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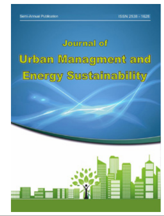



ORIGINAL RESEARCH PAPER

# The Influence of Physical Architectural Components on the Mental Health of Healthcare Staff: A Case Study of 22 Bahman Hospital, Mashhad City

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ABSTRACT

Mental health is fundamental to healthcare staff wellbeing, particularly in high-stress hospital environments where poor workplace design contributes to burnout and adverse patient outcomes. This study investigates the influence of physical architectural components on the mental health of medical staff at 22 Bahman Hospital, Mashhad, Iran. A correlational cross-sectional design was employed, identifying five architectural dimensions (access and movement, visual perception, geometry and dimensions, spatial complexity and diversity, and spatial hierarchy) and five mental health dimensions (feelings of peace, personal security, happiness, sense of belonging, and social interaction) through a theoretical review. A five-point Likert-scale questionnaire was administered to 130 healthcare staff (nurses and physicians) selected from a population of 198 via Cochran's formula (95% confidence level), and data were analysed using PLS-SEM via SmartPLS. Visual perception exerted the strongest architectural influence ($\beta = 0.862$, $T = 33.84$, $p < 0.001$), followed by geometry and dimensions ($\beta = 0.819$), access and movement and spatial hierarchy ($\beta = 0.776$ each), and spatial complexity and diversity ($\beta = 0.574$). Among mental health dimensions, personal security ranked highest ($\beta = 0.886$, $T = 41.97$, $p < 0.001$), followed by happiness ($\beta = 0.818$), sense of belonging ($\beta = 0.728$), social interaction ($\beta = 0.688$), and feelings of peace ($\beta = 0.675$). All constructs confirmed acceptable reliability ($\alpha > 0.7$; $CR > 0.8$) and convergent validity ($AVE > 0.5$). These findings demonstrate that strategic architectural interventions prioritising visual quality, spatial organisation, and perceived safety can meaningfully enhance healthcare staff mental health, offering evidence-based guidance for hospital architects and administrators.

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## INTRODUCTION

The mental health of individuals is crucial for advancing the national and societal goals of communities, as it helps reduce both material and human costs. Mental disorders represent one of the most significant components of the global disease burden. According to the World Health Organization (WHO, 2022), mental and neurological disorders currently account for approximately 13% of the total global disease burden, and projections suggest this figure will rise substantially in coming decades, underscoring the urgency of prioritising mental health across personal, social, and professional settings (Arasteh et al., 2008). Since the dawn of human existence, health has been a societal priority. However, discussions often emphasise physical health over psychological wellbeing. Addressing mental health is vital for societal development, and the interconnectedness of mind and body is well-established (Azimi et al., 2020). The architectural environment significantly impacts mental health, with stress levels serving as a key indicator. The built environment plays a crucial role in shaping mental health outcomes (Torabi et al., 2023). A landmark interdisciplinary research initiative at the University of South Australia-the "Spaces Under Pressure: Mental Health and Architecture" programme identified a substantial gap in research combining architecture and mental health and catalysed subsequent interdisciplinary inquiry in this field (Connellan et al., 2013). Recent European research has demonstrated that mental health facilities designed with healing architectural principles including access to daylight, spatial openness, and natural materials can significantly support recovery and wellbeing among both patients and healthcare workers (Jablonska & Furmanczyk, 2024). Evans (2003) demonstrated how built environment characteristics directly and indirectly affect mental health by influencing psychological processes and social interactions. Environmental architecture, as elaborated by Emamgholi (2014), encompasses psychological, physiological, and physical health pathways through its physical, environmental, aesthetic, and functional dimensions. Since the mid-1970s, studies on therapeutic buildings have shown that uninviting spaces such as windowless hallways, winding corridors, and sterile environments can contribute to mental health issues (Fadda, 2019). Ulrich's (1984) seminal study demonstrated that patients with a natural window view recovered faster and required less pain medication, establishing the empirical foundation for evidence-based therapeutic design. More recently, Huisman et al. (2012) conducted a comprehensive systematic review in Building and Environment confirming that physical environmental factors including single-patient rooms, lighting quality, and spatial layout have measurable effects on both patient recovery and staff wellbeing. Abdolmoula et al. (2023) examined how architectural and interior design features such as safety, noise attenuation, spatial layout, access to nature, and lighting are critical to the wellbeing of occupants in healthcare settings. Their work underscores that incorporating natural light, open floor plans, private and social spaces, artworks, and natural landscapes creates supportive environments for psychological wellbeing. Nakamura and O'Donnell (2025), in their study published in the Progression Journal of Human Demography and Anthropology, examined the relationships between urban physical and social environmental factors including spatial cohesion and neighbourhood cohesion and mental health indicators such as stress, anxiety, and depression. Their network analysis identified urbanisation as a key node connecting multiple mental health risk factors, with city dwellers demonstrating higher mental health burden indices compared to rural populations (Nakamura & O'Donnell, 2025).

## MATERIALS AND METHODS

*Conceptualizing Mental Health*

Mental health stands as a fundamental indicator of societal development and a universal human right. The World Health Organization (1948, reaffirmed 2022) defines health as “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity” (WHO, 2022). This holistic definition marked a paradigm shift by incorporating social wellbeing as an integral component of health. Contemporary scholarship emphasises that mental health is not merely the absence of disorder but a positive state of functioning enabling individuals to cope with normal life stressors, work productively, and contribute to their communities (Velayati & Rezaei Tabrizi, 2024). As presented in Figure 1, the five main components of mental health in this study feelings of peace, personal security, happiness, sense of belonging, and social interaction were selected based on a synthesis of prior theoretical frameworks and empirical research in this field. (Fig. 1)

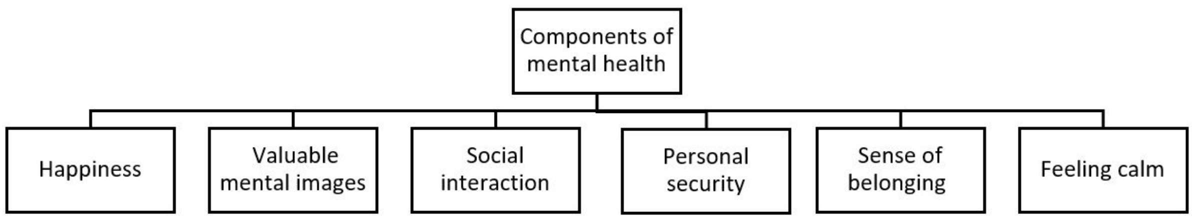


Figure 1: Components of mental health: taken from Velayati and Tabrizi (2024)

Recent studies further emphasize that mental health is not merely the absence of disorders but a positive state of functioning that enables individuals to cope with normal stresses of life. The World Health Organization (WHO) defines health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" (Svalastog et al., 2017). This perspective has been reinforced in contemporary research, highlighting that architectural environments can significantly modulate these health dimensions (Kellert & Heerwagen, 2023). This holistic definition marked a paradigm shift by incorporating social well-being as an integral component of health, acknowledging the profound impact of social environments, working conditions, and living circumstances on mental health status. (Tab. 1)

Table 1: Research background

| Author(s), Year | Country | Method | Setting | Variables | Key Findings |
|---|---|---|---|---|---|
| Ulrich (1984) | USA | Quasi-experimental | Hospital | Window view, w | Natural views reduced recovery time and pain medication use |
| Evans (2003) | USA | Literature review | Urban/built environment | Built env., mental health | Built environment directly and indirectly affects mental health via psychological processes |
| Connellan et al. (2013) | Australia | Interdisciplinary study | Mental health facilities | Architecture, mental health | Identified major research gap; stressed need for design-mental health integration |
| Huisman et al. (2012) | Netherlands | Systematic review | Healthcare facilities | Physical env. factors, user outcomes | Single rooms, lighting, spatial layout improve patient and staff outcomes |

| | | | | | |
|---|---|---|---|---|---|
| Norouzi et al. (2023) | Iran | Mixed methods | Psychiatric hospital | Lighting, safety, natural env. | Specific design conditions improve wellbeing of staff and adolescent patients |
| Hooper et al. (2023) | Multi-national | Survey/SEM | General hospital | Built env., staff satisfaction | Architectural design significantly predicts staff satisfaction and retention |
| Jablonska & Furmanczyk (2024) | Europe | Case study | Mental health facilities | Daylight, materials, spatial openness | Healing architecture principles support recovery and staff wellbeing |
| Present Study (2025) | Iran | PLS-SEM survey | General hospital (22 Bahman) | 5 physical + 5 MH dimensions | Visual perception and personal security are dominant factors |

*Physical Architectural Organisation*

Physical factors play a crucial role in determining the sociability and therapeutic quality of spaces. As illustrated in Figure 2, the framework of physical architectural components includes access and movement, visual perception, geometry and dimensions, spatial complexity and diversity, and spatial hierarchy, constituting the independent variables in the research model. As illustrated in Figure 2, the framework of architectural physical components includes access and movement, visual perception, geometry and dimensions, spatial complexity and diversity, and spatial hierarchy. These components are considered as independent variables in the research model.

The physical organisation of architectural spaces plays a crucial role in shaping social dynamics and mental wellbeing. Ulrich et al. (2008) conducted an extensive evidence-based review confirming that well-designed physical hospital settings improve staff outcomes, reduce stress, and enhance organisational performance. Physical architectural characteristics encompass colour, texture, form, lighting, materials, scale, visibility, and accessibility all strategically configured to support human needs (Najari Nabi & Mehdizadeh, 2020).

*Environmental Architecture and Health*

Architecture encompasses not just the design of buildings but also the lived experience of their occupants. The impact of architectural features on health is presented in Figure 3. As Emamgholi (2014) proposed, environmental architecture affects psychological, physiological, and physical health through four dimensions: physical elements, environmental factors, aesthetic qualities, and cleanliness. The integration of biophilic design principles characterised by the incorporation of natural elements, views of nature, natural light, and organic spatial forms has demonstrated particular promise in healthcare architecture. Browning et al.'s (2014) seminal framework of 14 Patterns of Biophilic Design identified specific design features capable of reducing stress, enhancing cognitive performance, and improving mood among healthcare occupants. These findings are supported by Kellert et al.'s (2008) foundational work on biophilic design theory, which documented the positive psychological effects of nature-connected built environments on human wellbeing. Huisman et al. (2012) systematically documented that optimised architectural environments particularly those incorporating single-patient rooms, natural lighting, and noise attenuation can reduce patient recovery time and significantly improve staff wellbeing. Critical elements such as open-area design, natural light integration, and material selection profoundly influence emotional states and behavioural patterns in clinical settings. (Fig. 3)

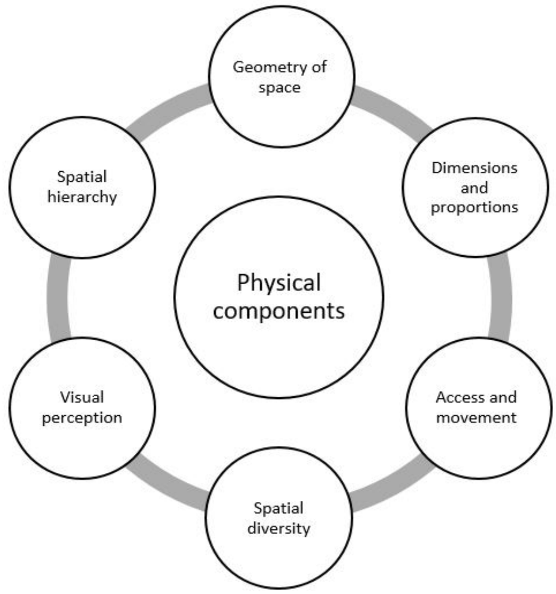


Figure 2: Framework of architectural physical components (Source: Authors)

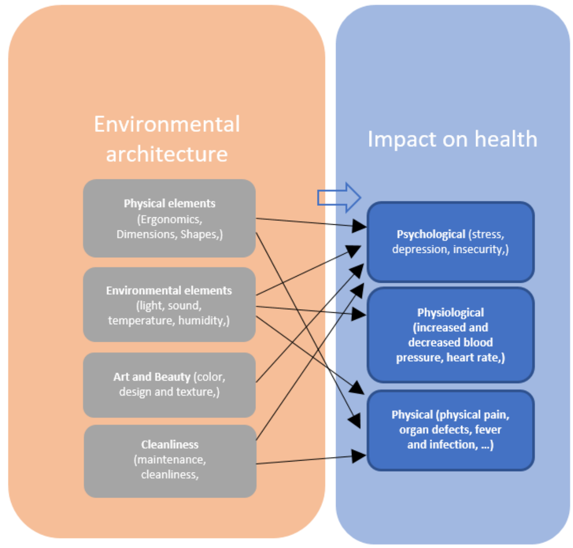


Figure 3: The impact of architectural features of the environment on mental health (Source: Developed by Authors)

*Conceptual Research Model*

The present cross-sectional study's conceptual model is based on two categories of dimensions: physical architectural components (access and movement, visual perception, geometry and dimensions, spatial complexity and diversity, and spatial hierarchy) and mental health dimensions (feelings of peace, personal security, happiness, sense of belonging, and social interaction). The model draws on areas receiving the most scholarly attention (Stenberg & Smet, 2015) and reflects priorities for future research promoting mental health in healthcare environments. Figure 4 illustrates the hypothesised relationships.

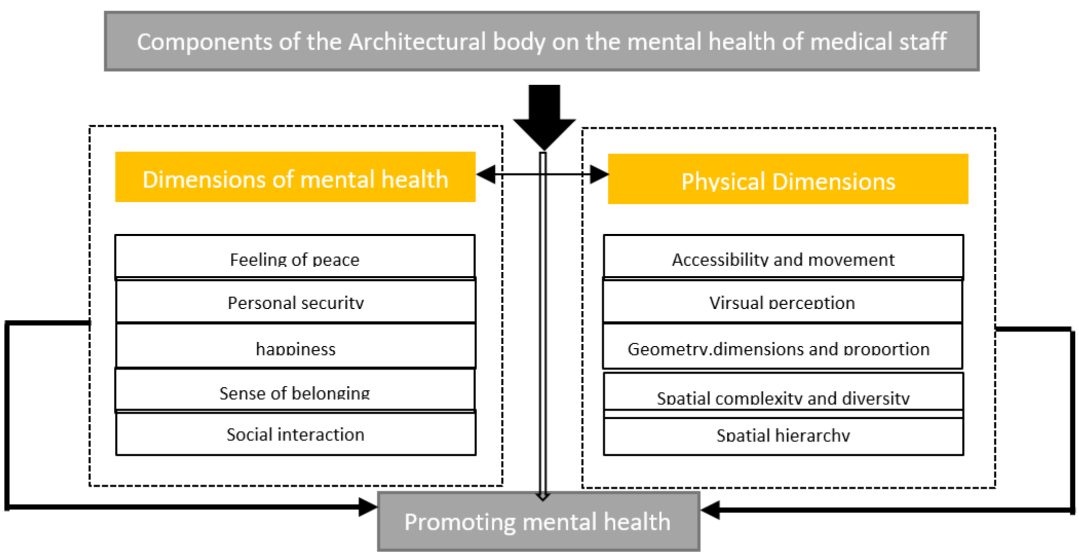


Figure 4: Conceptual research model (Source: Developed by Authors)

*Study Area*

22 Bahman Hospital is an educational-medical facility located in the Baba Nazar area of Mashhad, Iran, a neighbourhood characterised by economic deprivation, high population density, and a significant Afghan immigrant community. These factors create unique challenges: limited healthcare access, cultural barriers, and social stigma increase the burden on patients and heighten emotional demands on staff. Established in 1999 by Abdolhossein Bahman, the 175-bed hospital operates as an educational and medical centre with specialised units including ICU, NICU, and dialysis. Images 4 and 5 show the hospital location and interior, respectively.

*Research Design and Participants*

A correlational cross-sectional research design was employed. Using Cochran's formula with a 95% confidence level and a 5% margin of error, a sample of 130 healthcare staff (nurses and physicians) was selected from a total population of 198 through stratified random sampling. Inclusion criteria required a minimum of one year of continuous employment at the hospital. The response rate was 100%, as questionnaires were administered during scheduled staff meetings under direct researcher supervision. Smart-PLS software was selected for its suitability with relatively small samples, its capacity for both reflective and composite modelling, and its predictive capability all of which align with the exploratory and confirmatory objectives of this study.

*Data Collection Instrument*

A questionnaire was developed based on a five-point Likert scale (1 = very low to 5 = very high), comprising items assessing both physical architectural components and mental health dimensions. Item development followed a systematic review of the literature, after which a panel of five academic experts in architecture and environmental psychology reviewed the instrument for content validity. CVI values ranged from [X] to [X], and all items with CVR below 0.62 were revised or removed before final administration. The full questionnaire is provided in Appendix A. (Fig. 5)

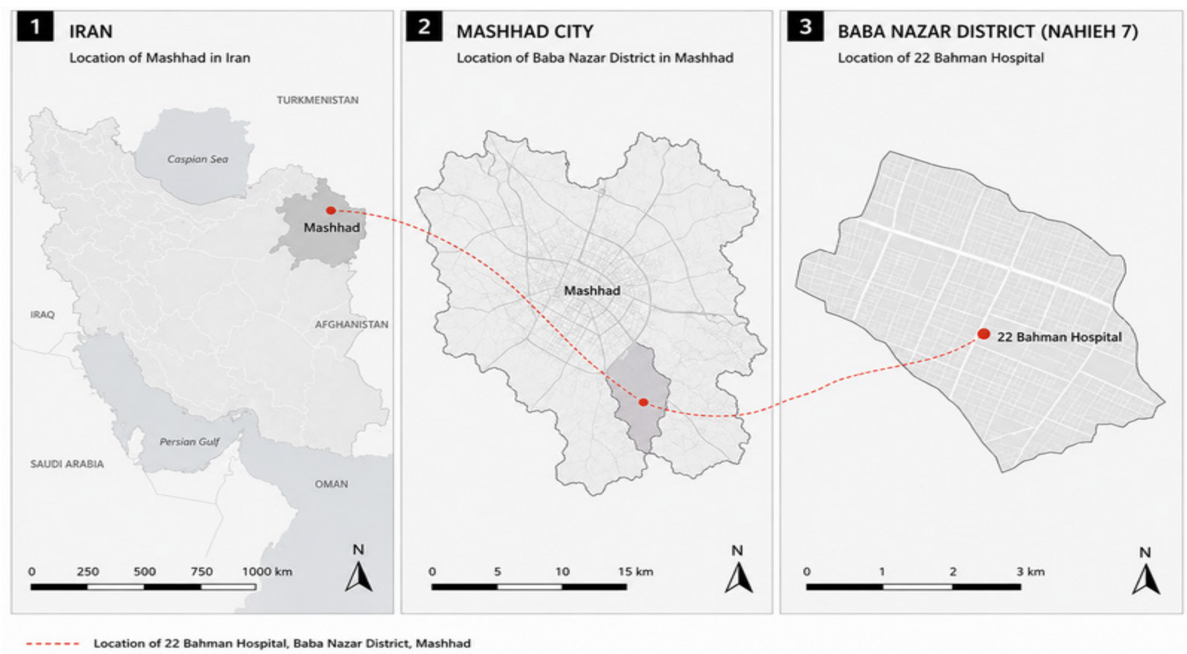


Figure 5: Location of 22 Bahman Hospital–Baba Nazar area

*Research Design and Participants*

A correlational cross-sectional research design was employed. Using Cochran's formula with a 95% confidence level and a 5% margin of error, a sample of 130 healthcare staff (nurses and physicians) was selected from a total population of 198 through stratified random sampling. Inclusion criteria required a minimum of one year of continuous employment at the hospital. The response rate was 100%, as questionnaires were administered during scheduled staff meetings under direct researcher supervision. Smart-PLS software was selected for its suitability with relatively small samples, its capacity for both reflective and composite modelling, and its predictive capability — all of which align with the exploratory and confirmatory objectives of this study.

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Table 2: Research variables

| Question (phrases) | Abbreviation symbol | Second-order variables | | Question (phrases) | Abbreviation symbol | First-order variables | |
|---|---|---|---|---|---|---|---|
| 4 | S1-S2-S3-S4 | Feeling calm | Mental health | 3 | K1–K3 | Spatial hierarchy | Physical |
| 4 | S5-S6-S7-S8 | Personal security | | 3 | K4–K6 | Access and movement | |
| 4 | S9-S10-S11-S12 | Happiness | | 3 | K7–K9 | Visual perception | |
| 4 | S13-S14-S15-S16 | Sense of belonging | | 3 | K10–K12 | Geometry, dimensions and proportions | |
| 4 | S17-S18-S19-S20 | Social interaction | | 3 | K13–K15 | Spatial complexity and diversity | |

*Data Analysis and Methodology*

To validate the theoretical model and calculate path coefficients, Partial Least Squares Structural Equation Modelling (PLS-SEM) was employed using SmartPLS 4.0 software. PLS-SEM is a variance-based approach particularly suited to exploratory research with non-normal data distributions and relatively small samples (Hair et al., 2019). SEM simultaneously tests a set of regression equations, combining multiple regression and factor analysis to assess both the measurement model and causal relationships within the structural model. Significance testing was conducted using bootstrapping with 5,000 subsamples.

*Confirmatory Factor Analysis (CFA)*

To ensure the quality of the research instruments, a Confirmatory Factor Analysis (CFA) was conducted to validate the measurement model and assess construct validity. This technique acts as a theory-testing model, grounded in a solid empirical foundation, to evaluate whether the questions effectively capture the relevant latent variables. The analysis focused on:

•Reliability: Assessed using Cronbach’s alpha and Composite Reliability.

•Validity: Evaluated through Convergent and Discriminant Validity.

•Model Fit: Examining how well the observed factor structures align with the theoretical model

*Path Analysis and Hypothesis Testing*

Following the validation of the measurement model, path analysis was performed to examine the relationships between variables. Significance testing was conducted using bootstrapping with 5,000 subsamples to ensure the robustness of the results (Figs. 6 and 7).

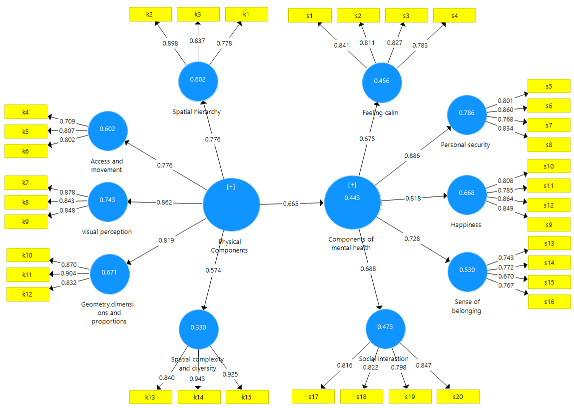


Figure 6: Structural model of research in the standard coefficient

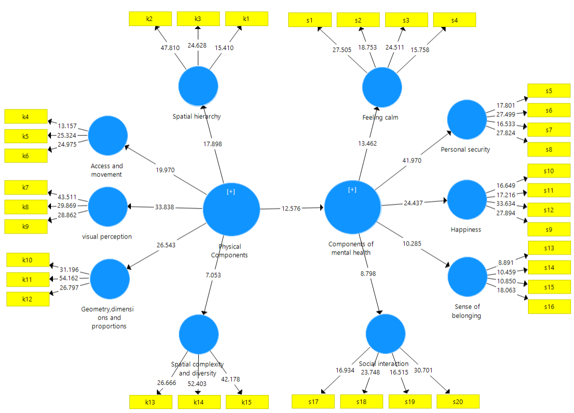


Figure 7: Structural model of the research in terms of significance coefficient

## MATERIALS AND METHODS

*Measurement Model Validation*

Reliability is a key psychometric property of measurement tools. This concept refers to the extent to which an instrument produces consistent results under the same conditions. The reliability coefficient indicates how effectively the measurement tool performs. According to Sarmad et al. (2011), reliability is characterized by stable test results, whereas changes in results indicate temporary inconsistencies. In the partial least squares (PLS) method for assessing structural reliability, three tools are commonly utilized: factor loading coefficients, Cronbach's alpha, and composite reliability (Davari and Rezazadeh, 2014). In this study, to ensure the reliability of the survey questionnaire, we employed both Cronbach's alpha and composite reliability criteria. Cronbach's alpha is a widely used measure of internal consistency and reliability. Internal reliability assesses the degree of correlation between a construct and its indicators. A Cronbach's alpha value above 0.7 signifies acceptable reliability, as it is a traditional benchmark for establishing the reliability of a construct. The modern PLS standard, known as composite reliability, is a more reliable measure than Cronbach's alpha. This criterion, described by Wertz et al. (1974), enhances reliability assessment by considering the correlation index rather than relying solely on absolute terms. A composite reliability value above 0.7 indicates adequate internal reliability for the model (Nunnally, 1987), while a value below 0.6 suggests a lack of reliability. Table 2 presents the Cronbach's alpha and composite reliability values, all of which fall within acceptable ranges. (Tab. 3)

*Validity*

Validity refers to how effectively a test measures the specific construct it is designed to measure (Sarmad et al., 2011). In this study, we employed both convergent validity and divergent validity to assess overall validity. To evaluate convergent validity, we analyzed the Average Variance Extracted (AVE) and Composite Reliability (CR). AVE indicates the extent of correlation between a construct and its indicators; higher correlation values signify a better fit (Barclay et al., 1995). According to Fornell and Larcker (1981), an AVE value of 0.5 is considered acceptable, while Magner et al. (1996) suggest that values above 0.4 are also appropriate. Generally, for convergent validity to be established, two conditions must be satisfied: CR should exceed AVE, and AVE must be greater than 0.5. Table 3 presents details regarding convergent validity. The results confirm that the convergent validity of the questionnaire has been successfully established. (Tab. 4)

Table 3: Cronbach's alpha coefficients and composite reliability of variables

| Main category | Subcategory | Cronbach's alpha | Composite reliability (CR) | Status |
|---|---|---|---|---|
| Physical components | Access and movement | 0.766 | 0.814 | Reliability confirmation |
| | Visual perception | 0.818 | 0.892 | Reliability confirmation |
| | Geometry, dimensions and proportions | 0.838 | 0.903 | Reliability confirmation |
| | Spatial complexity and diversity | 0.887 | 0.931 | Reliability confirmation |
| | Spatial hierarchy | 0.788 | 0.876 | Reliability confirmation |
| Components of mental health | Feeling calm | 0.833 | 0.888 | Reliability confirmation |
| | Personal security | 0.833 | 0.889 | Reliability confirmation |
| | Happiness | 0.846 | 0.896 | Reliability confirmation |
| | Sense of belonging | 0.724 | 0.807 | Reliability confirmation |
| | Social interaction | 0.839 | 0.886 | Reliability confirmation |

Table 4: Table related to the convergent validity of the questionnaire

| Main category | Subcategory | AVE | CR | CR > AVE | Status |
|---|---|---|---|---|---|
| Physical components | Access and movement | 0.595 | 0.814 | OK | Confirming the validity of convergence |
| | Visual perception | 0.734 | 0.892 | OK | Confirming the validity of convergence |
| | Geometry, dimensions and proportions | 0.756 | 0.903 | OK | Confirming the validity of convergence |
| | Spatial complexity and diversity | 0.818 | 0.931 | OK | Confirming the validity of convergence |
| | Spatial hierarchy | 0.703 | 0.876 | OK | Confirming the validity of convergence |
| Components of mental health | Feeling calm | 0.664 | 0.888 | OK | Confirming the validity of convergence |
| | Personal security | 0.666 | 0.889 | OK | Confirming the validity of convergence |
| | Happiness | 0.684 | 0.896 | OK | Confirming the validity of convergence |
| | Sense of belonging | 0.515 | 0.807 | OK | Confirming the validity of convergence |
| | Social interaction | 0.661 | 0.886 | OK | Confirming the validity of convergence |

The divergent validity is shown using the method of Fornell and Larker (1981) in Table 4. The second-order variables are not considered in this method. The findings of the present study indicated that the root AVE of latent variables is more than the correlation between them. Therefore, the latent variables have a stronger relationship with the indicators than other constructs, and the divergent validity of the model is acceptable. (Tab. 5)

Table 5: Divergent validity results using the Fornell and Larker method

| Factors | Component correlation value |
|---|---|
| Access and movement | 0.777 |
| Feeling calm | 0.815 |
| Geometry, dimensions and proportions | 0.869 |
| Happiness | 0.827 |
| Personal security | 0.816 |
| Sense of belonging | 0.718 |
| Social interaction | 0.813 |
| Spatial complexity and diversity | 0.904 |
| Spatial hierarchy | 0.838 |
| Visual perception | 0.857 |

*Ranking Body Components*

According to Standard coefficient (β) shown in Table 5; the most important component is visual perception component and the spatial complexity and diversity have the least importance. (Tab. 6)

Table 6: Ranking Components Body

| Main category | Subcategory | Standard coefficient(β) | T-Value | P-Value | Rank |
|---|---|---|---|---|---|
| Body | Access and movement | 0.776 | 19.970 | 0.000 | Third |
| | Visual perception | 0.862 | 33.838 | 0.000 | First |
| | Geometry, dimensions and proportions | 0.819 | 26.543 | 0.000 | Second |
| | Spatial complexity and diversity | 0.574 | 7.053 | 0.000 | Fourth |
| | Spatial hierarchy | 0.776 | 17.898 | 0.000 | Third |

*Ranking Mental Health Components*

As shown in Table 6, the personal security component is the most important and the feeling of peace component is the least important. (Tab. 7)

Table 7: RankingComponentsYMental health

| Main category | Subcategory | Standard coefficient()β | T-Value | P-Value | Rank |
|---|---|---|---|---|---|
| Mental health | Feeling calm | 0.675 | 13.462 | 0.000 | Fifth |
| | Personal security | 0.886 | 41.970 | 0.000 | First |
| | Happiness | 0.818 | 24.437 | 0.000 | Second |
| | Sense of belonging | 0.728 | 10.285 | 0.000 | Third |
| | Social interaction | 0.688 | 8.798 | 0.000 | Fourth |

## RESULTS AND CONCLUSION

This study provides compelling evidence that architectural design significantly influences the mental health of healthcare professionals working in challenging environments. Through confirmatory factor analysis of data collected from 130 medical staff at 22 Bahman Hospital, several key findings emerge that have important implications for healthcare facility design. The research demonstrates that among architectural components, visual perception ($\beta = 0.862$) exerts the strongest influence on staff mental health, followed by geometry, dimensions and proportions ($\beta = 0.819$), while access and movement and spatial hierarchy share equal importance ($\beta = 0.776$), and spatial complexity and diversity shows relatively lower impact ($\beta = 0.574$). This hierarchy suggests that visual aspects of the environment including lighting, sightlines, and visual comfort play a paramount role in supporting psychological well-being. Regarding mental health dimensions, personal security emerges as the most critical factor ($\beta = 0.886$), indicating that healthcare staff in the demanding context of Baba Nazar area prioritize safety and protection. This is followed by happiness ($\beta = 0.818$), sense of belonging ($\beta = 0.728$), social interaction ($\beta = 0.688$), and feelings of peace ($\beta = 0.675$).

The particularly strong relationship between spatial complexity and feelings of peace (coefficient: 4.790) suggests that varied and interesting spatial experiences can significantly reduce stress in high-pressure medical environments. Conversely, the relatively weaker impact of basic geometric proportions highlights that fundamental spatial configurations may be less influential in contexts where resource constraints limit design complexity. These findings offer practical guidance for hospital administrators and healthcare architects. Priority should be given to enhancing visual environments through improved lighting design, wayfinding systems, and visual connections to nature. Simultaneously, creating spatially diverse environments with varied room configurations and circulation patterns can effectively promote tranquility among medical staff. Future research should explore the longitudinal effects of these architectural interventions and examine their applicability across different healthcare settings and cultural contexts. Additionally, investigating the economic implications of these design strategies could provide further justification for their implementation in resource-constrained environments. In conclusion, this study establishes that strategic architectural design particularly focusing on visual perception and spatial diversity can serve as a powerful tool for supporting mental health among healthcare professionals, ultimately contributing to improved patient care and organizational performance in challenging healthcare settings.

### *Limitations*

Several limitations of this study should be acknowledged. First, the single-hospital case study design limits the generalisability of findings to other hospital types, sizes, and cultural contexts; multi-site replication is needed before the findings can be considered broadly applicable. Second, reliance on self-reported questionnaire data introduces social desirability and common method biases; future research should integrate objective environmental measurements (e.g., light intensity, noise levels, spatial dimensions) alongside subjective perceptions. Third, the cross-sectional design precludes causal inference; longitudinal studies are needed to establish whether architectural improvements produce sustained mental health gains. Fourth, the study population was restricted to nurses and physicians, excluding other healthcare worker categories whose responses may differ. Fifth, the absence of a control group makes it impossible to attribute observed mental health patterns solely to architectural factors, as other organisational and personal variables may be confounding. Finally, demographic moderating variables (gender, professional role, years of experience) were not examined in multi-group analysis, representing an area for future inquiry.

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