VOL. 11 NO. 4,
FEBRUARY, 2026
E-ISSN 3026-9210
P-ISSN 3026-815X

African Scholar Publications & Research International
www.africanscholarpub.com

Journal of Built Env. & Geological Research (JBEGR)

Passive Design Strategies for Sustainable Hospital Design in Tropical Climates: A Literature Review and Case Study of Khoo Teck Puat Hospital

Nwosu Izuchukwu John; Arc. Akintunde Onamade; Dr. Obafemi A. Ibitoye; & Dr. Gabriel Ogunyemi Olaoye
Department of Architecture, College of Postgraduate Studies, Caleb University, Ikorodu-Imota Road, Ikorodu, Lagos State.
Corresponding Author: nwosuizuchukwu43@gmail.com
DOI: https://doi.org/10.70382/ajbegr.v11i4.065

Abstract

Healthcare facilities in tropical regions face persistent challenges related to thermal discomfort, high energy consumption, and limited access to restorative environments. This study investigates the role of passive design strategies in enhancing sustainability and healing outcomes in tropical hospital settings. A qualitative research approach was adopted, combining a structured literature review with a case study of Khoo Teck Puat Hospital to examine the impact of building orientation, natural ventilation, daylighting, and therapeutic landscapes on indoor environmental quality and patient wellbeing. The findings reveal that natural ventilation and effective shading strategies significantly improve thermal comfort while reducing dependence on mechanical cooling systems. Daylighting contributes to improved patient recovery and staff productivity by supporting psychological wellbeing and visual comfort. Additionally, the integration of nature through courtyards, gardens, and visual connections to greenery promotes stress reduction and emotional restoration, reinforcing the principles of healing architecture. The study demonstrates that passive design provides a critical framework for developing resilient and energy efficient healthcare facilities in tropical climates. By prioritizing climate responsive strategies, hospital design can reduce environmental impact while enhancing patient outcomes. The paper concludes with recommendations for integrating passive design strategies into healthcare planning and identifies areas for future research to strengthen evidence based sustainable hospital design.

Keywords: Passive Design, Tropical Hospitals, Natural Ventilation, Daylighting, Healing Architecture, Sustainable Healthcare Design, Thermal Comfort, Biophilic Design.

Introduction

Hospitals are among the most energy intensive building types because they operate continuously and rely heavily on mechanical systems to maintain thermal comfort, lighting quality, and infection control. This constant demand for energy increases operational costs and environmental impact, especially in tropical climates where cooling loads remain high throughout the year (Rahman et al., 2021). Passive design presents a viable alternative by using natural ventilation, daylighting, and shading to regulate indoor conditions and reduce dependence on mechanical cooling. These strategies not only lower energy consumption but also create more comfortable indoor environments that support patient recovery and staff efficiency (Gamero-Salinas et al., 2021).

Access to natural light and views of nature has been associated with improved wellbeing, shorter hospital stays, and reduced stress among patients and healthcare workers. Such environmental qualities reinforce the role of design in healthcare outcomes and highlight the therapeutic value of integrating nature into hospital settings (Guidolin et al., 2024). In developing regions, where power supply can be inconsistent, passive strategies enhance building resilience by maintaining acceptable indoor conditions without full reliance on active systems. This approach aligns with the growing emphasis on climate responsive architecture and sustainable development in the built environment (Ogunyemi et al., 2022).

Problem Statement

Healthcare facilities in tropical regions face persistent challenges related to overheating, high energy consumption, and inadequate indoor environmental quality due to heavy reliance on mechanical cooling systems. These conditions not only increase operational costs but also compromise patient comfort, recovery outcomes, and staff productivity when thermal comfort is not consistently maintained (Rahman et al., 2021). Many existing hospital buildings were not designed with climate responsive principles, resulting in poor natural ventilation, insufficient shading, and limited daylight integration. This design gap contributes to indoor environments that can heighten stress, prolong recovery periods, and reduce overall wellbeing for both patients and healthcare providers (Rodríguez-Labajos et al., 2024).

In contexts where electricity supply is unreliable, dependence on active cooling systems further exposes healthcare facilities to service disruptions that affect clinical operations and patient safety. The absence of resilient passive design strategies highlights a critical need for architectural approaches that can sustain comfort and functionality under fluctuating energy conditions (Gamero-Salinas et al., 2021).

Despite growing global evidence on the benefits of therapeutic and climate responsive design, many healthcare projects in developing regions still prioritize conventional mechanical solutions over integrated passive strategies. This disconnect underscores the urgency for design frameworks that align environmental performance with patient-centered care and sustainable development goals (Ogunyemi et al., 2022).

Aim and Objectives

Aim

To evaluate how passive design strategies can enhance sustainability and thermal comfort in hospital environments, using Khoo Teck Puat Hospital as a case study.

Objectives

1. To examine the passive design features incorporated in Khoo Teck Puat Hospital.
2. To assess how natural ventilation strategies contribute to thermal comfort and infection control in healthcare spaces.
3. To evaluate the role of daylighting in improving patient wellbeing and reducing energy consumption.
4. To explore the relationship between passive design and overall hospital sustainability performance.
5. To propose design recommendations for sustainable hospital architecture in tropical climates.

Research Gap

Although numerous studies highlight the importance of sustainable architecture in healthcare, limited research provides an integrated evaluation of passive design strategies within functioning tropical hospitals. Many existing works focus on isolated elements such as energy efficiency or daylighting without examining how combined passive systems influence patient comfort, operational resilience, and environmental performance.

There is a scarcity of literature that contextualizes passive hospital design within developing regions where energy instability and resource constraints demand climate responsive solutions. This gap underscores the need for comprehensive case-based analysis to demonstrate how passive design can simultaneously support sustainability goals, healthcare outcomes, and long-term operational efficiency.

Literature Review

Sustainable hospital design has emerged as a critical response to rising energy demand, climate change, and the need for healthier indoor environments. Passive design strategies offer a climate-responsive approach that improves thermal comfort, indoor air quality, and patient wellbeing while reducing operational energy use in healthcare facilities (Ogunyemi et al., 2022). This section reviews key themes in passive healthcare design, including ventilation,

thermal comfort, daylighting, and sustainability, to establish a framework for analyzing the selected case study.

Passive Design in Healthcare Architecture

Passive design strategies are increasingly recognized as essential for reducing energy consumption and improving indoor environmental quality in healthcare facilities. By leveraging natural ventilation, solar shading, and building orientation, hospitals can maintain thermal comfort while minimizing reliance on mechanical systems, particularly in tropical climates where cooling loads are significant (Rahman et al., 2021). These strategies support climate-responsive architecture by aligning building performance with local environmental conditions and reducing operational costs in energy-intensive healthcare settings (Ogunyemi et al., 2022).

Thermal Comfort and Natural Ventilation in Hospitals

Thermal comfort is critical in healthcare environments, as temperature fluctuations can affect patient recovery, staff efficiency, and infection control. Natural ventilation improves air exchange rates, dilutes airborne contaminants, and reduces dependence on air conditioning systems, contributing to healthier indoor environments (Gamero-Salinas et al., 2021). In tropical regions, cross-ventilation and stack effect strategies have proven effective in maintaining acceptable indoor temperatures, demonstrating that passive airflow management can complement clinical requirements without compromising safety (Rahman et al., 2021).

Daylighting and Healing Environments

Access to daylight has been linked to improved patient outcomes, reduced stress levels, and shorter hospital stays. Exposure to natural light supports circadian rhythms and enhances psychological wellbeing, reinforcing the therapeutic role of architectural design in healthcare settings (Guidolin et al., 2024). Daylighting also reduces reliance on artificial lighting, lowering energy consumption while improving visual comfort for both patients and healthcare staff, thereby supporting sustainable hospital operations.

Passive Design and Hospital Sustainability

Hospitals are among the most resource-intensive building types, making sustainability a critical design priority. Passive design strategies contribute to sustainability by lowering energy demand, reducing greenhouse gas emissions, and improving building resilience in regions with unstable power supply. Integrating passive systems with healthcare functionality demonstrates that environmental performance and patient-centered care can be achieved simultaneously through climate-responsive architectural approaches (Gamero-Salinas et al., 2021).

Case Study Overview: Khoo Teck Puat Hospital

Located in Singapore's tropical climate, Khoo Teck Puat Hospital represents a climate-responsive approach to healthcare architecture that prioritizes passive environmental control and sustainable performance. The hospital was conceived as a "healing environment," where building form, orientation, and landscape integration work together to enhance thermal comfort, daylight access, and natural ventilation. Its design emphasizes cross-ventilation, shaded courtyards, and extensive greenery to moderate microclimate conditions and reduce dependence on mechanical cooling systems. By integrating water bodies, vegetation, and open corridors, the facility creates a porous building envelope that supports airflow and mitigates heat gain in a high-humidity environment. Beyond environmental performance, the hospital demonstrates how passive design can support patient recovery, staff wellbeing, and operational efficiency. The integration of sustainability principles with healthcare functionality positions the facility as a relevant model for climate-responsive hospital design, particularly in tropical regions where energy demand and thermal stress present ongoing challenges.

Research Methodology

This study adopts a qualitative research methodology to examine the role of passive design strategies in enhancing sustainability and healing outcomes in tropical hospital environments. The methodology combines a structured literature review with a case study analysis to develop a comprehensive understanding of climate-responsive healthcare design. The literature review identifies key passive design strategies from existing research, while the case study of Khoo Teck Puat Hospital illustrates the practical application of these strategies in a real-world tropical healthcare setting. This approach enables the integration of theoretical insights with practical design solutions relevant to sustainable hospital architecture.

Research Design

This study adopts a qualitative research design that integrates a structured literature review with a case study illustration. The approach enables a comprehensive understanding of passive design strategies in hospital architecture by synthesizing existing research and examining their practical application in a real-world healthcare facility. The design supports evaluation of how passive systems contribute to sustainability, thermal comfort, and healing environments within tropical contexts. The research design is particularly suitable for this study because passive design strategies in hospital environments require both theoretical understanding and contextual analysis. By combining literature review and case study analysis, the study establishes relationships between passive environmental strategies and sustainable healthcare outcomes.

Literature Review Strategy

The literature review was conducted using Elicit AI, an artificial intelligence research assistant designed to identify relevant academic literature based on research questions and keywords.

Unlike conventional academic databases such as Google Scholar, ScienceDirect, ResearchGate, JSTOR, and PubMed, Elicit AI applies machine learning techniques to extract insights, summarize findings, and recommend peer-reviewed studies relevant to the research focus.

The use of Elicit AI enabled a structured and efficient identification of relevant literature. Key research themes including passive design strategies, sustainable hospital architecture, thermal comfort, daylighting, and biophilic design in tropical climates were used to generate relevant academic sources. Approximately fifteen to twenty academic articles were initially identified through the search process. From this pool, seven studies were selected based on their relevance to passive design strategies, tropical climate considerations, sustainability outcomes, and healthcare environmental performance. This approach ensured that the selected literature aligned closely with the objectives of the study while maintaining academic rigor and thematic consistency.

Data Collection

Relevant literature was sourced from peer-reviewed journal articles identified through the Elicit AI research platform. Search terms included passive design in hospitals, natural ventilation in healthcare buildings, daylighting in healing environments, sustainable hospital architecture, and climate responsive design in tropical regions. The search focused primarily on recent studies to ensure contemporary relevance and applicability to current sustainability challenges in healthcare architecture. The collected literature provided insights into passive design strategies, sustainability performance, and healing outcomes in hospital environments.

Selection Criteria

The selected articles were chosen based on the following criteria:

1. Relevance to passive design strategies in hospital buildings
2. Focus on tropical or warm climate regions
3. Discussion of sustainability and energy efficiency
4. Consideration of patient wellbeing and healing environments
5. Peer-reviewed academic sources

Studies that did not directly relate to hospital environments or passive design strategies were excluded to ensure the relevance and quality of the literature review.

Case Study Selection

Khoo Teck Puat Hospital was selected as the case study due to its internationally recognized integration of passive design strategies within a tropical healthcare setting. The hospital demonstrates extensive use of natural ventilation, vegetated façades, shaded courtyards, and water features that enhance microclimatic cooling and patient wellbeing. The hospital's documented sustainability performance and climatic similarity to other tropical regions make it an appropriate model for sustainable hospital design. The case study provides practical

insights into how passive design strategies can be applied in healthcare facilities to improve environmental performance and patient outcomes.

Analytical Framework

A thematic synthesis approach was employed to analyze the literature and case study. Recurring passive design strategies were identified and evaluated based on their reported outcomes in energy efficiency, thermal comfort, indoor air quality, and patient recovery. The case study was examined to illustrate how these strategies function collectively within an operational hospital environment. This framework enables the translation of theoretical insights into practical design principles for sustainable healthcare architecture.

Limitations of the Study

The study is limited by its reliance on secondary data, which may restrict access to detailed performance metrics and operational data. The focus on English language publications may exclude relevant regional studies, introducing potential language bias. Additionally, while the selected case study provides valuable insights, contextual differences may influence the direct transferability of findings to other healthcare settings. Despite these limitations, the study provides meaningful insights into passive design strategies for sustainable hospital environments in tropical climates.

Results and Discussion

This section synthesizes the findings from the reviewed literature and case analysis, interpreting how passive design strategies influence environmental performance and healing outcomes in tropical healthcare settings. The discussion connects thermal comfort, daylighting, and biophilic integration to sustainability goals and patient-centered care.

Summary of Reviewed Literature

Table 1: Summary of Reviewed Literature

S/N	Title of Article	Author(s) & Year	Aim and Objectives	Methodology	Key Results
1	Passive cooling design strategies as adaptation measures for lowering indoor overheating risk in tropical climates	Gamero-Salinas et al. (2021)	Evaluates passive cooling strategies for reducing overheating risk in tropical buildings.	3,840 thermal simulations under present and future climate scenarios.	Natural ventilation, shading, and semi-outdoor spaces significantly reduce overheating risk and support climate-responsive design.
2	Thermal comfort assessment of naturally ventilated public hospital wards in the tropics	Rahman et al. (2021)	Assesses thermal comfort conditions in naturally ventilated hospital wards.	Field measurements and occupant surveys in tropical hospital wards.	Natural ventilation maintained acceptable comfort levels and reduced dependence on mechanical cooling.

S/N	Title of Article	Author(s) & Year	Aim and Objectives	Methodology	Key Results
3	A Study of Daylighting Impact at Inpatient Ward, Seri Manjung Hospital	Mara et al. (2022)	Examines the benefits of daylighting on patient wellbeing and staff comfort.	Quantitative survey using questionnaires distributed to patients and staff.	Natural light improved mood, reduced stress, and minimized fatigue caused by artificial lighting.
4	The Influence of Exposure to Nature on Inpatient Hospital Stays: A Scoping Review	Guidolin et al. (2024)	Reviews the therapeutic effects of nature exposure in hospital environments.	Scoping review of 41 studies.	Exposure to nature reduces anxiety, pain perception, and length of hospital stay.
5	Greenspaces of psychiatric clinics and patient perceptions: A mixed-methods exploration	Schmid et al. (2024)	Explores patient perceptions of hospital greenspaces.	Mixed-methods study with mapping and interviews (n=34).	Patients valued greenery for calmness and restoration, highlighting the healing role of landscape design.
6	Evaluation of Passive Cooling Strategies in Urologist Specialist Hospital, Ikoyi, Lagos State	Rasheed et al. (2024)	Identifies effective passive cooling strategies for Nigerian hospitals.	Qualitative analysis using secondary data and content analysis.	Natural ventilation, shading, insulation, and stack ventilation improved cooling performance in tropical healthcare settings.
7	Hospital design for inpatient psychiatry: A realistic umbrella review	Bodryzlova et al. (2024)	Synthesizes evidence on how hospital design affects patient outcomes.	Umbrella review of systematic reviews.	Built environment design significantly influences emotional wellbeing, safety, and recovery outcomes.

Synthesis of Findings

The reviewed studies consistently demonstrate that passive design strategies play a critical role in improving thermal comfort, energy efficiency, and patient wellbeing in tropical healthcare environments. Natural ventilation emerged as a dominant strategy for maintaining acceptable indoor temperatures while reducing dependence on mechanical cooling systems. This approach not only lowers operational energy demand but also enhances indoor air quality, which is essential in healthcare settings.

Daylighting was identified as another key passive design element influencing patient recovery and staff performance. Access to natural light improves mood, reduces stress, and minimizes fatigue associated with prolonged exposure to artificial lighting. These findings indicate that integrating daylighting into hospital wards contributes to both physiological and psychological wellbeing.

The integration of nature through views, gardens, and landscaped spaces was also found to have measurable therapeutic benefits. Exposure to greenery reduces anxiety, shortens hospital

stays, and supports emotional restoration. This reinforces the concept of healing architecture, where the built environment actively contributes to recovery outcomes.

In tropical contexts such as Lagos, shading devices, building orientation, and semi-outdoor transition spaces were highlighted as effective strategies for mitigating heat gain. These elements enhance thermal performance while maintaining visual and spatial connectivity with the outdoor environment.

Overall, the literature reflects a broader shift toward climate-responsive hospital design that prioritizes passive environmental control, sustainability, and human-centered healing.

Comparative Insights

A comparison of the reviewed studies reveals both convergence and contextual variation in passive design performance. Studies conducted in Southeast Asia and tropical regions show strong agreement on the effectiveness of natural ventilation and shading in reducing overheating risks. However, research in Nigerian healthcare facilities emphasizes additional challenges such as inconsistent power supply, which increases reliance on passive strategies as primary rather than supplementary systems.

While daylighting benefits are universally acknowledged, the extent of its effectiveness varies depending on ward orientation, window design, and glare control measures. Hospitals that integrate shading devices and light-diffusing elements achieve optimal visual comfort without increasing heat gain. Similarly, the therapeutic value of nature is widely supported, yet its implementation differs across contexts. In high-density urban hospitals, visual access to greenery may substitute for large outdoor gardens, demonstrating adaptability in healing design approaches. These variations highlight the importance of contextual design solutions that respond to climatic, cultural, and infrastructural conditions.

Practical Relevance

The findings of this study have direct implications for hospital design in tropical regions, particularly in rapidly urbanizing cities such as Lagos. First, integrating passive cooling strategies such as cross ventilation, shading devices, and thermal mass can significantly reduce energy consumption and operational costs in healthcare facilities. This is especially relevant in regions where energy infrastructure is unreliable or expensive. Second, designing for daylight access in patient wards and staff areas can enhance occupant wellbeing and improve workplace efficiency. Proper daylighting design reduces dependence on artificial lighting and contributes to sustainable building performance. Third, incorporating landscape elements and views of nature into hospital layouts can support patient recovery and psychological comfort. Even limited green interventions such as courtyard gardens, green walls, and shaded outdoor waiting areas can provide measurable healing benefits. Collectively, these strategies support the development of resilient, sustainable, and patient-centered healthcare environments.

Limitations of the Study

This study is based primarily on a review of existing literature and a single case study, which may limit the generalizability of the findings across all tropical healthcare contexts. Variations in hospital size, funding, infrastructure, and cultural expectations may influence the applicability of passive design strategies. Additionally, differences in research methods among the reviewed studies, including simulations, field measurements, and qualitative assessments, create challenges in direct comparison of results. The study also focuses on environmental and spatial design factors, without extensive analysis of operational policies, maintenance practices, or technological integration, which may influence building performance.

Implications for Sustainable Hospital Design

The synthesis underscores the necessity of integrating passive design as a foundational strategy rather than an optional feature in hospital planning. Climate-responsive design reduces environmental impact while improving patient outcomes, aligning healthcare infrastructure with global sustainability goals. Future hospital projects in tropical regions should prioritize site-responsive orientation, natural ventilation pathways, daylight optimization, and therapeutic landscapes. These elements collectively enhance resilience, reduce energy demand, and support holistic healing environments.

Conclusion and Recommendations

Conclusion

This study examined the role of passive design strategies in enhancing sustainability and healing outcomes in tropical healthcare environments, using a literature-based review supported by a case study illustration. The findings confirm that climate-responsive design significantly improves thermal comfort, indoor air quality, energy efficiency, and patient wellbeing. Natural ventilation emerged as a fundamental strategy for maintaining acceptable indoor environmental conditions while reducing reliance on mechanical cooling systems. In tropical hospital settings, where energy supply may be unreliable, passive cooling provides a resilient and cost-effective alternative. Daylighting was also found to support patient recovery and staff productivity by improving mood, regulating circadian rhythms, and reducing visual fatigue.

The integration of nature through views, courtyards, and landscaped spaces reinforces the principles of healing architecture. Access to greenery contributes to stress reduction, emotional restoration, and improved recovery experiences. In dense urban contexts, even limited green interventions can provide therapeutic value. The study further highlights that building orientation, shading devices, and transitional spaces are essential for minimizing heat gain and enhancing environmental performance in tropical climates. Collectively, these strategies demonstrate that passive design is not merely an environmental response but a holistic approach that supports sustainability, resilience, and patient-centered care.

Recommendations

Design Recommendations for Tropical Hospitals

Healthcare facilities in tropical regions should prioritize passive cooling strategies such as cross ventilation, shaded openings, deep overhangs, and ventilated corridors. These measures reduce indoor heat gain and improve air circulation, ensuring thermal comfort without excessive energy consumption.

Building orientation should be carefully considered to optimize prevailing wind flow and minimize solar heat gain. East–west elongation, shaded façades, and the use of buffer spaces can enhance environmental performance while maintaining functional efficiency.

Daylighting strategies should incorporate light-diffusing devices, shaded windows, and glare control elements to ensure visual comfort without increasing indoor temperatures. Patient wards and staff areas should be designed to maximize access to natural light.

The integration of therapeutic landscapes should be considered a core design element rather than an aesthetic addition. Courtyard gardens, green walls, shaded outdoor waiting areas, and visual access to vegetation can enhance patient recovery and psychological wellbeing.

Policy and Planning Recommendations

Healthcare planning authorities should incorporate passive design guidelines into hospital design standards and procurement frameworks. This will encourage climate-responsive solutions that reduce operational costs and improve healthcare outcomes. Investment in sustainable hospital infrastructure should prioritize long-term performance over short-term construction costs. Passive design strategies offer lifecycle cost savings through reduced energy consumption and maintenance requirements.

Recommendations for Future Research

Future studies should incorporate field measurements and post-occupancy evaluations to quantify the performance of passive design strategies in tropical hospitals. Comparative studies across multiple healthcare facilities would provide stronger empirical evidence and improve generalizability. Further research is also needed to explore the integration of passive and low-energy active systems, ensuring optimal performance under varying climatic and operational conditions.

References

Bodryzlova, Y., Lemieux, A. J., Dufour, M., Côté, A., Lalancette, S., & Crocker, A. G. (2024). Hospital design for inpatient psychiatry: A realistic umbrella review. *Journal of Psychiatric Research*, *178*, 94–106. https://doi.org/10.1016/j.jpsychires.2024.07.045

Gamero-Salinas, J., Monge-Barrio, A., Kishnani, N., López-Fidalgo, J., & Sánchez-Ostiz, A. (2021). Passive cooling design strategies as adaptation measures for lowering the indoor overheating risk in tropical climates. *Energy and Buildings*, *252*, 111417. https://doi.org/10.1016/j.enbuild.2021.111417

Guidolin, K., Jung, F., Hunter, S., Yan, H., Englesakis, M., Verderber, S., Chadi, S., & Quereshy, F. (2024). The influence of exposure to nature on inpatient hospital stays: a scoping review. *HERD Health Environments Research & Design Journal*, *17*(2), 360–375. https://doi.org/10.1177/19375867231221559

Mara, U. T., Muhamad, J., Ismail, A. A., Mara, U. T., Khair, S. M. a. S. A., Mara, U. T., Ahmad, H., & Mara, U. T. (2022). A study of daylighting impact at inpatient ward, Seri Manjung Hospital. *International Journal of Sustainable Construction Engineering Technology*, *13*(2). https://doi.org/10.30880/ijscet.2022.13.02.021

Ogunyemi, O. G., Alagbe, O., Tony, I., Chukwuka, O. P., Ajayi, T. O., & Oladipo, Y. O. (2022). CALEB UNIVERSITY ENERGY QUEST: A STUDY OF MICRO ELECTRIC POWER AS AN ALTERNATIVE SOURCE. *CALEB INTERNATIONAL JOURNAL OF DEVELOPMENT STUDIES*, *05*(02), 369–385. https://doi.org/10.26772/cijds-2022-05-02-019

Rahman, N. M. A., Haw, L. C., Fazlizan, A., Hussin, A., & Imran, M. S. (2021). Thermal comfort assessment of naturally ventilated public hospital wards in the tropics. *Building and Environment*, *207*, 108480. https://doi.org/10.1016/j.buildenv.2021.108480

Rasheed, S. A., Steve, J., Samuel, A. O., & Thomas, A. (2024). Evaluation of passive cooling strategies in Urologist Specialist Hospital, Ikoyi, Lagos State. *International Journal of Innovative Science and Research Technology (IJISRT)*, 2016–2021. https://doi.org/10.38124/ijisrt/ijisrt24feb1677

Rodríguez-Labajos, L., Kinloch, J., Nicol, L., Grant, S., & O'Brien, G. (2024). Impact of the design of adult mental health inpatient facilities on healthcare staff: a mixed methods systematic review. *BMJ Open*, *14*(3), e074368. https://doi.org/10.1136/bmjopen-2023-074368

Schmid, H., Nowak, A., Oeljeklaus, L., McCall, T., Hornberg, C., Caspers, B. A., & Zerbe, S. (2024). Greenspaces of psychiatric clinics and patient perceptions: A mixed-methods exploration. *People and Nature*, *6*(4), 1592–1604. https://doi.org/10.1002/pan3.10671