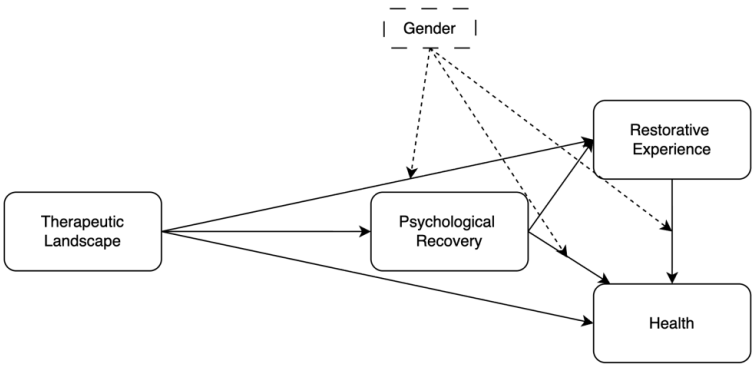


**Figure 1. Conceptual Framework**

## 2. Materials and methods

### 2.1 Study area

Regarding the urban context, this study selected Haikou, the capital of Hainan Province, China, as the research area (see **Figure 2**). Haikou was chosen as the research location primarily because its tropical climate and mild winters provide a suitable context for therapeutic landscape research. Haikou has an average annual temperature of approximately 24.5°C and relatively low winter cold stress, which may increase opportunities for older adults to engage with the outdoor environment, perform light activity, and interact with their daily landscape (China Haikou Government Portal, 2024). According to the 2024 China Migratory Retirement Winter Habitat Suitability Index, Haikou ranks first among relevant cities in China (Antai College of Economics and Management, 2024). These conditions make Haikou suitable for examining how the landscape environment supports restorative experiences, psychological recovery, and health among older adults.

Haikou is also relevant to this study due to its ageing trend and increasing need for institutional care. According to data from the "Hainan Province Three-Year Action Plan for the Construction of the Elderly Care Service System (2023-2025)," in 2021, Hainan Province had 1.5188 million permanent residents in the 60+ age group, representing 14.88% of the province's total permanent residents; and 10.78% aged 65 and above (Make, 2023). In Haikou City, the population aged 60 and above was 423,100, accounting for 14.1% of the permanent residents; and 280,900 were aged 65+, accounting for 9.36% of all permanent residents (Haikou Municipal Bureau of Statistics, 2024). These demographic trends indicate a growing need for elderly care provision in Haikou. Meanwhile, some nursing homes in the city have developed courtyards, green spaces, activity rooms, rehabilitation areas, and outdoor facilities (Xinhua News Agency, 2025b). These environmental features are closely related to therapeutic landscapes, restorative experience, psychological recovery, and health. Therefore, Haikou provides a suitable empirical setting for examining how nursing home landscapes influence older adults' daily experiences and health-related outcomes.

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**Figure 2. Map of study area.**

Source: (Central People's Government of the People's Republic of China,2021)

## 2.2 Participants

The target population consisted of male and female residents from two nursing homes in Haikou, China. NH1 and NH2 were selected through purposive sampling, using site-selection criteria adapted from the Implementation Guidelines for the National Standard on Classification and Assessment of Nursing Homes (2023 Edition). These criteria focused on accessibility, activity spaces, outdoor facilities, and basic environmental conditions. NH1 represented a larger-scale facility, while NH2 represented a smaller-scale facility, allowing the study to examine therapeutic landscapes across two different nursing home settings. Further details are provided in **Table 1**.

At the participant level, criterion-based purposive sampling was used. Residents were included if they were aged 55–75 years, able to perform basic daily activities independently, able to understand the questionnaire, and willing to participate. The lower age limit of 55 was used because it corresponds to the statutory retirement age for many women in China (Xinhua News Agency, 2025a) This age range was selected to reflect retired residents while reducing the possible influence of severe cognitive decline or communication difficulties on questionnaire completion.

A total of 385 valid questionnaires were collected, including 221 from NH1 and 164 from NH2. Participants included 45.9% males and 54.1% females, with a mean age of 67.41 years (SD = 4.050). Demographic variables included gender, number of children, nursing home residence, educational level, income, and previous occupation. Ethical approval was obtained from Heze Vocational College, Shandong Province, China. Before completing the questionnaire, all participants were given a clear explanation of the study purpose, questionnaire content, voluntary participation, anonymity, confidentiality, and their right to withdraw at any time. Only after the older residents agreed to participate were they invited to answer the questionnaire. The questionnaire did not collect identifiable private information, and both nursing homes were anonymized as NH1 and NH2.

**Table 1:Criteria for Selecting Nursing Homes**

Source: (Implementation Guidelines for the National Standard on Classification and Assessment of Nursing Homes ,2023)

Implementation Guidelines for the National Standard on Classification and Assessment of Nursing Homes (2023 Edition)

| Rules | Details |
|---|---|
| 1.1.1.3 | Nursing homes located in separate building subdivisions with separate transport systems (building lifts) and external entrances and exits are awarded 2 points; when located in separate building subdivisions with separate external entrances and exits, but there is a situation where the building lifts are shared with other buildings, 1 point is awarded. |
| 1.2.1 | Building area ≥ 35 ㎡/bed, 3 points; 25 ㎡/bed ≤ building area < 35 ㎡/bed, 2 points; If the building area is less than 25 ㎡/bed, 1 point will be awarded. With a maximum score of 3 points, only four nursing homes met the criteria. |
| 2.6.1.1 | Activity facilities (reading room, chess and cards room, gym, painting and calligraphy room, music and dance room, electronic reading room, classroom) in line with one of the 1 point, 2 points for 2, 3-4 points for 3, 5 or more for 4 points. |
| 2.6.1.2 | Other entertainment venues (audio-visual room, children's activity area, cookery classroom, tearoom, handicraft room) 0.5 points for each one, of which 2 or more will be awarded 1 point. |

## 2.3 Instrument Development

The questionnaire included two sections. The first section collected demographic information, including gender, number of children, nursing home residence, education, income, and previous occupation. The second section measured four latent constructs: therapeutic landscape, psychological recovery, restorative experience, and health. Therapeutic landscape was conceptualized through social, physical, and symbolic dimensions, consistent with therapeutic landscape theory (Gesler, 1993b). A total of 44 items were measured using a five-point Likert scale from 1 = strongly disagree to 5 = strongly agree. Details are shown in **Error! Reference source not found.**. The questionnaire was developed and administered in Chinese; the English items presented in Table 2 are translated versions for reporting purposes.

All constructs were specified as reflective. Therapeutic landscape was treated as a second-order reflective construct reflected by social landscape, physical landscape, and symbolic landscape. Health was also treated as a second-order reflective construct reflected by mental health and physical health. Psychological recovery and restorative experience were specified as first-order reflective constructs. This classification follows reflective measurement logic, in which indicators represent manifestations of the latent construct rather than causes of it (Hair et al., 2019; Jarvis et al., 2003; Sarstedt et al., 2019).

**Table 1:** Constructs and Measurement Items.

| Variable | Construct type | Construct order | Dimensions | Item code | Item | Source |
|---|---|---|---|---|---|---|
| Therapeutic landscape | Reflective | Second-order | Social landscape SoL | TL-Sol1 | I have opportunities to become familiar with other residents in this nursing home. | (Huang & Xu, |

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| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | TL-Sol2 | I can maintain friendly relationships with other residents here. | 2018; J. Li et al., 2023; Si et al., 2024; Q. Zhang et al., 2021) |
| | | | | TL-Sol3 | I could exchange life experiences with the other older adults in the nursing home. | |
| | | | Physical landscape PL | TL-PL1 | Haikou has comfortable blue sky and white clouds. | |
| | | | | TL-PL2 | The nursing home provides pleasant greenery. | |
| | | | | TL-PL3 | Haikou has good air quality. | |
| | | | | TL-PL4 | Haikou has a pleasant climate. | |
| | | | | TL-PL5 | Haikou receives sufficient natural sunlight. | |
| | | | | TL- PL6 | The nursing home provides spaces for exercise and leisure. | |
| | | | | TL-PL7 | The nursing home provides nutritious food. | |
| | | | | TL-PL8 | The nursing home offers adequate medical facilities. | |
| | | | Symbolic landscape SyL | TL-SyL1 | Nursing homes have extensive exercise facilities. | |
| | | | | TL-SyL2 | Haikou nursing home is suitable for the retirement aged（Local and out-of-province）. | |
| | | | | TL-SyL3 | Nursing homes have plenty of space for recreation. | |
| | | | | TL-SyL4 | Nursing home has a lot of “migratory birds” older adults. | |
| Psychological Recovery PR | Reflective | First-order | | PR1 | Living in this nursing home helps me recover and relax physically and mentally. | Korpela(2001a); Korpela et al (2008）; Von Lindern(2015) Q. Zhang et al (2021). |
| | | | | PR 2 | Living in this nursing home helps me regain energy and interest in life. | |
| | | | | PR3 | When I came nursing home after, I became more peaceful. | |
| | | | | PR4 | When I came nursing home after, I can concentrate better. | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | PR5 | When I came nursing home after, I became more quick-witted. | |
| | | | | PR6 | In this nursing home, I can forget my daily worries. | |
| | | | | PR7 | Living in this nursing home helps me feel calm and emotionally relieved. | |
| Restorative Experience RE | Reflective | First-order | | RE1 | The nursing home environment helps me feel restored in body and mind. | Korpela(2001a); Korpela et al (2008）; Von Lindern(2015) Q. Zhang et al (2021). |
| | | | | RE2 | I feel connected with nature in this nursing home. | |
| | | | | RE3 | The environment here gives me a sense of balance with nature. | |
| | | | | RE4 | The nursing home environment gives me a quiet and reflective experience. | |
| | | | | RE5 | Being in this nursing home makes me feel relaxed both physically and mentally. | |
| | | | | RE6 | This nursing home helps me take a break from daily concerns. | |
| Health HH | Reflective | Second-order | Mental Health MH | HH-MH1 | How would you rate your mental health ? | (Chen et al., 2024; Hedayati Marzbali et al., 2016) |
| | | | | HH－－MH2 | I have maintained a stable mental health condition in this nursing home. | |
| | | | | HH-MH3 | How would you describe your overall quality of life? | |
| | | | Physical Health PH | HH-PH1 | My health is now excellent. | (Huang & Xu, 2018; Q. Zhang et al., 2021) |
| | | | | HH-PH2 | My health has improved since I moved into this nursing home. | |
| | | | | HH-PH3 | I do not feel that I am unwell. | |
| | | | | HH-PH4 | I consider my general health to be very good. | |
| | | | | HH-PH5 | My sleep quality has improved. | |

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|---|---|---|---|---|---|
| | | | | HH-PH6 | My weight is within or close to a healthy range. |
| | | | | HH-PH7 | My blood pressure is within or close to a healthy range. |

Note. TL = therapeutic landscape; SOL = social landscape; PL = physical landscape; SYL = symbolic landscape; PR = psychological recovery; RE = restorative experience; HH = health; MH = mental health; PH = physical health.

### 2.4 Survey Procedure and Data Analysis

The survey was conducted in NH1 and NH2 from July 25 to August 17, 2025. The Chinese questionnaire was distributed through online survey links and on-site assistance. Before participation, all residents were informed of the study purpose, voluntary participation, anonymity, confidentiality, and their right to withdraw. Responses with missing data, obvious response patterns, or inconsistent answers were removed. Finally, 385 valid questionnaires were retained, including 221 from NH1 and 164 from NH2.

Data were analyzed using SmartPLS 4.0. PLS-SEM was selected because the model included higher-order constructs, mediation, moderation, and conditional indirect effects. The measurement model was assessed before the structural model. Higher-order constructs were estimated using the two-stage approach. Bootstrapping with 5,000 subsamples, a two-tailed test, and a 5% significance level was used to examine path coefficients, mediation effects, moderation effects, and conditional indirect effects.

## 3. Results

### 3.1 Measurement model

**Figure 3** shows the model used to test the proposed relationships among the constructs. The evaluation of the measurement model follows the two-step approach recommended in PLS-SEM, the measurement model was assessed before the structural model (Hair, 2021; Hair et al., 2019).

The model included reflective constructs at both first order and second-order levels. Therapeutic landscape was specified as a second-order reflective construct, reflected by social landscape, physical landscape, and symbolic landscape. Health was also specified as a second-order reflective construct, reflected by mental health and physical health. Psychological recovery and restorative experience were treated as first-order reflective constructs. The first-order constructs were evaluated through indicator loadings, internal consistency, convergent validity, and discriminant validity. The second-order constructs were assessed through the loadings of their lower-order dimensions.

Indicator reliability was supported by the outer loading results. All indicator loadings exceeded the recommended threshold of 0.708, suggesting that the indicators adequately represented their corresponding constructs. The reliability results were satisfactory. The reliability coefficients met the recommended criteria, with Cronbach's alpha between 0.805 and 0.942. These values were all above the recommended value of 0.70, indicating satisfactory reliability (see **Error! Reference source not found.**).

Convergent validity was assessed using AVE. The average variance extracted values ranged from 0.593 to 0.758, above the minimum criterion of 0.50. This result

indicates that each construct explained more than half of the variance in its indicators. For the higher-order constructs, the lower-order dimension loadings also confirmed the higher-order structure. Social landscape, physical landscape, and symbolic landscape adequately reflected therapeutic landscape, while mental health and physical health adequately reflected health.

Taken together, the results indicate that the measurement model achieved acceptable indicator reliability, internal consistency reliability, convergent validity, and higher-order construct validity. The findings support the use of both first order and second-order reflective constructs in this study (Shiau et al., 2019).

The second-order reflective constructs were further assessed through the loadings of their lower-order dimensions. As shown in **Error! Reference source not found.**, the loadings of social landscape, physical landscape, and symbolic landscape on therapeutic landscape were 0.743, 0.959, and 0.879, respectively. The loadings of mental health and physical health on health were 0.838 and 0.987, respectively. All loadings were higher than 0.708, indicating that the lower-order dimensions adequately represented their corresponding higher-order constructs (see **Error! Reference source not found.** ).

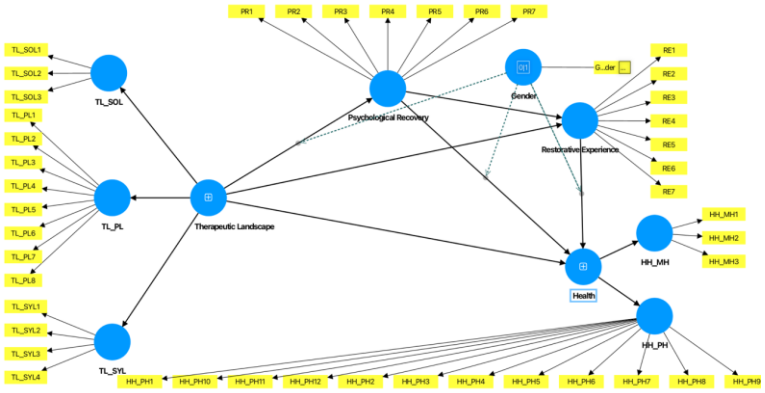


**Figure 3.** PLS-SEM Results of the Structural Model.

**Table 3:** Reliability and Convergent Validity.

| Variable | Dimensions | Item | Mean | SD | α (≥0.7) | rho_A (≥0.7) | CR (≥0.7) | AVE (≥0.5) | Outer Loadings |
|---|---|---|---|---|---|---|---|---|---|
| Therapeutic landscape TL | Social landscape SoL | SOL1 | 3.10 | 1.365 | 0.805 | 0.806 | 0.885 | 0.720 | 0.816 |
| | | SOL2 | 3.22 | 1.389 | | | | | 0.840 |
| | | SOL3 | 3.17 | 1.374 | | | | | 0.844 |
| | Physical landscape PL | PL1 | 3.15 | 1.424 | 0.902 | 0.902 | 0.921 | 0.593 | 0.744 |
| | | PL2 | 3.16 | 1.378 | | | | | 0.782 |
| | | PL3 | 3.16 | 1.383 | | | | | 0.789 |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | PL4 | 3.17 | 1.380 | | | | | 0.793 |
| | | PL5 | 3.17 | 1.369 | | | | | 0.741 |
| | | PL6 | 3.17 | 1.360 | | | | | 0.750 |
| | | PL7 | 3.14 | 1.390 | | | | | 0.771 |
| | Symbolic landscape SyL | SyL1 | 3.12 | 1.383 | 0.841 | 0.841 | 0.893 | 0.677 | 0.803 |
| | | SyL2 | 3.19 | 1.395 | | | | | 0.847 |
| | | SyL3 | 3.24 | 1.420 | | | | | 0.827 |
| | | SyL4 | 3.18 | 1.377 | | | | | 0.813 |
| Psychological Recovery PR | | PR1 | 3.13 | 1.367 | 0.920 | 0.921 | 0.936 | 0.676 | 0.825 |
| | | PR 2 | 3.19 | 1.315 | | | | | 0.769 |
| | | PR3 | 3.18 | 1.342 | | | | | 0.833 |
| | | PR4 | 3.28 | 1.351 | | | | | 0.824 |
| | | PR5 | 3.27 | 1.379 | | | | | 0.837 |
| | | PR6 | 3.19 | 1.382 | | | | | 0.841 |
| | | PR7 | 3.20 | 1.357 | | | | | 0.823 |
| Restorative Experience RE | | RE1 | 3.30 | 1.364 | 0.897 | 0.898 | 0.919 | 0.618 | 0.796 |
| | | RE2 | 3.29 | 1.334 | | | | | 0.779 |
| | | RE3 | 3.25 | 1.309 | | | | | 0.775 |
| | | RE4 | 3.36 | 1.325 | | | | | 0.820 |
| | | RE5 | 3.34 | 1.371 | | | | | 0.774 |
| | | RE6 | 3.29 | 1.365 | | | | | 0.773 |
| Health | Mental Health MH | MH1 | 3.16 | 1.300 | 0.841 | 0.841 | 0.904 | 0.758 | 0.865 |
| | | MH2 | 3.21 | 1.370 | | | | | 0.879 |
| | | MH3 | 3.20 | 1.346 | | | | | 0.868 |
| | Physical Health PH | PH1 | 3.14 | 1.282 | 0.942 | 0.942 | 0.950 | 0.611 | 0.769 |
| | | PH2 | 3.11 | 1.314 | | | | | 0.787 |
| | | PH3 | 3.18 | 1.323 | | | | | 0.739 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | PH4 | 3.09 | 1.357 | | | | 0.778 |
| | | PH5 | 3.08 | 1.313 | | | | 0.764 |
| | | PH6 | 3.08 | 1.387 | | | | 0.771 |
| | | PH7 | 3.15 | 1.297 | | | | 0.784 |
| | | PH8 | 3.17 | 1.298 | | | | 0.813 |
| | | PH9 | 3.14 | 1.332 | | | | 0.795 |
| | | PH10 | 3.12 | 1.319 | | | | 0.809 |
| | | PH11 | 3.14 | 1.332 | | | | 0.749 |
| | | PH12 | 3.12 | 1.319 | | | | 0.771 |

**Table 4:** Loadings of Second-Order Reflective Constructs.

| Higher-order construct | Lower-order dimension | Loading |
|---|---|---|
| Therapeutic Landscape | Social Landscape | 0.743 |
| Therapeutic Landscape | Physical Landscape | 0.959 |
| Therapeutic Landscape | Symbolic Landscape | 0.879 |
| Health | Mental Health | 0.838 |
| Health | Physical Health | 0.987 |

Discriminant validity was examined using the Fornell–Larcker criterion and the heterotrait–monotrait ratio. As shown in **Error! Reference source not found.** and **Error! Reference source not found.**, the square root of AVE for each construct were higher than their corresponding inter-construct correlations, supporting discriminant validity (Black & Barry J. Babin, 2019; Fornell & Larcker, 1981; Hair et al., 2020). The diagonal values in **Error! Reference source not found.** ranged from 0.770 to 0.871, and all were higher than the off-diagonal correlations. These findings suggest that each construct was more strongly associated with its own indicators than with the other constructs. The heterotrait–monotrait values ranged from 0.444 to 0.885, and all were below the recommended threshold of 0.90, indicating acceptable discriminant validity (Hair et al., 2019; Henseler et al., 2015). Although one value approached the threshold, the results suggest that mental health, physical health, psychological recovery, restorative experience, and the three therapeutic landscape dimensions were empirically distinct. This indicates that the constructs measured different theoretical concepts, reducing the risk of bias caused by poor construct separation or measurement redundancy.

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**Table 5:** Fornell–Larcker Criterion.

| | HH_MH | HH_PH | PR | RE | TL_PL | TL_SOL | TL_SYL |
|---|---|---|---|---|---|---|---|
| HH_MH | **0.871** | | | | | | |
| HH_PH | 0.739 | **0.781** | | | | | |
| Psychological Recovery | 0.462 | 0.515 | **0.822** | | | | |
| Restorative Experience | 0.438 | 0.494 | 0.469 | **0.786** | | | |
| TL_PL | 0.434 | 0.545 | 0.511 | 0.438 | **0.770** | | |
| TL_SOL | 0.382 | 0.451 | 0.410 | 0.453 | 0.604 | **0.848** | |
| TL_SYL | 0.372 | 0.442 | 0.435 | 0.419 | 0.772 | 0.526 | **0.823** |

Note. TL = therapeutic landscape; SOL = social landscape; PL = physical landscape; SYL = symbolic landscape; PR = psychological recovery; RE = restorative experience; HH = health; MH = mental health; PH = physical health

**Table 6:** Heterotrait–Monotrait Ratio.

| | HH_MH | HH_PH | PR | RE | TL_PL | TL_SOL |
|---|---|---|---|---|---|---|
| HH_PH | 0.830 | | | | | |
| Psychological Recovery | 0.520 | 0.549 | | | | |
| Restorative Experience | 0.504 | 0.537 | 0.513 | | | |
| TL_PL | 0.498 | 0.591 | 0.558 | 0.487 | | |
| TL_SOL | 0.465 | 0.517 | 0.472 | 0.532 | 0.709 | |
| TL_SYL | 0.444 | 0.497 | 0.492 | 0.482 | 0.885 | 0.639 |

Note. TL = therapeutic landscape; SOL = social landscape; PL = physical landscape; SYL = symbolic landscape; PR = psychological recovery; RE = restorative experience; HH = health; MH = mental health; PH = physical health

**Error! Reference source not found.** presents the $R^2$ and $Q^2$ values for the endogenous constructs. The model explained 28.8% of the variance in psychological recovery, 31.4% in restorative experience, and 45.0% in health. These results indicate modest to moderate explanatory power for the endogenous constructs. The $Q^2$ values for psychological recovery, restorative experience, and health were 0.269, 0.223, and 0.313, respectively. Since all $Q^2$ values were above zero, the model showed predictive ability.

**Table 7:** Explanatory Power and Predictive Ability.

| Construct | $R^2$ | $Q^2$ |
|---|---|---|
| Psychological Recovery | 0.288 | 0.269 |
| Restorative Experience | 0.314 | 0.2226 |
| Health | 0.450 | 0.313 |

### 3.2 Structural model assessment

Following Hair (2021) recommendations, the structural model and mediation effects were assessed to examine the relationships among therapeutic landscape, psychological recovery, restorative experience, and health. The results are presented in **Error! Reference source not found.** and **Error! Reference source not found.**.

As shown in **Error! Reference source not found.**, therapeutic landscape had a significant positive effect on psychological recovery ($\beta = 0.593$, $t = 10.876$, $p < .001$), restorative experience ($\beta = 0.334$, $t = 6.190$, $p < .001$), and health ($\beta = 0.301$, $t = 6.227$, $p < .001$). Psychological recovery also had significant positive effects on restorative experience ($\beta = 0.293$, $t = 5.839$, $p < .001$) and health ($\beta = 0.354$, $t = 5.546$, $p < .001$). Restorative experience further had a significant positive effect on health ($\beta = 0.332$, $t = 5.245$, $p < .001$). These findings support H1 to H6 and indicate that therapeutic landscape influenced health through both direct and psychological-restorative pathways.

As shown in **Error! Reference source not found.**, psychological recovery significantly mediated the relationship between therapeutic landscape and restorative experience ($\beta = 0.174$, $t = 4.748$, $p < .001$), supporting H7a. Psychological recovery also mediated the relationship between therapeutic landscape and health ($\beta = 0.204$, $t = 4.980$, $p < .001$), supporting H7b. These results suggest that psychological recovery is an important mechanism through which therapeutic landscape contributes to restorative experience and health among older adults in nursing homes.

**Table 8:** Direct Effects.

| Hs | Relationships | β | p-value | t-value | Result |
|---|---|---|---|---|---|
| H1 | Therapeutic Landscape → Psychological Recovery | 0.593 | < .001 | 10.876 | Supported |
| H2 | Therapeutic Landscape → Restorative Experience | 0.334 | < .001 | 6.190 | Supported |
| H3 | Psychological Recovery → Restorative Experience | 0.293 | < .001 | 5.839 | Supported |
| H4 | Psychological Recovery → Health | 0.354 | < .001 | 5.546 | Supported |
| H5 | Restorative Experience → Health | 0.332 | < .001 | 5.245 | Supported |
| H6 | Therapeutic Landscape → Health | 0.301 | < .001 | 6.227 | Supported |

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**Table 9:** Mediation Effects.

| Hs | Relationships | β | p-value | t-value | Result |
|---|---|---|---|---|---|
| H7a | Therapeutic Landscape → Psychological Recovery - Restorative Experience | 0.174 | < .001 | 4.748 | Supported |
| H7b | Therapeutic Landscape → Psychological Recovery - Health | 0.204 | < .001 | 4.980 | Supported |

### 3.3 Moderating Effect of Gender

Gender was tested as a moderator in two selected relationships. As shown in **Error! Reference source not found.**, gender significantly moderated the relationship between therapeutic landscape and restorative experience (β = -0.268, t = 2.475, p = .013), supporting H8a. Since gender was coded as 0 = male and 1 = female, the negative coefficient indicates that the positive effect of therapeutic landscape on restorative experience was weaker among female residents than among male residents. Gender also significantly moderated the relationship between psychological recovery and health (β = -0.216, t = 2.181, p = .029), supporting H8b. This result suggests that the positive effect of psychological recovery on health was also weaker among female residents than among male residents.

As shown in **Error! Reference source not found.**, the conditional indirect effect of therapeutic landscape on health through psychological recovery was significant for both male and female residents. The effect was stronger among male residents (β = .223, t = 4.817, p < .001, 95% CI [.137, .319]) than among female residents (β = .073, t = 2.189, p = .029, 95% CI [.008, .140]). These findings indicate that the indirect effect of therapeutic landscape on health through psychological recovery varied by gender. Therefore, H9 was supported in terms of conditional indirect effects.

**Table 10:** Moderating Effects of Gender.

| Hs | Relationships | β | p-value | t-value | Result |
|---|---|---|---|---|---|
| H8a | Gender × Therapeutic Landscape → Restorative Experience | -0.268 | 2.475 | .013 | Supported |
| H8b | Gender × Psychological Recovery → Health | -0.216 | 2.181 | .029 | Supported |
| Note. Gender was coded as 0 = male, 1 = female. | | | | | |

**Table 11:** Conditional Indirect Effects by Gender.

| Gender | Indirect path | β | t-value | p-value | 95% CI |
|---|---|---|---|---|---|
| Male | Therapeutic Landscape → Psychological Recovery → Health | .223 | 4.817 | < .001 | [.137, .319] |

| | | | | | |
|---|---|---|---|---|---|
| Female | Therapeutic Landscape → Psychological Recovery → Health | .073 | 2.189 | .029 | [.008, .140] |

Note. Gender was coded as 0 = male, 1 = female.

## 4. Discussion

### 4.1 Key findings

The findings show that therapeutic landscapes significantly promoted psychological recovery among older adults in nursing homes. This supports therapeutic landscape theory, which views healing environments as the interaction of physical settings, social relations, and symbolic meanings (Gesler, 1993a). Since nursing home residents repeatedly live with the same environment, greenery, outdoor activity areas, social spaces, and meaningful environmental cues may become part of their everyday psychological support. This finding is also consistent with Attention Restoration Theory and Stress Recovery Theory, which explain how supportive environments reduce mental fatigue, relieve stress, and support emotional recovery (R. Kaplan, 2001; R. Kaplan & Kaplan, 1989; S. Kaplan, 1995; Ulrich, 1983; Ulrich et al., 1991b).

The relatively strong path from therapeutic landscape to psychological recovery suggests that psychological recovery is a central response to nursing home landscapes. It also positively influenced restorative experience and health, and mediated the relationships between therapeutic landscapes and both outcomes. This indicates that psychological recovery is both an outcome of therapeutic landscapes and a key mechanism linking environmental experience with restorative and health-related benefits. Previous research has also connected restorative qualities with emotional relief, lower stress, and improved well-being (K. Korpela et al., 2002; Malekinezhad et al., 2020; Thwaites et al., 2016). However, recovery should not be viewed as the only pathway. Place attachment, perceived safety, and social connectedness may also operate alongside recovery by strengthening belonging, encouraging the use of shared spaces, supporting companionship, and reducing loneliness. These pathways may help explain the direct and indirect effects of therapeutic landscapes on restorative experience and health.

Therapeutic landscapes also had a direct positive effect on health. This suggests that nursing home landscapes support health not only through visual greenness, but also through daily use, emotional relief, social interaction, light activity, and place meaning. This is consistent with studies linking garden quality, outdoor contact, social participation, and place attachment with well-being and self-rated health among older adults (Guo et al., 2024; Liljegren et al., 2024; Zuo et al., 2024b).

Gender moderated both the therapeutic landscape–restorative experience path and the psychological recovery–health path. This suggests that male and female residents may not obtain the same restorative and health-related benefits from similar nursing home landscapes. The conditional indirect effects further indicate that the environment–recovery–health pathway differed in magnitude by gender. This extends the therapeutic landscape model by showing that such pathways are not uniform across residents (Davila et al., 2022; Deng et al., 2020; Fernández Núñez et al., 2022; H. Xu & Wang, 2021; W. Yu et al., 2021; Zheng Zhaokai, 2023).

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### 4.2 Contributions and Implications of the Study

This study contributes to therapeutic landscape research by explaining the mechanism between environment and health, rather than treating this relationship as a simple association. By identifying psychological recovery as a mediating pathway, the study clarifies how nursing home landscapes may support restorative experience and health among older residents. This mechanism-based approach responds to the need for more detailed explanations of how therapeutic landscapes work in everyday care environments (Allison Williams, 1999; Duff, 2016).

This study focuses on nursing home residents, a group that remains underrepresented in therapeutic landscape research. Unlike park visitors or short-term patients, nursing home residents repeatedly experience the same environment in daily life. Their routines, social contact, activity choices, and emotions are closely shaped by the institutional setting. The findings therefore suggest that nursing home landscapes should move beyond visual quality and support rest, movement, interaction, and emotional comfort. The inclusion of gender as a moderator is another contribution. The results show that therapeutic landscape effects may vary across resident groups. Rather than creating separate spaces for men and women, nursing home design should provide flexible, accessible, safe, and socially supportive spaces for diverse users.

Several limitations should be noted. First, data were collected from only two nursing homes in Haikou, which may limit the applicability of the findings to other settings and regions. Second, the study relied on self-reported questionnaires, so responses may have been influenced by social expectations, temporary emotions, or memory bias. Third, the sample included only residents who could live independently and communicate clearly, leaving older adults with more serious cognitive or physical difficulties underrepresented. Future studies could develop a multi-pathway model by testing place attachment, perceived safety, social connectedness, loneliness, social support, and actual physical activity as additional mediators or contextual variables. Longitudinal and mixed-method research could further clarify causal relationships and examine whether therapeutic landscape benefits accumulate over time or fluctuate with residents' changing personal, social, and environmental conditions.

## 5. Discussion

This study examined the relationships among therapeutic landscapes, psychological recovery, restorative experience, and health among older adults in nursing homes. The results indicate that therapeutic landscapes were positively associated with all three outcomes. Psychological recovery functioned as an important mediating mechanism, linking therapeutic landscapes with both restorative experience and health. Restorative experience was also related to health, suggesting its role as a more immediate experiential outcome within the broader environment–health pathway.

Gender further shaped several relationships in the model. It moderated both the association between therapeutic landscapes and restorative experience and the pathway from psychological recovery to health. The conditional indirect effects also showed that the indirect relationship between therapeutic landscapes and health through psychological recovery varied by gender. These results suggest that nursing home residents should not

be understood as a uniform group, as their restorative and health-related responses to the same environment may differ.

Taken together, the study highlights the value of therapeutic landscapes in long-term care settings. Nursing home landscapes should be planned as lived and frequently used spaces, rather than as decorative green areas only. Practical improvements may include barrier-free access, shaded seating, safe walking routes, flexible activity spaces, better indoor–outdoor connections, and social areas that encourage communication, companionship, and daily participation. At the policy level, design standards for nursing homes should place greater emphasis on restorative landscape quality, accessibility, and gender-sensitive needs. Such design does not require separate spaces for male and female residents. Rather, it calls for diverse, safe, and flexible environments that respond to different mobility levels, social preferences, safety perceptions, and emotional needs. Although psychological recovery was identified as a key mechanism in this study, future research should further examine place attachment, perceived safety, and social connectedness to explain how therapeutic landscapes contribute to residents' well-being and daily adaptation over time.

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