PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 6 (2024), Page 640 – 650

ANALYSIS OF THE END-USER RESPONSES TOWARDS BIOPHILIC DESIGN IMPLEMENTATION IN MALAYSIAN PRIVATE HOSPITALS

Nurul Zalifah Zakaria[1], Suriati Ahmad[2*], Atikah Fukaihah Amir[3]

[1]*Department of Built Environment Studies and Technology,*
College of Built Environment,
UNIVERSITI TEKNOLOGI MARA PERAK BRANCH, MALAYSIA
[2,3]*Department of Built Environment Studies and Technology,*
College of Built Environment,
UNIVERSITI TEKNOLOGI MARA PERAK BRANCH, MALAYSIA

Abstract

Hospitals are the central place to get treatment, especially during the COVID-19 pandemic that badly hit the world. Significantly, hospitals need a healing environment promoting health and well-being. One initiative is integrating biophilic design as done by international hospital building design to maximise the human-nature relationship in a hospital environment. Hence, the positive impacts of green hospitals enable biophilic design to be applied in Malaysia. Therefore, this study aims to identify the successful implementation of biophilic design for space planning in Malaysian green hospitals. A questionnaire survey method with two hundred respondents was conducted, and the questionnaire survey data were analysed using Statistical Package for Social Science (SPSS). From the analysis of the end-user responses, ten biophilic design elements have been discovered to help improve the health and well-being of the hospital end users, including patients, staff and visitors. These research findings further demonstrate the potential of biophilic design to be implemented in Malaysian private hospital designs to enhance the healing environment supporting the medical health care system.

Keywords: biophilic design, private hospital, healing environment, Malaysia

[2] Senior Lecturer at Universiti Teknologi MARA Perak Branch. *Email: suria564@uitm.edu.my

INTRODUCTION

Biophilic design is a concept established by Edward O. Wilson in 1984 that comes from the term biophilia, which refers to the relationship with nature. He emphasised the concept of people and nature relationships through his Biophilia book (Krcmova, 2009). His encouragement to connect with nature and green elements has guided a better building design. Nowadays, many green buildings with biophilic designs have been developed by designers to connect humans with nature even though the country is progressing and technology is becoming more sophisticated (Mohd Ariffin & Gad, 2017; Shamri et al., 2022).

Based on the study by White et. Al (2019) states that people must spend at least 120 minutes interacting with nature weekly. Human connection with nature is essential to increase health and well-being. By integrating biophilic design into building design, people could have positive impacts even on the building. Biophilic design helps lower blood pressure, reduce stress, increase the feeling of tranquillity and much more (Browning et al.,2014). Applying biophilic design to hospital building design could enhance the healing environment. It should be utilised within the hospital building's internal compound and spaces. Research by Ulrich in 1980 has proven that the hospital building with natural design speeds up patients' recovery and healing process (El Messeidy, 2019). It is essential to design a hospital with a biophilic design for occupants to connect with nature.

PROBLEM STATEMENT

As Malaysia is developing, the use of modern technology and machines in the construction of hospital buildings has grown. Designing hospitals without considering human nature's relationship has taken away the healing benefits of human health care (Lydia, 2019). Khoo Teck Puat Hospital in Singapore (Cheok & Chan, 2017) and Ostra Hospital in Sweden (El-Messeidy, 2019) are successful green hospitals that have implemented biophilic design concepts to increase human-nature connection. The biophilic buildings in Malaysia can only be found covering the shophouse (Bahauddin et al., 2019&2021) and office building design (Ibrahim et al., 2021) (Hui & Bahauddin, 2019). Since no biophilic hospital has been built in Malaysia, this study places a notable gap in both knowledge and practice to fill up the lack of study on the biophilic design implementation in Malaysian hospitals.

Malaysia and 192 other countries are working towards achieving the 2030 Agenda for Sustainable Development. The 2030 Agenda consists of more than 200 indicators, 17 Goals and 169 Targets to benefit the environment and humankind. Goal 3 of the SDGs emphasizes ensuring people's healthy lives and well-being at all ages. Besides that, SDGs Goal 11 focuses on developing sustainable cities and communities. In line with the national agenda such as the

2030 Agenda, Shared Prosperity Vision 2030 and Twelfth Malaysia Plan, this highlights the significance of improving the current hospital design to create a prosperous, inclusive and sustainable Malaysia. In addition, the condition of the hospital, which has become the focus since the COVID-19 pandemic hit, has caused the hospital's healing environment to be improved. Quarantine patients in hospitals and workers working overtime caused a lack of interaction with nature. This affected hospital occupants' mental and physical health (Muller et al., 2020). Therefore, a study on a biophilic design approach to enhance the hospital healing environment is needed, thus enhancing the significance of this research.

LITERATURE REVIEW

Biophilia to Biophilic Design

Biophilic design comes from the term biophilia. Biophilia has different meanings according to the views of researchers and their field of study. The *Dictionary of Environment and Ecology Fifth Edition* in 2004 defines the meaning through two words, bio and philia. Bio means living organism, and philia means attraction to something. The term biophilia was also popularized by a psychoanalyst named Erich Fromm in his book *The Anatomy of Human Destructiveness* in 1973 (Moghaddami, 2019). He introduces the concept of biophilia while elaborating on the differences between nature and 11 human beings. Biophilia means the innate feeling of human beings connecting with nature (Sayuti, 2016).

Besides that, Edward O. Wilson describes biophilia as a natural tendency to concentrate on life and life processes (Krcmarova, 2009). Biophilia has a physiological relationship with nature and contains the genetic basis of its meaning. He established and popularised a hypothesis about biophilia in 1984 through his book *Biophilia*. The hypothesis is about the concept of humans' relationship with nature and some biotic forms.

The word biophilia inspired the existence of biophilic design, a concept of integrating nature and the built environment. In the 21st century, the concept of biophilic design began to enter the field of architecture and building development (Zhong et al., 2021). In a book titled *Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life*, Kellert et al. (2011) elaborated on the positive impacts of natural systems, processes and constructed landscapes built in the buildings remain essential to human health, well-being and performance.

Healing Environment

Healing is an overall process of recovering mind, body and spirit, resulting in a beneficial change and movement towards self-realization no matter the absence or presence of disease (Dubose et al., 2016). In the meantime, a *healing environment* can be defined as physical and nonphysical environments intended

to aid recovery. As opposed to cure, which is linked to health conditions, healing seems more closely related to spirituality and mental state. A concept used to describe medical facilities is the environment of healing. An excellent healing environment in which it helps in balancing between artificial consumption and nature design (Kamali & Abbas, 2012). In order to achieve the optimum healing environment, four categories must be addressed: internal, interpersonal, behavioural and external, as shown in Figure 1 below.

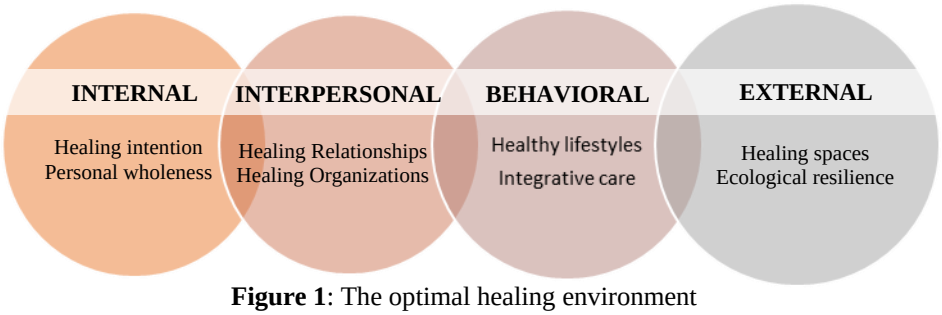

Figure 1: The optimal healing environment
Source: Reproduce illustration from Sakallaris et al., 2015

Being surrounded by those four categories in a hospital environment could improve healing and patient health. A healing environment should be comfortable, promote human health, and provide a sense of tranquillity for its occupants. The suitable architectural layout of a therapeutic setting would indirectly influence the outcomes for the occupants, including shorter hospital stays, happier patients and much more (Huisman et al., 2012). Hospitals must be designed well since the healing environment affects people's health.

Biophilic Design Advantages Towards Human Health and Wellbeing

Compared to its financial advantages and contribution to the structure, the biophilic design undoubtedly has numerous favourable effects on people's psychological, spiritual, mental, and bodily moods. Among them are stress reduction, quicker recovery, focus recovery, enhanced wellbeing, and declining crime rates (Moghaddami, 2019). According to Salingaros (2015), in order to have a positive influence on human health, biophilic design, also referred to as a bottom-up approach, is required. An experiment conducted at the hospitals by Salingaros and Mehaffy (2015) provides proof of this. According to the trial, patient rooms with windows overlooking greenery may improve the healing environment and lessen patient discomfort. This is beneficial and advised for those using pain medication. Humans who spend most of their lives in developed environments can benefit mentally and physically from sensory interaction with nature (Aduwo et al., 2021). Numerous studies from various organizations

depicted how biophilic design affects healing. In addition to architecture, scientifically verified disciplines like neurology and endocrinology have responded to the link between biophilic design and healing, health, and wellbeing. The benefits of biophilic design patterns to stress cognitive performance, emotion, mood, and preferences are illustrated in Table 1.

Table 1: The Advantages of Biophilic Design

NO	BIOPHILIC DESIGN PATTERNS		STRESS REDUCTION	COGNITIVE PERFORMANCE	EMOTION, MOOD AND PREFERENCES
1	Nature in the space	Visual connection with nature	Lowered blood pressure and heart rate	Improved mental engagement/ attentiveness	Positively impact attitude and overall happiness
2		Non-visual connection with nature	Reduced systolic, blood pressure and stress hormone	Positively impact cognitive performance	Perceived improvements in mental health and tranquillity
3		Non-rhythmic sensory stimuli	Positively impact heart race, systolic, blood pressure and sympathetic nervous system activity	Observed and quantified behavioural measures of attention and exploration	
4		Thermal and airflow variability	Positively impacted comfort, well-being and productivity	Positively impacted concentration,	Improved perception of temporal and spatial pleasure
5		Presence of water	Reduced stress, increased feelings of tranquillity, lower heart rate and blood pressure	Improved concentration and memory restoration, Enhanced perception and phycological responsiveness	Observed preferences and positive emotional responses
6		Dynamic and diffuse light	Positively impacted circadian system functioning, Increased visual comfort		
7		Connection with natural system			Enhanced positive health responses, Shifted perception of environment
8	Natural analogues	Biomorphic forms and patterns			Observed view preference
9		Material connection with nature		Decreased diastolic blood pressure, Improved creative performance	Improved comfort
10		Complexity and order	Positively impacted perceptual and		Observed view preference

NO	BIOPHILIC DESIGN PATTERNS		STRESS REDUCTION	COGNITIVE PERFORMANCE	EMOTION, MOOD AND PREFERENCES
			physiological stress responses		
11	Nature of the space	Prospect	Reduced stress	Reduced boredom, irritation and fatigue	Improved comfort and perceived safety
12		Refuge		Improved concentration, attention and perception of study	
13		Mystery			Induced strong pleasure response
14		Risk/peril			Resulted in strong dopamine or pleasure responses

Source: Reproduce table from Browning et al, 2014.

METHODOLOGY

This study used a quantitative data collection method. A questionnaire survey using a random sampling method was conducted for data collection. Guided by a literature review, two hundred respondents were involved in this study. These respondents were staff, outpatients, and visitors visiting the hospital. Due to limited inpatient access and strict ward access granted by the hospital administration, the sample only focused on the outpatients in the general hospital areas, including the clinic, pharmacy area, cafeteria and hospital lobby. Significantly, there are six green hospitals in Malaysia. Among the six hospitals, the Pantai Hospital Laguna Merbok was selected as the case study for this research.

To fulfil the study, reliable information about how hospital users perceive the application of biophilic design and how they interact with natural elements within the hospital was acquired. The data collection included two ways of reaching out to hospital end users. A direct approach to scanning for QR codes and posters was used to gain attention from all hospital end users. The data collection included two ways of reaching out to hospital end users. This includes a direct approach to the end users for QR code scanning and through survey posters placed at several strategic and allowable areas within the Pantai Hospital Laguna Merbok (see Figure 2). In particular, this research has undergone the UiTM Research Ethics Committee approval and further getting consent from the hospital administration before proceeding with the questionnaire survey.

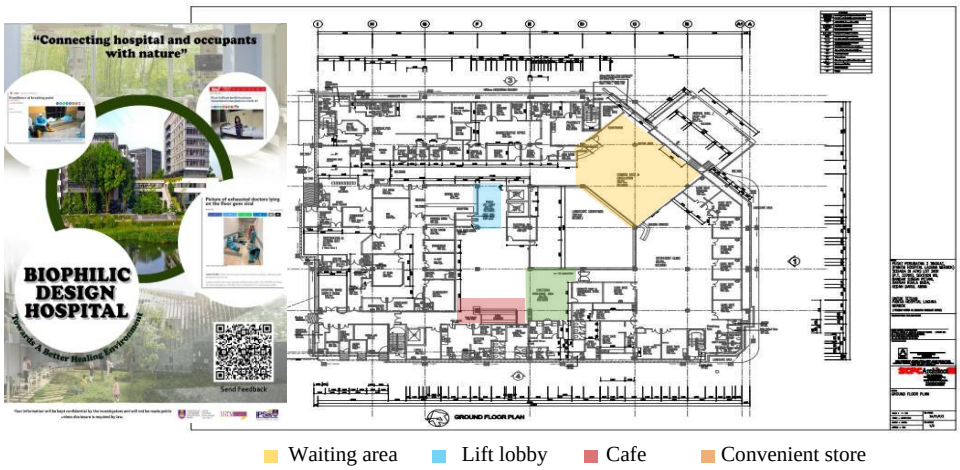

Figure 2: Location of Poster Inside the Hospital
Source: Architect of Pantai Hospital Laguna Merbok

RESULTS AND DISCUSSION

The questionnaire survey was analysed using Statistical Package for Social Science (SPSS). The data analysed from SPSS were referred to the Percentage of Consensus of Agreement analysis. It is to identify the successful implementation of biophilic design elements for space planning. The percentage value that considered as consensus through the Percentage of Consensus of Agreement (PoCoA) had been reached was set at either 66.7%, 75%, 80% or 100% (Ayob et al., 2022). Therefore, the Percentage of Consensus of Agreement (PoCoA) determines the Cut-off Point Percentage for the questionnaire survey data. The cut-off point percentage used and applicable to this study is 75%. Table 2 below shows the respondents' selection criteria for biophilic design for private Malaysian hospitals. Overall, this questionnaire survey obtained positive feedback from the respondents.

Table 2: The Respondent Selection Criteria for Biophilic Design for Malaysian Private Hospital

	Strongly Disagree	Disagree	Neither Disagree or Agree	Agree	Strongly Agree
Current design is good for healing	Not available	4%	19.5%	51%	25.5%
Application of natural elements	Not available	Not available	1%	12.5%	86.5%
Prospects	Not available	Not available	Not available	3%	**97%**

	Strongly Disagree	Disagree	Neither Disagree or Agree	Agree	Strongly Agree
Refuge	Not available	Not available	Not available	3.5%	**96.5%**
Complexity and order design	Not available	Not available	Not available	4.5%	**95.5%**
Shape and form that suitable for the healing environment	Not available	Not available	5%	6.5%	**93%**
Natural colours	Not available	Not available	Not available	13.5%	**86.5%**
Plants or landscape design	Not available	Not available	1%	15.5%	**83.5%**
Cultural and ecological	Not available	Not available	3.5%	14.5%	**82%**
Natural light	Not available	Not available	6%	15%	**79%**
Image of nature	Not available	1.5%	5%	15%	**78.5%**
Water features	2.5%	2%	6%	13.5%	**76%**
Natural materials	Not available	1%	13%	47.5%	16%
Pets	6%	8.5%	45%	11%	29.5%

Source: Author

Most of the respondents in this questionnaire survey are females between eighteen and thirty years old. The observations made while collecting data show that the eighteen- to thirty-year-old group is more proficient in using gadgets and QR scan code applications. Most older people do not have a QR code scanning application and lack the experience to answer forms online. Table 2 shows the respondent selection criteria for biophilic design in Pantai Hospital Laguna Merbok. There are ten biophilic design elements that most respondents strongly agree to be applied to hospital design, which includes prospects, refuge, complexity and order design, shape and form that are suitable for the healing environment, natural colours, plants or landscape design, cultural and ecological, natural lighting, image of nature and water features element. The ranking of elements indicates the contribution to the successful implementation of biophilic design. The main elements that help hospital users heal are prospects. This means that the design of the hospital has a long-term benefit. It is essential to insert this biophilic design element into hospital design to enhance the healing environment. The element that least assists in healing is incorporating the pet's area. As depicted in Table 2, most respondents neither agree nor disagree with having pets in the hospital building area. This is because the application of this element was

never found in any hospital design. However, some prefer it to be applied, considering that interaction with animals has many positive effects. Implementation of this element in hospital design is not crucial in designing a hospital. Significantly the hospital occupants generally strongly agree if the hospital building design applies biophilic design elements.

All biophilic design elements with a percentage higher than 75% in this questionnaire survey are the successful implementation of the biophilic design elements in the hospital. The respondents also suggested some improvements for future hospital design that highlight space planning, outdoor plants and the hospital's colours. It indicates that these top three elements play an essential role in healing. Besides that, there are also suggestions to improve the hospitals' water features elements, universal design, maintenance, sound elements, view and much more. The minor elements demanded by hospital users to be improved in future hospital designs are linked to materials and the aromatic smell inside the building.

CONCLUSION AND RECOMMENDATION

Biophilic design is a concept that can be enhanced and utilized in Malaysian hospital building design. It is a concept that has been introduced previously in hospital design abroad, and it can gain recognition in Malaysia. This study's findings discovered that ten biophilic design elements are suitable for integration into private hospitals in Malaysia based on the hospital end users' response. The biophilic design elements with 75% and above responses are successfully implemented and could be utilized by designers to build a biophilic hospital in the future. The biophilic design elements are prospects, refuge, complexity and order design, shape and form suitable for a healing environment, natural colours, plants or landscape design, cultural and ecological, natural light, the image of nature and water features. The elements, natural materials, and pets scored less than 75%, indicating their low capability to promote health and well-being and enhance the healing environment. Nevertheless, hospital users will need the benefits of biophilic design and elements that enhance the healing environment within the Malaysian private hospital design. Biophilic design has proven to improve the healing environment in hospitals and has many positive impacts on hospital users’ health and well-being.

ACKNOWLEDGEMENT

The authors would like to express gratitude for the cooperation from the respondents, the hospital and those involved in data collection and contribution in completing this research paper.

REFERENCES

Aduwo, E. B., Akinwole, O. O., & Okpanachi, P. O. (2021). Assessing Workers' Productivity Through Biophilic Design as a Measure of Sustainability in Selected Office Buildings in Lagos State, Nigeria. *IOP Conference Series: Earth and Environmental Science*, 665(1).

Ayob, Z. (2020). Linking Green Urbanism with Walkability: The City of Alor Setar, Malaysia. (Unpublished doctoral dissertation). University of Nottingham, Nottingham, United Kingdom.

Bahauddin, A., Ong, J. and Prihatmanti, R. (2019) The Biomorphic and Biophilic Design Approaches in Rebuilding Place of Heritage Shophouses. *The European Proceedings of Multidisciplinary Sciences EpMS*, 280-290.

Bahauddin, A., Prihantmanti, R., and Ong, J. (2021) Biophilic Design Patterns and Local Knowledge of Plants Application in Baba-Nyonya Heritage Shophouses' Courtyard. *ARTEKS: Jurnal Teknik Arsitektur, 6*(2):305–314.

Browning, W., Ryan, C., and Clancy, J. (2014) 14 Patterns of Biophilic Design: Improving Health & Well-being in the Built Environment. New York. Terrapin Bright Green LLC, 61 pp.

Cheok, C., and Chan, K. L. (2017) Khoo Teck Puat Hospital. *In Mental Health of A Nation*, 114–119.

Dubose, J., MacAllister, L., Hadi, K., & Sakallaris, B. (2016). Exploring the Concept of Healing Spaces. In *Health Environments Research and Design Journal* (Vol. 11, Issue 1, pp. 1–14).

El Messeidy, R. (2019) Application of Biophilic Patterns in Health Care Environments to Enhance Healing. *Engineering Research Journal 163*, 87-99.

Hui, J. O. M., and Bahauddin, A. (2019). Biophilic Design in Heritage Indoor Co-Working Space in George Town, Penang, Malaysia. *Malaysian Journal of Sustainable Environment, 6*(2):642–650.

Huisman, E. R. C. M., Morales, E., Hoof, J. V. & Kort, H. S. M. (2012) Healing environment: A review of the impact of physical environmental factors on users. *Building and Environment*. 70-80.

Ibrahim, I., Khairuddin, R., Abdullah, A., Amin, I. M., and Wahid, J. (2021). Analysis of Biophilic Design in Communal Space of an Office Building. Case study: Pertubuhan Arkitek Malaysia (PAM) Centre. *Proceedings of 8th International Conference on Advanced Materials Engineering & Technology* (ICAMET 2020), 1-8.

Kamali, N. J. & Abbas, M. Y. (2012). Healing Environment: Enhancing Nurses' Performance through Proper Lighting Design. *Procedia - Social and Behavioral Sciences, 35*, 205–212.

Kellert, S. R. Heerwagen, J. and Mador, M. (2011). Dimensions, Elements, and Attributes of Biophilic Design. Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life. John Wiley & Sons Inc, 19 pp.

Krcmarova, J. (2009) Wilson's Concept of Biophilia and The Environmental Movement in the USA. *Internet Journal of Historical Geography and Environmental History*, *6*(1-2):4-17.

Lydia, S. (2019) *Biophilic Interior Design Concept for Outpatient Clinic for Hospital Kuala Lumpur*. Universiti Teknologi MARA. 14 pp.

Moghaddami, H. J. (2019). *Re-Thinking Biophilic Design Patterns in Preschool Environments for Children.* Master Thesis, The Graduate School of Natural and Applied Sciences of Middle East Technical University, 138 pp.

Mohd Ariffin, N. A. & Gad, S. F. (2017). Content Analysis of the Existence of Biomimicry Life's Principles in Green Building Index Malaysia. *Journal of the Malaysian Institute of Planners*, 15(1): 179-190

Muller, A. E., Hafstad, E. V., Himmels, J. P. W., Smedslund, G., Flottorp, S., Stensland, S., Stroobants, S., Van de Velde, S., and Vist, G. E. (2020). The Mental Health Impact of The Covid-19 Pandemic on Healthcare Workers, and Interventions to Help Them: A Rapid Systematic Review. *In Psychiatry Research* 293, 1-11.

Sakallaris, B. R., Voss, M. & Smith, K., Jonas, W. B. (2015). Optimal Healing Environments. *Global Adv Health Med. 4*(3). 40-45.

Salingaros, N. A. (2015). Biophilia and Healing Environments: Healthy Principles for Designing the Built World. Terrapin Bright Green, LLC, 1–44.

Salingaros, N. A. & Mehaffy, M. W. (2015) Design for a living planet: Settlement, science and the human future. Portland: Sustasis Press.

Sayuti, N. A. A. (2016) *Biophilic Design? A Study of Emotions, Influences, and Perceptions of Furniture Design Incorporating Living Organisms*. Ph.D. Thesis, University of Canberra. 107 pp.

Shamri, S. L., Husini, E. M., Arabi, F., Abdul Manaf, A., Mat Idris, M., & Jamaludin, J. (2022). Strategies in Improving the Building Efficiency and Daylight: A Case Study of Green Building. *Journal of the Malaysian Institute of Planners*, 20(2): 99-109

Ulrich, R. S. (1993). Biophilia, Biophobia, and Natural Landscapes. The Biophilia Hypothesis. America: Island Press, 483 pp.

White, M. P., Alcock, I., Grellier, J., Wheeler, B. W., Hartig, T., Warber, S. L., Bone, A., Depledge, M. H., and Fleming, L. E. (2019). Spending At Least 120 Minutes A Week in Nature is Associated with Good Health and Wellbeing. *Scientific Reports*, *9*(1):1–11.

Wilson, E. O. (1984). Biophilia, The Human Bond with Other Species. America: Harvard University Press, 158 pp.

Zhong, W., Schröder, T., & Bekkering, J. (2021). Biophilic Design in Architecture and Its Contributions to Health, Well-Being, and Sustainability: A Critical Review. *Frontiers of Architectural Research*, *11*(1):1-28.

Received: 17th April 2024. Accepted: 2nd September 2024