

Biophilic Design in Healthcare

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Abstract—In recent years, biophilic design has become an important focus in healthcare design because of its potential to enhance well-being by bringing elements of nature into the built environment. By incorporating features like natural light, greenery, and organic materials, healthcare spaces can become more calming and supportive for patients, families, and staff. This paper explores how biophilic design improves recovery rates, reduces stress, and boosts satisfaction. By reviewing key studies and practical applications, the research highlights the growing importance of biophilic design in creating healing environments.

Index Terms—Biophilic design, healthcare, nature in architecture, patient well-being, stress reduction.

I. INTRODUCTION

Healthcare spaces are often designed with functionality as the main priority, but this can sometimes lead to environments that feel cold and clinical. While this approach ensures efficiency, it can also increase stress for patients, families, and even staff. In contrast, biophilic design aims to create spaces that feel more natural and welcoming, which can promote both physical healing and mental well-being.

Biophilic design is about reconnecting people with nature through architecture. This can mean something as simple as adding a window with a view of trees or as complex as designing entire indoor gardens. The idea is backed by research showing that exposure to natural elements helps people recover faster, feel less stressed, and perform better in their work.

This paper focuses on how biophilic design can be applied in healthcare settings, exploring its effects on patients and staff and highlighting the key elements that make this approach so effective.

II. LITERATURE STUDY

Biophilic design has gained attention in healthcare architecture for its ability to create healing environments that integrate nature with human spaces. Its foundations are built on the understanding that human beings have an innate connection to the

natural world, a concept known as "biophilia." This approach transforms healthcare facilities from cold, sterile places into environments that reduce stress and support recovery. The following review explores the findings of several studies that emphasize the impact of biophilic design on patients, staff, and visitors in healthcare settings.

A. Role of Natural Elements in Recovery

One of the landmark studies on biophilic design in healthcare was conducted by (Ulrich, 1984). This research compared the recovery outcomes of patients who had access to natural views versus those who faced brick walls. The findings revealed that patients with views of greenery had shorter hospital stays, used fewer pain medications, and reported lower levels of stress. This study provided early evidence that natural elements can have a direct and measurable impact on patient recovery.

In addition, a study by Harris (2000) found that hospital rooms with access to natural light improved patients' moods and reduced feelings of isolation. Natural light was shown to regulate circadian rhythms, leading to better sleep patterns and faster recovery. These results emphasize the importance of daylight in healthcare settings, not just as an energy-saving feature but as a therapeutic tool.

B. The Role of Nature in Healing

(Kellert, 2015) identified several biophilic design patterns that are particularly relevant to healthcare settings. These patterns include:

1. Visual Connections to Nature: Large windows, skylights, or open courtyards that provide views of greenery or water.
2. Natural Light: Designing spaces to maximize sunlight exposure.
3. Natural Materials and Textures: Using wood, stone, or other organic materials to create a sense of warmth and comfort.
4. Living Elements: Incorporating plants, green walls, or indoor gardens to bring nature indoors.

These elements not only make spaces feel more inviting but also have measurable effects on how people feel and recover. For example, patients exposed to natural light often sleep better, which is essential for healing. Similarly, greenery can create a sense of calm and reduce feelings of anxiety.

C. Psychological Benefits of Biophilic Design

(Verderber, 2016) explored how exposure to nature influences the psychological well-being of patients. They discovered that views of gardens, water features, or even images of natural landscapes helped patients feel calmer and more at ease during stressful hospital experiences. This aligns with findings by Kaplan and Kaplan (1989), who introduced the concept of "restorative environments," explaining that nature reduces mental fatigue and promotes a sense of peace.

Another key study by Salonen et al. (2013) investigated the emotional impact of biophilic features such as healing gardens, green walls, and water elements. Patients reported lower levels of anxiety and depression when they had access to these elements during their stay. The study concluded that biophilic design is not only beneficial for physical recovery but also for emotional health, making it a holistic approach to patient care.

D. Enhancing Staff Well-Being

Healthcare workers often face high stress levels due to demanding schedules and emotionally taxing work. (Newman, 2015) studied the impact of biophilic design on healthcare staff and found that natural elements in the workplace improved mood, reduced burnout, and enhanced job satisfaction. The presence of greenery in staff lounges, for example, created a calming environment that allowed workers to recharge during breaks.

Similarly, Pati et al. (2008) highlighted how access to daylight improved healthcare workers' productivity and focus. Their study found that well-lit workspaces reduced fatigue and increased accuracy in tasks such as administering medication. These findings underscore the importance of designing healthcare spaces that support not only patients but also the people who care for them.

E. Real-World Applications

Numerous healthcare facilities around the world have successfully implemented biophilic principles. One prominent example is Khoo Teck Puat Hospital in

Singapore, which integrates natural ventilation, extensive greenery, and water features throughout its design. The hospital is often referred to as a "hospital in a garden" because of its lush landscaping and open spaces. Studies conducted at the hospital show that patients experience faster recovery, staff feel less stressed, and overall satisfaction levels are higher.

Another notable example is Maggie's Centres in the UK. These cancer care centers are designed with biophilic principles, prioritizing natural light, organic materials, and access to gardens.

III. CASE STUDY

A. Khoo Teck Puat Hospital

Khoo Teck Puat Hospital (KTPH), located in Yishun, Singapore, is a shining example of how biophilic design can transform a healthcare facility into a healing environment. Opened in 2010, KTPH was designed with the goal of integrating nature into every aspect of the hospital's structure and operation. Often referred to as a "hospital in a garden," KTPH provides a welcoming and calming environment for patients, staff, and visitors while promoting sustainability and efficiency.



Figure 1: KTPH

Source: *When Asked To Build A Hospital That Lowers Blood Pressure They Built This*

Design Philosophy

KTPH's design is rooted in the belief that exposure to nature can improve physical and mental well-being. The hospital was deliberately designed to feel more like a garden or park rather than a traditional clinical space. Architects incorporated greenery, natural light, and open spaces into the design to create an environment that reduces stress and supports healing.

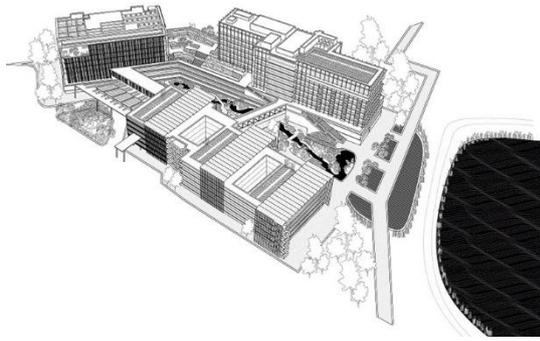


Figure 2: The winning concept sketch of Khoo Teck Puat Hospital by CPG Consultants

Source: Singapore's Khoo Teck Puat Hospital: Biophilic Design in Action | Human Spaces

B. Natural Features and Healing Environments

The hospital uses various biophilic elements to create a healing environment. These include:

- **Extensive Greenery:** Lush gardens, vertical green walls, and rooftop gardens are present throughout the hospital. These features provide visual comfort and improve air quality, making the environment more relaxing and therapeutic.
- **Natural Light:** Large windows and skylights ensure that most indoor areas are bathed in natural light, which has been shown to improve mood and regulate sleep cycles for patients and staff alike.
- **Water Features:** The proximity to Yishun Pond allows for the soothing presence of water. Patients in rooms with views of the pond often report feeling calmer and more at peace.
- **Therapeutic Gardens:** The hospital grounds include small, quiet gardens where patients and visitors can sit, walk, or engage in light activities. These spaces are designed to reduce anxiety and encourage mindfulness.

C. Impact on Patients

KTPH has proven that its design benefits patients both physically and emotionally. Rooms with views of greenery or the pond contribute to a more calming atmosphere, which has been linked to shorter hospital stays and reduced reliance on pain medication. Patients in this environment also report feeling less isolated, as the open design encourages them to engage with their surroundings.

For outpatient services, waiting areas are located near gardens or open courtyards, reducing the tension and unease that patients often feel before appointments.

These features also make the hospital feel less clinical and more like a community space.

D. Benefits for Staff and Visitors

The hospital's biophilic design also extends its benefits to healthcare staff. Workspaces are designed to maximize access to daylight and provide views of greenery, which helps reduce stress and burnout. Staff lounges are located near gardens or courtyards, giving healthcare workers a chance to recharge during demanding shifts.

Visitors also benefit from the calming environment. The hospital includes shaded walkways, open-air seating areas, and quiet gardens where families can relax. These features help reduce the emotional strain of visiting loved ones in the hospital and create a more supportive atmosphere for everyone involved.



Figure 3: Hospital Farm (Are sold to cover costs)

Source: Singapore's Khoo Teck Puat Hospital: Biophilic Design in Action | Human Spaces

C. Sustainability and Community Engagement

KTPH is not just a healthcare facility but also a model for sustainable design. The hospital incorporates energy-efficient systems, such as natural ventilation and rainwater harvesting, to minimize its environmental footprint. Solar panels are used to generate clean energy, and the landscaping is designed to support biodiversity by attracting birds, butterflies, and other wildlife.

The integration with Yishun Pond goes beyond aestheticism also serves a practical purpose by helping manage stormwater and preventing flooding in the surrounding areas. The hospital frequently collaborates with the local community, organizing educational activities and promoting wellness programs that make use of its natural spaces.

C. Outcomes and Recognition

Since its opening, Khoo Teck Puat Hospital has received widespread acclaim for its innovative approach to healthcare design. Patients, staff, and visitors consistently express high levels of satisfaction with the environment. Studies have found that the biophilic elements of KTPH contribute to faster recovery times, improved mental health, and better overall experiences for everyone using the facility.

The hospital has also received numerous awards for its sustainable design, including recognition from the Building and Construction Authority (BCA) of Singapore. It serves as a benchmark for how future healthcare facilities can integrate nature, sustainability, and human-centered design.



Figure 4- Khoo Teck Puat Hospital
Source-<https://www.therapygowhere.com/ad/khoo-teck-puat-hospital-ktp/>

IV. CONCLUSION

Biophilic design is transforming the way healthcare facilities are built and experienced. By integrating natural elements into these spaces, hospitals can become places of healing not just for the body but for the mind as well. Patients recover faster, families feel more at ease, and staff can do their jobs more effectively.

As the demand for patient-centered care continues to grow, biophilic design offers a way to create healthcare environments that are not only functional but also truly supportive. This approach is not just a trend—it's a step toward building a healthcare system that cares for the whole person.

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