INTERNATIONAL MULTIDISCIPLINARY JOURNAL OF RESEARCH FOR INNOVATION, SUSTAINABILITY AND EXCELLENCE (IMJRISE)
Online ISSN: 3028-032X | Print ISSN: 3028-0370
PUBLISHED BY: RISEJOURNALS.ORG
Volume 1, Issue no. 11 | **307**

Integrating Healing Architecture as Design Approach for Pulmonary Hospital in Bacolod City

DOI: 10.5281/zenodo.14189260

Aied John Sobretodo
Draftsman, Province of Negros Occidental Engineering Office
https://orcid.org/0009-0000-8368-4564| aidjohnsobretodo1@gmail.com

Rejay Y. Alvarado, LPT, MPM
Head, Research Office, La Consolacion College Bacolod
https://orcid.org/0000-0003-2662-5749 | rejayalvarado@lccbonline.edu.ph

Abstract:

Respiratory health challenges in Bacolod City necessitate specialized healthcare facilities to alleviate patient burdens and reduce overcrowding. This study aims to design a Pulmonary Hospital integrating healing architecture principles to create environments conducive to patient recovery and well-being. A mixed-methods approach was employed, including observations, expert interviews, and site surveys of facilities like the Lung Center of the Philippines. Key healing architecture elements relevant to pulmonary health were identified: natural ventilation to improve air quality, effective sanitation to prevent infections, and incorporation of natural elements to reduce stress and promote healing. Findings show that integrating these elements enhances patient outcomes by reducing recovery times and improving overall well-being. The proposed site offers strengths such as flood resilience, high air quality, and accessibility. Challenges like noise from a nearby road and distance from the city center are addressed with strategies like soundproofing and transportation planning. Recommendations focus on site planning that maximizes natural light and ventilation, efficient space design, calming aesthetics, and sustainable technologies like energy-efficient systems and eco-friendly materials. Design proposals comply with relevant laws and emphasize scalability and sustainability for future growth. This research demonstrates how healing architecture can enhance patient well-being in specialized medical settings. By applying these principles to pulmonary care, the study offers insights for future healthcare facility designs addressing respiratory health challenges.

Keywords: Healing architecture, Pulmonary hospital, Bacolod City, Respiratory health, Sustainable design, Healthcare facility design, Patient-centric design

Introduction:

Hospitals serve as critical institutions providing medical treatment and services to address current health issues, primarily focusing on patient care (Wang and Wang, 2018). Historically, they were modest religious buildings caring for the destitute or homeless, while most medical treatments were provided to the wealthy in their homes (De et al., 2020; Cilliers, 2002). The World Health Organization (2018) refers to hospitals as components in developing healthcare systems, frequently serving as venues where doctors, nurses, and other healthcare professionals establish foundational clinical practices. Furthermore, hospitals significantly influence the relationship between society and health coverage, facilitating the treatment of populations across countries (Bulakh et al., 2021).

Due to increasing demands for specific treatments in various countries, hospitals have undergone significant transformations owing to technological advancements (Dash et al., 2019). Schneider, Miller, and Ohsfeldt (2008) noted that specialized hospitals are stand-alone facilities dealing with patients who have particular medical problems or require specific medical or surgical operations. The architecture of specialized hospital design must carefully reflect specific medical and procedural models along with patient needs (Rebel, 2014). Specialized hospitals exhibit architectural adaptations from traditional hospitals to meet the challenges of the rapidly evolving healthcare landscape (Young and Yang, 2007).

Trends in hospital design have historically reflected prevailing ideas toward health and disease, as well as technological and social developments of the time (Kjisik, 2009). Hospital operations changed due to the pandemic and other shifting global conditions, resulting in typological developments in hospital design and new approaches (Perkins and Will, 2021). Some hospitals embraced new technologies and market possibilities while expanding and improving healthcare services (Mokhtar, 2017).

Globally, hospital design interacts with various factors, including culture, activities, existing procedures, and technological advances (Anjali and Rashid, 2007). In the Philippines, practices in establishing hospitals focused on understanding the fundamentals of hospital planning and design, complying with the strict processing requirements of the Department of Health (Prosperidad, 2018). These hospitals provided high-quality services; however, due to

poverty, limited access to healthcare, and budget constraints, they struggled to keep pace with current trends in medical services seen in other countries (Flores, 2022).

Through healing architecture, hospitals began investigating how the built environment contributes to mental ability, well-being, and overall health (Ghazaly et al., 2022). Healing architecture involves designing spaces that rely on intuition to conceptualize advantageous structures for preserving and rehabilitating well-being (Lundin, 2015). The belief is that the planned environment can be more effective than medical therapy in enhancing people's health (Berg and Wagenaar, 2006). Healing architecture aims at emerging opportunities that understand the relevance of the physical environment in healthcare outcomes (Lundin, 2015). Several healthcare organizations have recognized the potential of healing architecture in guiding patients toward stress reduction and therapy (Ghazaly et al., 2022).

The use of nature in hospitals traces back to the Asclepieia of ancient Greece. Studies have shown that interaction with nature helps reduce anxiety, blood pressure, and pain (Ulrich, 1992). Incorporating nature in hospitals involves designing facilities that integrate emerging concepts through sustainability and ergonomic approaches, striving to fully integrate the natural environment into human comfort to heal and establish healthy communities at both architectural and urban levels (Ghazaly et al., 2022; Hedge, 2016). As guiding principles in design, architects and hospital experts utilize knowledge of the health effects of various physical qualities of built environments on patients, staff, and visitors (Berg and Wagenaar, 2006).

Respiratory diseases have been a top priority in the Philippines for years, as they are among the leading causes of morbidity and mortality (Aumentado, 2020). In response to respiratory diseases such as COVID-19, pneumonia, and other lung-related problems, the city government of Bacolod launched the Bacolod Respiratory Outpatient (BRO) Facility to serve as a consultation center for mild respiratory infections (Guadalquiver, 2020). However, this facility could not fully accommodate the needs and demands for treating lung-related diseases since it was only a temporary setup in the Bay Center (Sorongon, 2022). During the third quarter of 2022, hospitals in Bacolod reached their peak capacities and were unable to fully accommodate patients with lung-related diseases due to limitations in bed capacities (Diaz, 2021).

This study was motivated by a desire to explore how architecture could be utilized to produce healing spaces in healthcare settings. It was also inspired by the need for healing architecture focused on pulmonary care demands, serving as an opportunity to operate healthcare facilities specializing in patients' respiratory needs. Bacolod City hospitals had various design approaches, but no significant studies had shown the application of healing architecture. It was necessary to establish a pulmonary hospital, particularly in the Western Visayas region, to cater to lung-related diseases outside the Lung Center of the Philippines. This would lessen the burden of transportation, expenses, and accommodation for residents of the Western Visayas seeking medical treatment for pulmonary-related diseases.

Patients from the Visayas and Mindanao would benefit from the construction of these medical facilities since they would not incur additional expenses while seeking treatment at the Lung Center of the Philippines in Quezon City (Aumentado, 2020). Given that respiratory complications remained among the significant causes of mortality among Filipinos (Lacson, 2020), the provincial administration aimed to continue implementing initiatives aligned with the national government's efforts to offer primary health care to the people. This proposal also provided an excellent facility to Bacolod City as a specialized medical center to accommodate residents of the Western Visayas (Cabral, 2010).

The study aimed to provide an architectural design for the proposed specialized hospital in Bacolod City." The facility's design offered specialized medical services, aiding in addressing the current problems of the Lung Center of the Philippines and minimizing mortality issues in pulmonary-related cases in the city and surrounding areas while meeting legal and architectural requirements. Specifically, the study sought to identify the healing architecture elements needed for the design of a pulmonary hospital and to establish the connection between pulmonary health and healing architecture. It also aimed to identify and integrate healing principles and their application to a specialized pulmonary hospital in the areas of site planning, building function and space planning, building aesthetics, and building technology and materials.

The study was anchored on the concepts of healing architecture as the primary framework and supplemented with sustainable architecture and ergonomics, as discussed in the studies of Ghazaly et al. (2022), Aydın et al. (2017), and Lu and Hignett (2006). The concept of healing architecture implies a vision of a continuous process in forming a better, healthier, and cognitively acceptable workplace. Lawson (2010) discussed that healing architecture is considered a "smart investment" because it saves money, increases staff efficiency, and reduces patients' hospital stays by making the stay less stressful, as cited in the works of Ulrich (1992). Throughout architectural history, architects and artists have used various approaches to promote healing through buildings (Lawson, 2010). The idea is that the physical healthcare environment might impact how quickly patients recover or adapt to various chronic and acute illnesses (Akuneho and Napoleon, 2021).

Healing architecture can be anchored on sustainability by adopting sustainable development approaches in medical buildings across various countries (Bulakh and Merylova, 2020). Sustainability is the outcome of human actions (Mahdiraji et al., 2018). The concept is linked with "sustainable architecture," whose most important purpose for sustainable development is to improve sustainability in healthcare facilities. Hospital design should incorporate providing a supportive atmosphere (Aripin, 2007). In 2017, healing architecture introduced a new approach to sustainable designs; buildings' relationships with the environment can vary depending on their purposes (Aydın et al., 2017). The healthcare sustainability movement was known for its approach as the "Green Hospital." Green hospitals are intended to provide benefits beyond environmental advantages. In response to these sustainable design approaches, hospitals should strive to preserve the environment and apply sustainability concepts. The healing hospital principle is defined as "patient-centric" rather than "care-centric," and green hospitals should focus on creating patient-friendly, non-intimidating hospital facilities (Aydın et al., 2017).

The design of contemporary hospitals comprises the physical structure and the implementation of current working systems, covering organization, technology, workplace, and productive environments (Andersen et al., 2021). Ergonomics involves the characteristics of work that may alter some considerations of everyone's job to improve productivity (Miruthu and Suresh, 2018). Many studies on hospital ergonomics have been conducted to determine human factors impacting healthcare workers. These studies describe workplace situations, surroundings, and operations that may contribute to strategies aimed at reducing potential dangers and enhancing working conditions (Bonnie et al., 2013). Incorporating ergonomics in the workplace provides long-term advantages and positive experiences for individuals and practices (Miruthu and Suresh, 2018). Although it has long been recognized that ergonomics and human factors can benefit architectural design, healthcare facilities—as dynamic systems with multiple users of equipment, products, and treatment care environments—are often utilized without planning for the users who will perform activities within them, resulting in disorganized workplaces (Villeneuve, 2004).

The study addressed the impact, relevance, and expected outcomes of the proposed specialized hospital in Bacolod City serving as a basis for beneficiaries upon the success and completion of the proposed structure. The resulting design rationale was expected to benefit patients by meeting their demands and helping create medical facilities in the city that are easily accessible. Medical practitioners could be encouraged to specialize further in this medical discipline, providing them with work opportunities and an improved environment to practice medicine. Residents of Bacolod could have access to professional medical aid locally, promoting awareness about maintaining a healthy lifestyle and respiratory system. Public officials of the local government could gain insights into the need and importance of medical institutions specializing in respiratory health, providing data and information for future development strategies. The study could also be beneficial to architects, engineers, researchers, and future researchers by providing knowledge and references for designing pulmonary facilities.

The study focused on investigating related theories and factors associated with the healing architecture of hospitals. It aimed to understand the current state of pulmonary health among Filipinos and to ease the burden of patients, especially those traveling and seeking specialized respiratory treatment in the city. The study sought to address the increasing morbidity and mortality rates of respiratory diseases and to reduce the overcrowding problems of the Philippine Lung Center. It was limited to the geographic, socio-cultural, and climatic conditions of Bacolod City in Negros Occidental during 2022–2023. The research did not claim that architectural surroundings and geographic characteristics could cure pulmonary diseases or replace traditional medical practices. Instead, it aimed to demonstrate how building design could contribute to essential human health and well-being and to identify specific architectural design strategies and principles that could be applied.

The study developed a set of architectural principles that integrated healing architecture with supplementary sustainability and ergonomics into the design rationale. The objective was to identify an architectural intervention that could assist patients and enlighten them on sustaining themselves within the community through healing influences.

Methodology:

This study employed a descriptive research approach to explore how healing architecture can be integrated into the design of a pulmonary hospital in Bacolod City. The descriptive approach seeks to explain individuals, activities, or circumstances as they present in nature (Siedlecki, 2020; Akhtar, 2016; Ethridge, 2004; Borg & Gall, 1989). Descriptive research focuses on current challenges or problems using data collection strategies that allow for a thorough explanation of the situation (Fox & Bayat, 2007). The aim was to collect sufficient data and information from related journals and studies about the integration of healing architecture in hospitals to meet the research goals and discover probable solutions leading to the proposed facility.

The study's data sources comprised both primary and secondary data. Primary data referred to information gathered directly from original sources through observation, interviews, and site surveys, serving as genuine and distinct inputs in the study (Kabir, 2016; Wagh, 2022). The primary data aimed to identify specialized

hospitals, medical facilities, and experts on the subject matter, including pulmonologists, medical workers, architects, and other allied professionals. Secondary data served as a foundation for designing primary research and provided a basis for assessing primary data outcomes. These were obtained from previously published books, historical documents, journals, case studies, websites, and related articles (Sindin, 2017; Novak, 1996). Secondary data were collected from articles on healing architecture, case studies, and online resources to support the proposal.

Data collection procedures involved both primary and secondary methods to gather comprehensive information relevant to the study. Observation involved collecting data by observing physical settings, including viewing, listening, reading, touching, and recording the behavior and characteristics of phenomena (Dudovskiy, 2018). The researcher conducted site visits to the Lung Center of the Philippines to investigate existing or similar projects, assessing facilities and the functional relationships between spaces. Documentation was applied to existing pulmonary facilities to understand spatial requirements, requiring sensory examination of settings to apply insights to the proposed study.

Interviews were conducted to explore perspectives on particular ideas, programs, or situations (Boyce & Neale, 2006). The researcher organized interviews with experts in pulmonary hospitals, including medical workers, architects, and allied professionals involved in hospital projects. These interviews helped gather relevant studies and practical insights to apply to the hospital design. The study targeted three groups of interviewees: architects with hospital design planning experience, architects working at the Lung Center of the Philippines, and pulmonologists. Including architects with hospital design experience provided insights into legal requirements, design considerations, and materials for the proposed hospital. Architects from the Lung Center of the Philippines offered suggestions on design implementations specific to pulmonary hospitals. Pulmonologists provided information on facilities and equipment used to treat patients with pulmonary conditions. These interviewees contributed valuable information regarding facilities and materials for the proposed hospital in Bacolod.

Published materials simplified complex information for better understanding (Asad, 2022). Data and information were gathered from books, magazines, articles, journals, and architectural theses. These resources served as essential references for developing concepts, theories, architectural designs, and understanding trends in specialized hospital architecture. Internet research involved gathering data through online resources (Buchanan & Zimmer, 2021). The researcher collected information from web references, utilizing internet research to access related information and articles globally. References were extracted from various websites and academic research repositories, providing convenience and time efficiency (Hewson, 2006).

Data collection was systematic to address the study's objectives, utilizing both primary and secondary sources for comprehensive findings, conclusions, and recommendations. Primary data on sustainability, ergonomics, and healing architecture were collected from research articles and discussions. Key participants, including experts in pulmonary hospitals in the Philippines, were identified and interviewed to gather insights for architectural design improvements and adoption of new healing techniques.

Hospital visits and facility inspections were requested through formal letters signed by the research adviser and forwarded to the Lung Center of the Philippines. All information gathered was kept confidential and accessible only to the researcher. The interview process enhanced and clarified relevant issues related to the study objectives, with data serving as supporting evidence in the design rationale. Observations were crucial for understanding how people interact with built environments, leading to detailed architectural design guidelines. Instinctive observations allowed recognition of behavioral patterns within daily activities. Observations were conducted in areas corresponding to interviews to ensure accurate information and results.

Documentation involved collecting data and information from government sectors relevant to the study, facilitated by letters signed by the adviser. Documentation played a vital role in understanding facilities and records of specialized hospitals, allowing comparisons to determine the application of healing architecture in medical institutions. Secondary data from published materials and internet sites were used to conceptualize concepts of sustainability, ergonomics, and healing architecture. These resources informed how these concepts could be enabled through architecture to promote design schemes in society. Secondary data were significant for compliance with national building codes, plumbing codes, fire codes, and other legal requirements essential for the design rationale.

Ethical principles guided the research design and methods, ensuring the protection and respect of participants and the integrity of the research process. The study adhered to considerations of autonomy, beneficence, competence, confidentiality, dignity, honesty, integrity, justice, non-maleficence, privacy, and responsibility. Participants were respected in their ability to make informed decisions about their involvement after being informed of potential costs and benefits (Singh & Hylton, 2015). There was no compulsion to participate. The researcher had a responsibility to promote participants' well-being (Singh & Ivory, 2015), minimizing possible harm and aiming to benefit the medical industry by proposing an accessible specialized pulmonary hospital.

Professional skills and knowledge were enhanced through engaging with experts in pulmonology and architecture, gaining insights into pulmonary health, healing processes, management, and facility requirements. Sensitive information, including research techniques, participant roles, and contact information, was kept confidential (Cristobal & Cristobal, 2013). Data such as floor plans and private spaces were protected and erased upon study completion. Participants' dignity was upheld by respecting their willingness to share information and not pressuring them to disclose sensitive details (Shultziner, 2007). Truthfulness and ethical implementation were maintained throughout the study (Silverman, 2017), avoiding misleading information. Agreements and promises were upheld, ensuring consistency and sincerity in the research process (CityU Library, 2013). Participants were treated equally, ensuring fair distribution of benefits, risks, and costs (Benatar, 2002).

The researcher avoided causing harm, only gathering statistical data relevant to pulmonary health conditions in the Western Visayas region (Singh & Ivory, 2015). Personal information was protected, and only necessary data were collected (Smith et al., 2011). An informed consent form was provided to ensure participants' privacy and autonomy. The researcher aimed to promote education and advocacy, contributing positively to society and minimizing harm (CityU Library, 2013) by highlighting the relationship between healing architecture and pulmonary health in built environments.

Results

The study aimed to integrate healing architecture principles into the design of a pulmonary hospital in Bacolod City, focusing on enhancing patient recovery and well-being through architectural elements. An extensive review of literature identified five key elements of healing architecture that were considered essential for creating a therapeutic environment: integration between light and color; circulation and space organization; form building system; building envelope; and evidence-based design (Ghazaly et al., 2022).

The integration between light and color emerged as a crucial factor in influencing patients' psychological and physiological states. Light and color have a constant influence on individuals, affecting health and efficiency (Podolsky, 1983). Appropriate color choices in healthcare environments can provide interest, comfort, and reassurance to patients and healthcare workers (Mahnke & Mahnke, 1987). The combination of color and light was found to influence individuals' moods, making them feel more energetic or optimistic, or conversely, gloomy and unhappy (Ghazaly et al., 2022). This underscores the importance of carefully selecting lighting and color schemes to enhance the healing process.

Circulation and space organization were identified as critical components affecting the functionality and user experience within the hospital. Complex circulation patterns can lead to confusion, discomfort, and productivity losses (Okonkwo & Muhammad, 2018; Ghazaly et al., 2022). Effective circulation routes facilitate the flow of people through and around the building, serving a connecting purpose and enhancing spatial legibility (Ching, 2016). By avoiding complex path networks and ensuring clear navigation, the hospital design can reduce stress and improve efficiency for both patients and staff.

The form building system plays a significant role in ensuring the efficiency and functionality of the healing environment. Hospitals require designs that focus on patient and caregiver needs, easy maintainability, and integration with the environment (Gupta & Kant, 2005). Building forms should consider attributes such as lighted and shaded areas, airflow, and movement near spaces to enhance the quality of healing in the built environment (Jones, 2018; Pilosof & Jones, 2021; Ghazaly et al., 2022). By adapting to trends and technologies in health facilities, building forms can support the dynamic needs of hospitals.

The building envelope was found to be essential in achieving human comfort through protection and climate control. It involves the separation of the interior of the building from the exterior environment while facilitating outdoor and indoor protection and climate control (Ralegaonkar & Gupta, 2010; Oral et al., 2004). In hospitals, building envelopes help maintain humidity and temperature independently while meeting space pressurization needs (Bonnema et al., 2010). Achieving human comfort through building envelopes is a key aspect of healing architecture in hospitals (Ghazaly et al., 2022).

Evidence-Based Design (EBD) was recognized as a grounding concept for quality improvements in hospital design. EBD is based on the idea that the built environment can have a substantial physical and emotional influence on patients (Alfonsi et al., 2014). Hospital developments have recognized healing architecture as a grounding concept for the design's quality improvements using EBD (Anaker et al., 2016; McCullough, 2010). The approach revealed significant links between healthcare design solutions and clinical outcomes, such as reducing anxiety, blood pressure, improving postoperative course, decreasing pain medication requirement, and shortening hospital stays (Brambilla et al., 2019). EBD aims to improve the quality of the hospital care environment by incorporating the most current research, information, and experiences in the area (Elf et al., 2017).

The study also explored the connection between healing architecture and pulmonary health. Factors such as light, air quality, and temperature were found to influence respiratory functions, thereby directly benefiting patients (Jelles, 2021). The environment significantly impacts respiratory problems, including indoor and outdoor air quality (National Institutes of Health and Sciences, 2022; Belvitch & Bruzzese, 2021). Poor indoor air quality causes lung disorders such as asthma, allergies, chronic obstructive pulmonary disease (COPD), and lung cancer (European Lung Foundation, 2021). Hospital air quality and ventilation have a significant impact on pathogen concentrations in the air, which can result in adverse medical complications (Association of Healthcare Provider, 2017). Sanitation was also identified as crucial in preventing respiratory infections (Rabie & Curtis, 2006).

Site analysis of the proposed location in Barangay Mansilingan, Bacolod City, revealed that the site orientation to the northwest allowed for optimal daylight access, and the natural surroundings contributed to a therapeutic ambiance. The site features various surrounding vegetation and offers views of sugarcane farms and mountainous ranges, providing a natural landscape beneficial for rehabilitation. The current zoning is residential (R3), but future reclassification to mixed-use zoning is anticipated due to urbanization.

The sun path analysis indicated that the warmest part of the day affects the southern portion of the site. The site experienced strong air circulation due to minimal structures and existing vegetation. Building orientation and design could leverage sun and wind patterns to enhance thermal comfort and reduce energy consumption.

The site complied with the World Health Organization's recommendation for hospital lot size, with a total area of approximately 21.68 hectares. Roads and accessibility were favorable, with the site accessible via a provincial road and offering public and private transportation options. Existing utilities, including power supply from Central Negros Electric Cooperative, Inc. (CENECO), water supply from Bacolod City Water District (BACIWA), and telecommunication services, are available.

The climate and natural conditions of Bacolod City, characterized by a Type 3 climate with a short dry season and no pronounced maximum rain period, support the growth of various vegetation. This presents opportunities for integrating therapeutic gardens and natural elements into the hospital design. The soil type, Guimbala-on Fine Sandy Loam, is well-drained and suitable for vegetation, which is advantageous for planting in therapeutic gardens.

Safety and security considerations include the proximity of the nearest police station and fire stations within a 6 to 9-minute drive, ensuring timely emergency response. The proposed site is within 10 to 30 minutes of several existing hospitals in Bacolod City, aligning with recommendations for specialized hospitals to be near general hospitals to facilitate referrals and accommodate patients requiring specialized care.

Building function and space planning were developed in accordance with Department of Health guidelines, classifying hospital zones into outer, second, inner, deep, and service zones. The pulmonary services to be offered include emergency room, outpatient department, clinical research, pathology and laboratory, pediatric pulmonary services, pulmonary critical care and sleep medicine, radiological services, and thoracic surgery. Legal and space requirements were considered, including compliance with the National Building Code, Fire Code of the Philippines, Code on Sanitation, Accessibility Law, and other relevant regulations.

The design integrated healing architecture elements, such as therapeutic environments with gardens featuring vegetation, flowers, and water features. Circulation was planned to provide efficient flow for patients, staff, and visitors, considering factors like the flow of staff, patients, families, information, medication, supplies, equipment, and output (Cardon & Giffin, 2015). Access control measures were included to enhance security and infection control, incorporating security waypoints, guardhouses, CCTV cameras, and controlled access to certain areas.

Building aesthetics focused on the integration of light and color to create a therapeutic environment. Natural and daylight views were emphasized to improve patient recovery and staff comfort. Material choices were made with consideration for infection control, durability, and maintenance, selecting appropriate wall finishes and flooring materials suitable for healthcare settings. Controlling heat gain and ensuring proper ventilation were addressed through the use of HVAC systems and roofing designs conducive to the local climate.

Discussion

The findings of this study underscore the significant impact that healing architecture elements can have on the design and functionality of a pulmonary hospital. By integrating principles such as the use of light and color, efficient circulation and space organization, thoughtful form building systems, effective building envelopes, and evidence-based design, the hospital environment can be transformed into a therapeutic space that enhances patient recovery and well-being.

The integration of light and color plays a pivotal role in influencing patients' psychological and physiological states. Appropriate lighting and color schemes can reduce stress, promote comfort, and improve overall patient satisfaction

(Podolsky, 1983; Mahnke & Mahnke, 1987). In a pulmonary hospital, where patients may experience heightened anxiety due to respiratory issues, the calming effects of natural light and soothing colors become even more critical. The site's orientation and natural surroundings offer an excellent opportunity to harness daylight and incorporate views of nature, which have been shown to positively affect patient outcomes (Ulrich et al., 2004). By providing patients with exposure to natural elements, the hospital design can contribute to reducing anxiety, improving mood, and enhancing the healing process.

Efficient circulation and space organization are essential in reducing confusion and stress within healthcare facilities. Designing clear and accessible pathways enhances the experience for patients, staff, and visitors (Ching, 2016; Okonkwo & Muhammad, 2018). This is particularly important in a specialized facility like a pulmonary hospital, where timely access to critical care areas can impact patient outcomes. By considering the flow patterns of staff, patients, families, information, medication, supplies, equipment, and output (Cardon & Giffin, 2015), the hospital can optimize operational efficiency and reduce potential bottlenecks.

The form building system contributes to the hospital's ability to support complex medical functions while providing a healing environment. By considering factors such as natural light, airflow, and spatial relationships, the design can facilitate patient recovery and staff efficiency (Gupta & Kant, 2005; Jones, 2018; Pilosof & Jones, 2021). The adaptability of building forms to accommodate future technological advancements and changing healthcare needs is crucial in ensuring the hospital remains functional and relevant over time.

The building envelope serves not only as a physical barrier but also as a means of controlling the internal environment. In a pulmonary hospital, where air quality and temperature can directly affect patient health, the building envelope's role becomes even more significant (Ralegaonkar & Gupta, 2010; Oral et al., 2004). By maintaining appropriate humidity and temperature levels, the hospital can create a comfortable environment that supports healing and minimizes the risk of infection (Bonnema et al., 2010; Ghazaly et al., 2022). Incorporating energy-efficient materials and design strategies also contributes to sustainability and operational cost savings.

Evidence-Based Design provides a framework for integrating research findings into the architectural design process. By relying on empirical evidence, the hospital can implement design strategies that have been proven to improve patient outcomes, such as reducing anxiety and shortening hospital stays (Alfonsi et al., 2014; Brambilla et al., 2019). This approach aligns with the broader trend in healthcare towards patient-centered care and continuous quality improvement. Utilizing EBD ensures that the design decisions are not solely based on aesthetics or tradition but are grounded in data that demonstrate tangible benefits to patients and staff.

Connecting healing architecture with pulmonary health highlights the interplay between environmental factors and respiratory conditions. The study emphasizes the importance of air quality, ventilation, and exposure to nature in supporting respiratory health (Jelles, 2021; National Institutes of Health and Sciences, 2022). By addressing indoor and outdoor air pollution, incorporating natural ventilation, and providing access to green spaces, the hospital can mitigate factors that exacerbate pulmonary conditions and promote a healthier environment for patients and staff (Belvitch & Bruzzese, 2021; Agopian, 2018). This holistic approach recognizes that healing is not confined to medical interventions but is also influenced by the environment in which care is delivered.

The site analysis reinforces the potential for integrating healing architecture elements within the specific context of Bacolod City. The natural surroundings, including vegetation and views of the landscape, offer intrinsic therapeutic benefits that can be leveraged in the hospital design. Challenges such as noise from traffic and future urbanization necessitate proactive design solutions, such as the use of vegetation buffers and strategic placement of building elements to minimize noise and maintain a tranquil environment. Incorporating green spaces and therapeutic gardens not only enhances aesthetics but also provides spaces for relaxation and reflection, contributing to mental well-being.

Climate and natural conditions inform the design strategies for thermal comfort, energy efficiency, and sustainability. Utilizing passive design principles and selecting appropriate materials can reduce the environmental footprint while enhancing occupant comfort (Rania & Azmy, 2017). The well-drained soil and favorable climatic conditions support the integration of therapeutic gardens, which offer additional benefits such as stress reduction and opportunities for physical activity (Gudka et al., 2017). These design elements align with sustainable practices and contribute to the hospital's social responsibility.

Safety and security are integral to the healing environment. Incorporating access control measures, surveillance systems, and designing spaces that promote visibility and ease of movement ensure the safety of patients, staff, and visitors (Accutech, 2021; Department of Health, 2004). These measures also contribute to infection control by limiting unauthorized access to sensitive areas and reducing the potential for contamination (Emmanuel et al., 2020). A secure environment enhances trust and confidence in the healthcare facility.

Building aesthetics, including the use of light, color, and materials, significantly impact the perception of the hospital environment. Selecting colors that evoke positive emotions and support the healing process influences patient mood

and comfort (Olesen, 2013; Olguntürk et al., 2020). Incorporating natural and daylight views not only enhances aesthetic appeal but also contributes to physiological benefits such as regulating circadian rhythms and improving sleep quality (Benedetti et al., 2001; Aripin, 2007). These considerations are particularly important in inpatient areas where patients spend extended periods.

Material choices are critical in maintaining hygiene, durability, and functionality within the hospital. Selecting wall finishes and flooring materials that are easy to clean, resistant to microbial growth, and durable under heavy use supports infection control and reduces maintenance costs (Lavy & Dixit, 2012; Harris & Fitzgerald, 2015). The use of non-toxic, low-emission materials also contributes to indoor air quality, which is particularly important in a pulmonary hospital (Pereira et al., 2020). These material choices reflect a commitment to patient safety and environmental sustainability.

Controlling heat gain and ensuring proper ventilation are essential for thermal comfort and respiratory health. Integrating HVAC systems, shading devices, and building orientation strategies can optimize thermal conditions within the hospital (Lenzer et al., 2020; Witt et al., 2015). By creating an environment that minimizes thermal stress, the hospital supports patient recovery and staff performance. Effective ventilation systems also play a crucial role in reducing the transmission of airborne pathogens, enhancing infection control measures.

In conclusion, the study demonstrates that integrating healing architecture elements into the design of a pulmonary hospital can have profound effects on patient outcomes, staff well-being, and operational efficiency. By thoughtfully considering factors such as light, color, circulation, form, and evidence-based design principles, the hospital can create a therapeutic environment that addresses the specific needs of pulmonary patients. The findings support the notion that architectural design is not merely an aesthetic endeavor but a critical component of healthcare delivery that can enhance the quality of care and promote healing.

Future research could focus on empirical studies measuring the impact of these design interventions on patient health metrics, staff satisfaction, and overall hospital performance. Additionally, exploring patient and staff feedback through post-occupancy evaluations would provide valuable insights into the effectiveness of the design and identify areas for further improvement. Engaging stakeholders in the design process can ensure that the hospital meets the needs of the community it serves, fostering a sense of ownership and satisfaction.

Conclusion:

This study illuminates the profound impact of healing architecture on the design and functionality of specialized pulmonary hospitals, particularly in Bacolod City. It underscores the vital role that thoughtful design plays in promoting patient recovery, enhancing staff efficiency, and improving overall healthcare outcomes.
Key healing architecture elements essential for a pulmonary hospital include the integration of light and color, serving both aesthetic and therapeutic purposes. Light influences circadian rhythms, sleep patterns, mood, and overall well-being. Natural daylight reduces hospital stays and improves outcomes, while thoughtfully designed artificial lighting shapes spaces and affects occupants' feelings. Strategic use of colors like green, blue, and pink enhances the healing environment by promoting relaxation, inducing calmness, and minimizing unpredictable behavior. Understanding these psychological and physiological effects allows architects to create environments that reduce stress and promote healing.

Efficient circulation within the hospital is critical for enhancing the therapeutic effect. Clear pathways and minimized unnecessary movement reduce fatigue, confusion, and stress for patients and staff, improving functionality and the overall experience. Separating staff, visitors, and patient circulation ensures privacy and infection control, which is vital in a pulmonary healthcare setting.

Adaptive forms and passive building systems create environments that support healing processes, ensuring longevity and sustainability. Incorporating natural ventilation and daylighting reduces energy consumption and enhances occupant comfort. The building envelope regulates temperature, humidity, and air quality—crucial for respiratory patients—by maintaining conditions conducive to healing and protecting from external pollutants.
Evidence-based design principles are a cornerstone of modern hospital architecture, enabling architects to implement strategies proven to enhance patient outcomes and staff satisfaction. This approach ensures hospitals are aesthetically pleasing, functionally efficient, and supportive of health and well-being by integrating validated solutions from the latest research.

Connecting pulmonary health with healing architecture is pivotal, as pulmonary health is intrinsically linked to air quality. Healing architecture positively influences pulmonary patients through enhanced ventilation, improved sanitation, and natural elements. Proper ventilation provides clean air, reduces pollutants, and prevents pathogen buildup, accelerating recovery. Advanced HVAC systems maintain optimal air conditions, directly impacting respiratory health.

Enhanced sanitation practices in design minimize respiratory infections and pathogen transmission. Using antimicrobial surfaces, easy-to-clean materials, and dedicated sanitation zones reduces contamination risks. Infection control measures like widened corridors and separate circulation paths prevent nosocomial infections via air, water, and contact.

Incorporating natural elements provides therapeutic benefits. Exposure to nature through gardens, greenery, and natural light reduces stress, lowers blood pressure, and improves mood—crucial for pulmonary patients experiencing anxiety. Nature offers normalcy and psychological healing by providing an escape from the clinical environment.

The chosen site in Bacolod City offers strategic advantages, meeting functional standards for future expansions and ensuring adaptability to growing demands. Its accessibility enhances community reach, facilitating timely interventions. Resilience against natural disasters ensures operational continuity, critical for emergency services.
Environmental factors at the site, like ambient noise, air quality, thermal comfort, and natural vistas, contribute to a therapeutic environment. Noise control through tree planting enhances tranquility, while strategic orientation and landscaping maximize wind patterns and natural ventilation to maintain air quality.

Meticulous zoning, stringent sanitation, effective infection control, and therapeutic environments are essential in building function and space planning. Zoning separates functional areas for patients, staff, services, and the public, enhancing efficiency, privacy, and infection control. Insights from the Lung Center of the Philippines inform necessary facilities for a specialized pulmonary hospital.

Efficient circulation planning for staff and public reduces congestion and cross-contamination. Ergonomic design and adherence to health regulations ensure safety and high-quality care. Integrating therapeutic environments within hospital spaces reduces stress and anxiety, enhancing the healing process and improving recovery times.
Building aesthetics significantly impact hospital perception and functionality. Strategic use of colors influences mood and behavior, supporting psychological needs. Shades of blue, green, and brown relieve tension by creating tranquility. Lighting design, particularly natural daylight, regulates circadian rhythms, improves sleep, and enhances mood. Artificial lighting complements natural light, ensuring adequate illumination while minimizing discomfort.

Building technology and materials are critical. Material selection affects structure, aesthetics, hygiene, and maintenance. Durable, easy-to-clean materials reduce infection risks and extend lifespan. Ceilings influence sleep quality and provide privacy. Advanced HVAC systems offer environmental control, impacting physiological responses. Roofing must be flexible and durable, accommodating helipads and future expansions.
Wall finishes and flooring significantly impact indoor environment quality. Wall finishes affect bacteria levels and air quality. Flooring should be smooth, easy to maintain, and non-slip, preventing accidents and pathogen growth. Material selection adheres to health guidelines, ensuring safety and hygiene compliance.

Reliable utilities—water, electricity, telecommunications—are essential. Contingency plans like generators and water tanks ensure uninterrupted operations. Integrating renewable energy sources, like solar panels, enhances sustainability and reduces costs.

In conclusion, integrating healing architecture elements is essential in designing a specialized pulmonary hospital. Embracing factors like light, color, spatial circulation, adaptive forms, building envelopes, and evidence-based design allows for environments that promote healing and well-being. The connections between pulmonary health and architectural design underscore the importance of prioritizing ventilation, sanitation, and natural elements in healthcare facilities.

These findings provide valuable insights for healthcare architecture, offering practical implications for future facility designs, especially in pulmonary care. Implementing these principles can improve patient recovery, reduce hospital stays, and enhance the overall healthcare experience. Future architectural endeavors should continue to integrate these healing elements to ensure the built environment contributes effectively to the healing process.

By fostering a holistic approach that addresses environmental, psychological, and physiological factors, healthcare facility design standards can be redefined. This study demonstrates the potential of architecture not only to house but to heal, setting a precedent for future innovations in health and design. Integrating healing architecture into pulmonary hospital design advances the creation of environments that are functional and therapeutic, supporting the needs of patients, staff, and the community.

The implications extend beyond this context; these principles can be adapted to other healthcare settings. Future research could explore long-term impacts on patient outcomes, staff retention, and efficiency. Investigating economic benefits of reduced hospital stays and improved recovery rates can further justify adopting these design principles.

Ultimately, the design of healthcare facilities is a critical component of the healing process. By integrating evidence-based design with a deep understanding of the needs of pulmonary patients, hospitals can become more than just places of treatment—they become environments of healing, comfort, and hope.

Recommendations:

The study emphasizes the importance of integrating healing architecture principles into the design of specialized pulmonary hospitals to significantly enhance patient recovery, staff efficiency, and overall healthcare outcomes. It recommends incorporating therapeutic elements such as light and color to create calming and welcoming spaces that promote healing. Maximizing natural daylight and thoughtfully designing artificial lighting can improve mood and regulate circadian rhythms, contributing to patient well-being. Optimizing circulation within the hospital by designing separate pathways for patients, staff, and visitors enhances accessibility, reduces stress, and improves infection control. The adoption of adaptive building forms and passive systems is advised to ensure sustainability and accommodate future expansions, with effective building envelopes regulating humidity and temperature to create conditions conducive to patient recovery.

Implementing evidence-based design principles is crucial, utilizing current research and trends to inform architectural decisions and ensure that design solutions positively influence patient outcomes and staff satisfaction. Enhanced air quality management through advanced HVAC systems is emphasized, as maintaining optimal air conditions accelerates patient recovery and directly impacts respiratory health. Rigorous sanitation and infection control measures should be integrated into materials and spatial planning to facilitate cleanliness and minimize infection risks. Incorporating natural elements such as healing gardens, greenery, and access to natural light provides therapeutic benefits, reducing stress and aiding psychological healing.

Strategic site selection and planning are important, recommending locations that meet functional standards for anticipated growth, offer accessibility via public and private transportation, and are resilient against natural disasters. Compliance with regulatory standards is essential to ensure the safety, legality, and quality of the healthcare facility, adhering to relevant laws, codes, and guidelines. Sustainable practices in material selection and building technologies are encouraged, using durable, hygienic, and eco-friendly materials, and incorporating renewable energy sources to reduce operational costs and environmental impact.

The study advocates for continuous improvement through ongoing research to explore the long-term impacts of healing architecture on patient outcomes, staff retention, and operational efficiency. Finally, adopting a holistic design approach that addresses environmental, psychological, and physiological factors is vital, transforming hospitals into environments of healing, comfort, and hope, ultimately benefiting patients, staff, and the broader community.

References:

Aamarpali, A. (2017). Importance of hospital environment. ResearchGate, 2–5.
Able Roofing. (2017, August 9). The pros and cons of a flat roof. Retrieved December 12, 2022, from https://www.ableroof.com/blog/pros-cons-flat-roof/
Accutech Security. (2021, March 25). What is hospital access control, and why is it important? Retrieved December 10, 2022, from https://www.accutechsecurity.com/what-is-hospital-access-control-and-why-is-it-important/
Agnihotri, K. (2022). Places of healing. Canadian Family Physician, 68, 487. https://doi.org/10.46747/cfp.6807487
Agopian, N. (2018, March 10). Increased ventilation: The medicine hospitals need for healthy IAQ. Retrieved from https://www.renewaire.com/wp-content/uploads/2018/10/MAR_LIT_122_RGB_White_Paper_Hospitals_Ventilation-1.pdf
Ajala, A.-R. T. (2017). Traffic management strategies and best practices. GG Associates, 4–13. Retrieved from https://www.researchgate.net/publication/320618360_Traffic_Management_Strategies_and_Best_Practices
Akhtar, I. (2016). Research design. In Research in social science: Interdisciplinary perspectives (pp. 68–80). Retrieved from https://ssrn.com/abstract=2862445
Akuneho, J. T., & Napoleon, I. (2021). Healing architecture in hospital designs. Global Scientific Journals, 9(6), 1321–1325. Retrieved from http://www.globalscientificjournal.com
Alfonsi, E., Capolongo, S., & Buffoli, M. (2014). Evidence-based design and healthcare: An unconventional approach to hospital design. Annali di Igiene, 26, 137–143. https://doi.org/10.7416/ai.2014.1968
Alhamdani, M. R., & Sari, D. P. (2021). A strategy of a masterplan of Landak general hospital: A study of architectural programming. IOP Conference Series: Earth and Environmental Science, 1007(1), 012022. https://doi.org/10.1088/1755-1315/1007/1/012022
Al-Shafaey, N., Abdelkader, M., Sabry, H., & Nessim, A. (2020). Double-skin facades in healing environments: An approach for enhancing daylighting performance in south-oriented patient rooms in Cairo, Egypt. Engineering Research Journal, 57–73.
American Lung Association. (2022, November 11). What makes outdoor air unhealthy. Retrieved December 10, 2022, from https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy

Anåker, A., Heylighen, A., Nordin, S., & Elf, M. (2017). Design quality in the context of healthcare environments: A scoping review. Health Environments Research & Design Journal, 10(4), 137–150. https://doi.org/10.1177/1937586716679404
Andersen, S. N., & Broberg, O. (2021). Transfer of ergonomics knowledge from participatory simulation events into hospital projects. Work: A Journal of Prevention, Assessment & Rehabilitation, 68(2), 365–378. https://doi.org/10.3233/WOR-203379
Association of Healthcare Providers (India). (2017). The standard for green & clean hospital (1st ed.). New Delhi: Association of Healthcare Providers. Retrieved from https://www.scribd.com/document/357186023/AHPI-Standard-for-Green-Clean-Hospital
Atmowardoyo, H. (2018). Research methods in TEFL studies: Descriptive research, case study, error analysis, and R & D. Journal of Language Teaching and Research, 9(1), 197–204. https://doi.org/10.17507/jltr.0901.25
Aydın, D., Yaldız, E., & Büyüksağin, S. (2017). Sustainable hospital design for sustainable development. In Proceedings of the 8th International Conference on Urban Planning, Architecture, Civil and Environment Engineering (pp. 116–119). Dubai: Scientific Research Projects. https://doi.org/10.15242/HEAIG.H1217804
Benedetti, F., Colombo, C., Barbini, B., Campori, E., & Smeraldi, E. (2001). Morning sunlight reduces length of hospitalization in bipolar depression. Journal of Affective Disorders, 62, 221–223.
Bhagat, R. K., & Linden, P. F. (2020). Displacement ventilation: A viable ventilation strategy for makeshift hospitals and public buildings to contain COVID-19 and other airborne diseases. Royal Society Open Science, 7, 1–7. https://doi.org/10.1098/rsos.200680
Boyce, C., & Neale, P. (2006). Conducting in-depth interviews: A guide for designing and conducting in-depth interviews. Pathfinder International Tool Series. Retrieved from https://www.semanticscholar.org/paper/Conducting-in-depth-interviews%3A-a-guide-for-and-for-Boyce-Neale/17d92c3d9ca9aff1a763e57edf39058798a57a9b
Brambilla, A., Rebecchi, A., & Capolongo, S. (2019). Evidence-based hospital design: A literature review of the recent publications about the EBD impact of built environment on hospital occupants' and organizational outcomes. Annali di Igiene, 31, 165–180. https://doi.org/10.7416/ai.2019.2269
Brassfield, M. (2022, August 25). Study: Green roofs on hospitals help patients' recovery. Retrieved November 30, 2022, from https://www.hfmmagazine.com/articles/4546-study-green-roofs-on-hospitals-help-patients-recovery
Bulakh, I., & Merylova, I. (2020). Sustainable hospital architecture—Potential of underground spaces. Civil Engineering and Architecture, 8(5), 1127–1135. https://doi.org/10.13189/cea.2020.080539
Bulakh, I., Didichenko, M., Kozakova, O., Chala, O., & Kovalska, G. (2021). Is the hospital-park future of the sustainable hospital architecture? In E3S Web of Conferences (Vol. 280, p. 04014). EDP Sciences. https://doi.org/10.1051/e3sconf/202128004014
Carr, R. F. (2017, April 6). Hospital, Whole Building Design Guide. Retrieved from https://www.wbdg.org/building-types/health-care-facilities/hospital
Caspari, S., Eriksson, K., & Naden, D. (2006). The aesthetic dimension in hospitals: An investigation into strategic plans. International Journal of Nursing Studies, 43, 851–859. https://doi.org/10.1016/j.ijnurstu.2006.04.011
Chand, S., Shastry, C. S., Hiremath, S., Joel, J. J., Bhat, C. H. K., & Mateti, U. V. (2020). Water, sanitation, hygiene and biomedical waste disposal in the healthcare system: A review. Biomedicine, 40(1), 14–19.
Ching, F. D. K. (2016). Architectural concepts: Circulation—Movement through space. Wiley.
Cilliers, L. (2002). The evolution of the hospital from antiquity to the end of the Middle Ages. Curationis, 25(4), 60–66. https://doi.org/10.4102/curationis.v25i4.806
Connaway, L. S., & Powell, R. R. (2010). Basic research methods for librarians. Santa Barbara, CA: Greenwood Publishing Group.
Cubukcuoglu, C., Nourian, P., Sariyildiz, S. I., & Tasgetiren, F. M. (2021). Optimal design of new hospitals: A computational workflow for stacking, zoning, and routing. Automation in Construction, 134, 104102. https://doi.org/10.1016/j.autcon.2021.104102
Dalke, H., Littlefair, P. J., Loe, D. L., & Camgöz, N. (2004). Lighting and colour for hospital design. Norwich: TSO (The Stationery Office).
Elf, M., Nordin, S., Wijk, H., & McKee, K. J. (2017). A systematic review of the psychometric properties of instruments for assessing the quality of the physical environment in healthcare. Journal of Advanced Nursing, 73(12), 2796–2816. https://doi.org/10.1111/jan.13281
Environmental Protection Agency. (2022, December 5). Introduction to indoor air quality. Retrieved December 9, 2022, from https://www.epa.gov/indoor-air-quality-iaq/introduction-indoor-air-quality
Environmental Protection Agency. (2022, July 12). Outdoor air quality. Retrieved December 10, 2022, from https://www.epa.gov/report-environment/outdoor-air-quality
Esguerra, J. (2022, December 9). Respiratory health: Everything you need to know. Retrieved December 12, 2022, from https://hellodoctor.com.ph/respiratory-health/lung-health-facts/
Fricke, O. P., Halswick, D., Längler, A., & Martin, D. D. (2019). Healing architecture for sick kids. Zeitschrift für Kinder- und Jugendpsychiatrie und Psychotherapie, 47(1), 27–33. https://doi.org/10.1024/1422-4917/a000635
Ghasemi, N., & Ghasemi, F. (2017). Double-skin façade technology and its aspects in field of aesthetics. Environment and Energy Consumption Optimization, 293.
Ghazaly, M., Badokhon, D., Alyamani, N., & Alnumani, S. (2022). Healing architecture. Civil Engineering and Architecture, 10(3A), 108–117. https://doi.org/10.13189/cea.2022.101314
Granger, W. (2021, January 8). Viewing, watching, observing: Aging and the architecture of intermediate space.

Retrieved from https://www.platformspace.net/home/viewing-watching-observing-aging-and-the-architecture-of-intermediate-space
Gupta, S., & Kant, S. (2005). Trends and dimensions in hospital architecture: A hospital administrator's perspective. JK Science, 7(2), 61–62.
Hamer, S. (2020, December 6). Architectural concepts: Circulation. Retrieved from https://portico.space/journal//architectural-concepts-circulation
Harris, D. D., & Detke, L. A. (2013). The role of flooring as a design element affecting patient and healthcare worker safety. Health Environments Research & Design Journal, 6(3), 95–119. https://doi.org/10.1177/193758671300600308
Hastuti, A. S. O., & Daquioag-Lorica, J. D. (2020). Patients healing: An integrative literature review the effect of healing garden to improve the. Journal of Health and Caring Sciences, 2(1), 34–47. https://doi.org/10.37719/jhcs.2020.v2i1.ra001
Hedge, A. (2016). Ergonomic workplace design for health, wellness, and productivity. Boca Raton, FL: CRC Press.
HIPAA Journal. (2020, June 2). Improving clinical staff workflow in hospitals. Retrieved December 12, 2022, from https://www.hipaajournal.com/improving-clinical-staff-workflow-in-hospitals/
HMC Architects. (2018, November 9). Hospital design guidelines to better enable sustainable practices. Retrieved December 12, 2022, from https://hmcarchitects.com/news/hospital-design-guidelines-to-better-enable-sustainable-practices-2018-11-09/
Husein, A., & Salim, S. S. (2020). Impacts of daylight on improving healing quality in patients' room: Case of Shorsh Hospital in Sulaimani City. International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies, 1–8.
Jiang, S., & Verderber, S. (2017). On the planning and design of hospital circulation zones: A review of the evidence-based literature. Health Environments Research & Design Journal, 10(2), 124–146.
Kabir, S. M. S. (2016). Basic guidelines for research: An introductory approach for all disciplines. Chittagong, Bangladesh: Book Zone Publication.
Karaçor, E. K. (2016). Public vs. private: The evaluation of different space types in terms of publicness dimension. European Journal of Sustainable Development, 5(3), 51–58. https://doi.org/10.14207/ejsd.2016.v5n3p51
Lawson, B. R. (2010). Healing architecture. Arts & Health, 2(2), 95–108. https://doi.org/10.1080/17533010903488517
Leccese, F., Montagnani, C., & Iaia, S. (2016). Quality of lighting in hospital environments: A wide survey through in situ measurements. Journal of Light & Visual Environment, 40(2), 10–18. https://doi.org/10.2150/jlve.IEIJ150000568
Lundin, S. (2021). Can healing architecture increase safety in the design of psychiatric wards? Health Environments Research & Design Journal, 14(1), 106–117. https://doi.org/10.1177/1937586720971814
Mahdiraji, H. A., Arzaghi, S., Stauskis, G., & Zavadskas, E. K. (2018). A hybrid fuzzy BWM-COPRAS method for analyzing key factors of sustainable architecture. Sustainability, 10(5), 1626. https://doi.org/10.3390/su10051626
Mahnke, F. H., & Mahnke, R. H. (1987). Color and light in man-made environments. New York, NY: Wiley.
Miruthu, B. R., & Suresh, M. (2018). Modelling the ergonomics factors affecting the work system in hospital: An ISM approach. International Journal of Pure and Applied Mathematics, 119(7), 183–198.
Murphy Construction. (2017, August 9). The importance of color in clinics and hospitals. Retrieved December 12, 2022, from https://murphyconstruction.net/2017/08/09/the-importance-of-color-in-clinics-and-hospitals/
O'Hara, A. C., Miller, A. C., Spinks, H., Seifert, A., Mills, T., & Tuininga, A. R. (2022). The sustainable prescription: Benefits of green roof implementation for urban hospitals. Frontiers in Sustainable Cities, 4, Article 798012. https://doi.org/10.3389/frsc.2022.798012
Pilosof, N. P. (2021). Building for change: Comparative case study of hospital architecture. Health Environments Research & Design Journal, 14(1), 47–60.
Ritchie, H., & Roser, M. (2017, August). Air pollution. Retrieved from Our World in Data website: https://ourworldindata.org/air-pollution
Siedlecki, S. L. (2020). Understanding descriptive research designs and methods. Clinical Nurse Specialist, 34(1), 8–12. https://doi.org/10.1097/NUR.0000000000000493
Ulrich, R. S. (1984). View through a window may influence recovery from surgery. Science, 224(4647), 420–421.
Ulrich, R. S., Quan, X., Zimring, C., Joseph, A., & Choudhary, R. (2004). The role of the physical environment in the hospital of the 21st century: A once-in-a-lifetime opportunity. The Center for Health Design. Retrieved from https://www.healthdesign.org/system/files/Ulrich_Role%20of%20Physical_2004.pdf
World Health Organization. (2018, June 1). Heat and health. Retrieved from https://www.who.int/news-room/fact-sheets/detail/climate-change-heat-and-health
World Health Organization. (2019, September 13). Patient safety. Retrieved December 12, 2022, from https://www.who.int/news-room/fact-sheets/detail/patient-safety
Yamaguchi, Y. (2015, October 5). Better healing from better hospital design. Harvard Business Review. Retrieved November 29, 2022, from https://hbr.org/2015/10/better-healing-from-better-hospital-design
Zabihi, H., Habib, F., & Mirsaeedie, L. (2012). Sustainability in building and construction: Revising definitions and concepts. International Journal of Emerging Sciences, 2(4), 570–578.