Quest Journals
Journal of Architecture and Civil EngineeringVolume 10 ~ Issue 7 (July 2025) pp: 38-44
ISSN(Online): 2321-8193
www.questjournals.org

Research Paper

Impacts of Biophilic Elements on Health in Ibarapa General Hospitals, Southwest, Nigeria

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Abstract
Against the background of the fact that various authors have recognized the impacts of biophilicelements on the health of residents in both residential and commercial building settings, this study assesses the impacts of biophilic elements on the health of residents in the general hospitals in Ibarapa region of Oyo State, southwest, Nigeria. Multistage sampling technique was employed and three sets of questionnaires were administered to two hundred and twenty- nine respondents comprising one hundred and twenty-five patients, seventy- two medical practitioners and thirty- two visitors. Frequency counts, percentages and cross tabulation were used to analyze the data collected and mean weight value was used to measure the impacts of biophilic elements on health. Results showed that the available biophilic elements in the hospitals are mostly greenery and plants (58.5%) as well as natural light (27.9%). Biophilic elements had strong impact on relaxation (IBEH =4.46;4.81), and minimal impact on cognitive restoration (IBEH = 3.97;4.50). It was concluded that biophilic elements aids relaxation in the hospitals and had low impact on cognitive restoration. The study therefore recommends that emphasis should be harnessed to create more outdoor gardens and courtyards for people to relax and connect with nature as well as factor in, indoor plants in waiting areas, wards and offices to bring greenery inside spaces.

Keywords: *Impacts, Biophilic elements, Health, General hospitals*

***R**eceived 06 July, 2025; **R**evised 15 July, 2025; **A**ccepted 17 July, 2025 © The author(s) 2025.*
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I. Introduction

Living environments have been shown to have a significant impact on human health and well-being both physically and emotionally. Exposure to nature called biophilic has significant impacts on both physical and mental health (Andreucci, 2021). Human bodies are most suited to living in a natural setting, and integrating nature into urban design has been linked to better environmental and human health effects. Access to nature and open spaces in cities is essentialfor social, physical, and mental health, as highlighted by global health emergencies like COVID-19. However, there is still an inequality between the desire for nature and daily life experiences, negatively impacting health, productivity, and well-being.

Biophilic design which is the incorporation of nature into design is beginning to gain attention worldwide.This is because of its importance in buildings. However, despite the fact that numerous studies have extensively investigated biophilic design in residential and workplace environments, biophilic design in hospitals has only recently begun to attract attention, despite the growing interest in the potential benefits of biophilic elements which are features of natural environment such as plant and water for patient welfare and well-being (KullerandWesterberg, 2017; Baechetta and Francesco, 2020; Parks and Green Space Strategy, 2020).

In hospital design generally, one important way to aid patients' recovery is the incorporation of green features as humanity evolves in close relation to nature, and the quality of the relationship is reflected in the emotions, thoughts, culture, and health that an individual or society expresses. However, in modern times, the modern space ingeneral hospitals has been conceived and designed by giving nature a role that is not only marginal, but also irrelevant to the health and happiness of individuals (Totaforti, 2018). Thus, the global health challenges of the 21st century require a new way of thinking and a change in the organization of healthcare services through an approach that considers human needs in their entirety and not in a strictly therapeutic sense (Totaforti,2018). In Nigeria, most studies examined the incorporation of biophilic elements in commercial

property design as a measure of sustainability in selected office buildings (Aduwo, AkinwoleandOkpanachi, 2021), but existing literature has not extensively established the biophilic elements that are adaptable for patients' recovery in general hospitals.

Hence, while existing research has examined the impacts of biophilic elements on the health of residents in both residential and commercial building settings (Browning and Cole, 2017)**,** there remains a significant gap in understanding their specific effects within hospital environments, most especially general hospital. There is thus a dearth of literature specifically addressing the emotional and psychological feelings of patients as a result of biophilic elements in general hospitals (Kalra,Jena, andYeravdekar, 2018).Against this background, this study assesses the impacts of biophilic elements on health in the general hospitals in Ibarapa region in order to make suggestions towards improving the health of the residents of the area.

Conceptualization and Review of Literature

The basic principle of biophilic design is that incorporating natural elements into our environment improves the connection between humans and the natural world. This design approach seeks to integrate natural elements into built spaces to improve people's effectiveness, well-being, and health (Zhong, Schröder, andBekkering, 2022). Natural plants, water features, and natural sunlight are just a few examples of the many elements that mimic the natural world and are used in biophilic design (Kellert, 2018). The concept is not just about aesthetics; it has a firm foundation in the human brain and is based on the hypothesis of biophilia, which holds that individuals have an innate tendency to seek connections with nature and other forms of life (Brielmann, Buras, Salingaros, and Taylor, 2022). There is increasing evidence to support the psychological and physiological benefits of biophilic design; that is, environments with natural components can lower stress, foster creativity, and promote general well-being (Yin, Zhu,MacNaughton, Allen and Spengler 2018).With its revolutionary implications for office, residential, hospital, and school design, this offers a novel approach to architecture and interior design that prioritizes the well-being of people and the environment (Bayır 2024). The impact of nature-inspired interiors on people's mental health and general well-being highlights how crucial it is to incorporate natural elements into both home and work environments (Jha, and Behera, 2022).

Healthcare settings have seen a rise in the use of biophilic design, which incorporates nature into architectural surroundings, recently. Its effect on patient healing is the subject of numerous investigations. According to Smith(2023), biophilic components like natural light and vegetation have a good impact on patient outcomes. Exposure to nature lowers stress and enhances emotional well-being (Johnson and Brown, 2022). Additionally, Smith and Williams (2022) investigated how biophilic design benefited patients' psychological well-being in outpatient clinics. Compared to patients in normal clinic settings, individuals exposed to biophilic features reported feeling more at ease and having less anxiety. It implies that biophilic design has applications in outpatient as well as inpatient settings.Though the body of research on the subject generally concurs that biophilic design has a beneficial impact on patient healing, other studies like Johnson *et al.*(2021) demand stricter methodology and standardized assessment instruments. They contend that a deeper comprehension of the causal relationship between particular design techniques and results related to healing is required.

II. Materials and Methods

Study Area

The study area is Ibarapa region, situated betweenlongitude $7^0$15'N and 7^0 55'N, as well as latitude 3^0 0'E and 3^0 30'E; in Oyo state (Figure 1) in the southwestern part of Nigeria. It is a unique and fascinating area that offers a rich blend of cultural heritage, natural resources, and economic opportunities. This region, located in Oyo State comprising three local government areas: Ibarapa Central, Ibarapa East, and Ibarapa North, is the focus of this study.

Ibarapa region (Figure 2) is located within the tropical savanna climate zone, characterized by two distinct seasons: wet and dry. The wet season, which spans from April to October, is marked by heavy rainfall, while the dry season, from November to March, is characterized by dry and dusty conditions. The terrain of the region is generally undulating, with elevation ranges from 100 to 500 meters above sea level.

The region is drained by several rivers, including the Ogun River, which provides water for irrigation, drinking, and other purposes. The Ogun River, with its source in Oyo State, flows through the Ibarapa region and empties into the Lagos Lagoon. This river plays a crucial role in supporting the agricultural and economic activities of the region. Ibarapa region has a population of approximately 350,000 people, with a mix of urban and rural settlements. The region is predominantly agrarian, with farming being the mainstay of the economy. Agriculture is the primary source of livelihood for the majority of the population, with crops such as cassava,

yam, and maize being the main staples. The region is also known for its livestock production, with cattle, goats, and sheep being the main animals reared.

The people of Ibarapa are known for their rich cultural heritage, with a strong tradition of art, music, and festivals. The region is home to a number of cultural festivals, including the Egungun festival, the Oro festival, and the Ogun festival, which are celebrated annually.

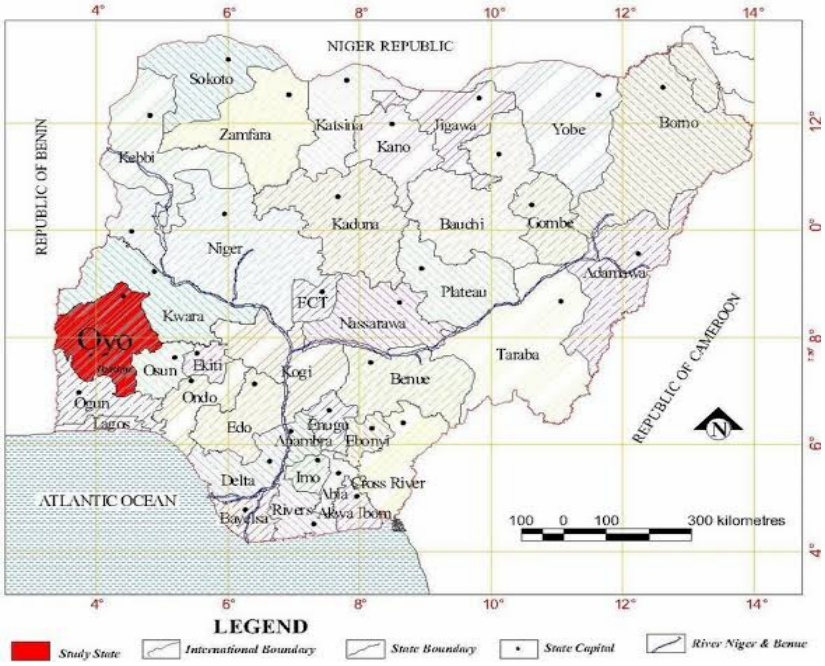

Figure 1: Oyo State in the Context of Nigeria
Source: United Nation Cartographic Section (2024)

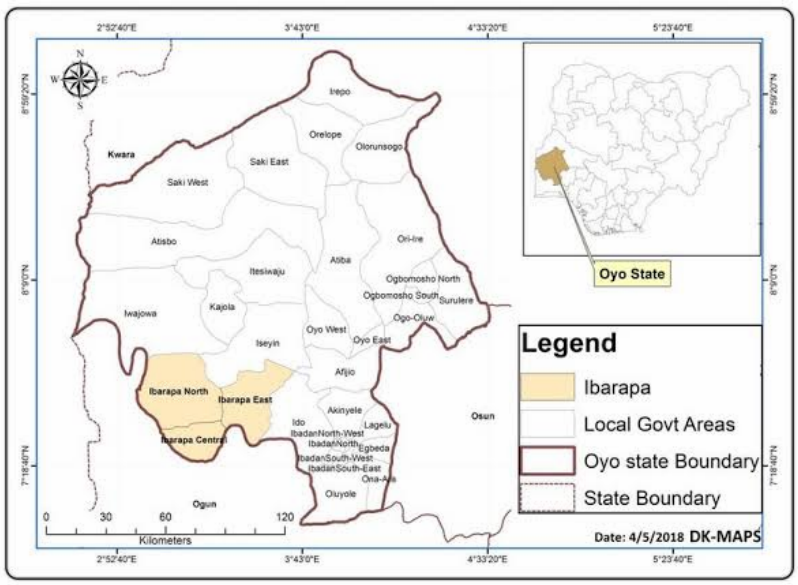

Figure 2: Ibarapa Region in the Context of Oyo State
Source: Forest and Forest Product (2017)

The study adopted quantitative research technique and is purely exploratory and descriptive in nature. Both primary and secondary data were utilized for the study and all the general hospitals in Ibarapa region constituted the sample frame. Multistage sampling technique was adopted and the first stage involved the

identification of the general hospitals in the region.Field survey carried out shows thehospitalsto be;Igboora,Eruwa,Lanlate and Ayete general hospitals.

In the secondstage, the population of patient was identified in each of general hospitals which correspond to the patients on admission because they are the set of people whohad access to biophilic elements and will be able to give account of them and impacts on health.A total of forty-six 46 bed spaces were found in Igbo-Ora general hospital withseventeen (17) medical practitioners and one hundred and two (102) visitors. At Ayete general hospital, twenty (20) bed spaces were discovered with thirteen (13) medical practitioners and fifty (50) visitors. Eruwa general hospital hadforty eight (48) bed spaces, thirty (30) medical practitioners and one hundred and six (106) visitors. Also, at Lanlate general hospital,twenty (20) bed spaces were discovered with sixteen (16) medical practitioners and fifty-five (55) visitors (Table 1).

In the third stage,the sample size was chosen and Slovin formula was employed using:

$$n = \frac{N}{1+NE^2}$$

Where: n = Sample size
N= Population size
E= margin of error * i.e. 95% confidence level gives* desired (0.05)
n = 125 (Patients); 72 (Medical Practitioners)

Thus, a total of one hundred and twenty-five (125) patients, andseventy-two (72) medical practitioners were used for the study,while thirty-two (32) visitors, representing 10 percent of the total visitors were selected. This is because the population of visitors is large and the sample size selected is sufficient to capture the necessary information concerning the characteristics of the visitors. Thus, a total of two hundred and twenty-nine (229) respondents were used for the study. Three sets of questionnaires were used: the first set of questionnaires was administeredto patients, the second set to medical practitioners, while the third set of questionnaires was administered to the visitors. The questionnaire for patients was administered at peak hours when women normally give births and patients fall sick and observation shows this to be during rainy season and the questionnaire was harvested on the spot. Questionnaire for the medical practitioners was administered whenever they were on duty as they are normally on shifting basis: morning, afternoon and night duty. The third set of questionnaires for visitors was administered during visiting period (see Table 2).

Table 2: Sample Size

S/N	Hospital		Location	Patients	Medical Practitioners	Visitors/Weekly	Total Sample Size
1	Igboora Hospital	General	Igboora	42	16	10	68
2	Ayete Hospital	General	Ayete	20	13	5	38
3	Eruwa Hospital	General	Eruwa	43	28	11	82
4	Lanlate Hospital	General	Lanlate	20	15	6	41
	Total			**125**	**72**	**32**	**229**

Source: Author's Field Survey (2024)

Frequency counts and percentages were used to analyze the data collected. Mean Weight Value was used to measure the impacts of Biophilic elements on the health of residents in the area.

III. Results and Discussion

(i) Socio-economic Characteristics of Respondents

The gender distribution of respondents in the selected general hospitals in the study area revealed that more than half **(**52.8%) of the respondent were male, while female constitutes 47.2% (Table 1). However, majority (39.3%) aged 41-60 years, followed by those who aged 20-40 years (32.3%). Analysis shows that respondents were highly educated having HND/First/Post graduate degree (38.2%) and mostly worked with the public sector (43.2%) or were self-employed (20.5%).Almost four-tenths (38.9%) of medical professionals had

professional experiences of between 6 and 10 years, 11 – 15 years (36.1%) whereas, those with professional experiences less than 5 years were 13.9% and above 15 years constitute 11.1%. Thus, significant portions of the medical practitioners had reliable professional experience that enabled them to give accurate information on biophilic elements within hospital premises.

Table 1 : Socio-economic Characteristics of Respondents

S/NO	Variable	Frequency	Percentage (%)
1	**Gender**		
i	Male	108	47.2
ii	Female	121	52.8
	Total	**229**	**100.0**
2	**Age (Years)**		
i	<20	19	8.3
ii	20-40	74	32.3
iii	41-60	90	39.3
iv	>60	46	20.1
	Total	**229**	**100.0**
3	**Educational Background**		
i	No formal Education	41	17.9
	Primary Education	26	11.4
	Secondary Education	27	11.8
	NCE/ OND	46	20.1
	HND/First degree/ Post graduate	89	38.9
	Total	**229**	**100.0**
4	**Occupation**		
i	Public	99	43.2
ii	Private	29	12.7
iii	Self-employed	47	20.5
Iv	Unemployed	28	12.2
V	Student	26	11.4
	Total	**229**	**100.0**
5	**Years of Experience (Medical Practitioners)**		
I	<5 years	10	13.9
Ii	6-10 years	28	38.9
Iii	11-15 years	26	36.1
Iv	>15 years	08	11.1
	Total	**72**	**100.0**
	Total	**32**	**100.0**

Source: Author's Field Survey (2024)

(ii)**Available Biophilic Elements**

More than half (58.5%) of the respondents indicated that greenery and plants are the most dominant biophilic elements in the sampled hospitals. Some (27.9%) respondents attested to availability of natural light whereas, view of nature (6.6%) and walkways with shaded area (7.0%) were other biophilic elements within the sampled hospital premises (see Table 2). The implication of this is that respondents are sensitive to the presence of biophilic elements within the hospital premises in the study area. However, it is noted that all the general hospitals in Ibarapa region have different types of biophilic elements. Thus, the implication drawn is that all the general hospitals in Ibarapa region have diverse biophilic elements and greenery as well as plantsare the most common biophilic elements available in all the hospitals in the region.

Table 2: Biophilic Elements in Ibarapa General Hospitals

S/NO	Biophilic Elements	Frequency (N)	Percentage (%)
I	Greenery and Plant	134	58.5
Ii	Natural Light	64	27.9
Iii	View of Nature	15	6.6
Iv	Walkway with Shaded area	16	7.0
	Total	**229**	**100.0**

Source: Author's Field Survey (2024)

(ii) Impacts of Biophilic Elements on Health

Table 3 presents the summary of result of the perceived impact of biophilic elements on the health of patients as well as visitors in the study area. Likert scale was employed in measuring the weight of responses of respondents (patients and visitors) on the impacts of biophilic elements within the selected general hospitals.

The responses were grouped into five classes to determine degree of impact on the index placed by patients and visitors. The ratings (Very High- VH, High-H, Indifferent-I, Not High- NH and Not High at all- NHAA) were used to determine its level of impact and these were assigned weight of 5, 4, 3, 2 and 1 respectively to the ratings in deceasing order of relevance.

The result as presented in Table 2 revealed perceptions of both patients and visitors on the impact of biophilic elements on health. It was observed that biophilic elements have strong high impact on relaxation (IBEH = 4.46; 4.81) as well as visual delight (IBEH = 4.43; 4.59) as perceived by patients and visitors respectively. The implication of this is that some biophilic elements such tree canopies provide shelter against harsh weather condition. This is expected as variations in weather elements such temperature and sunshine could make ambient condition unbearable for patients' occupation. Additionally, visual delight is another impact of biophilic elements on the health in the sense that tree canopy reduces solar radiation with resultant implication on vista and views within the hospitals.

On the other hand, perceived impacts of biophilic elements were minimal on some health variables such as stress reduction (IBEH = 4.14; 4.53), mood improvement (IBEH = 4.16; 4.38) and cognitive restoration (IBEH = 3.97; 4.50). It is imperative to infer from the findings that impacts of biophilic elements on the aforementioned variables were not significant because of negative deviations around the mean.

Table 3: Perceived Impacts of Biophilic Elements on Health

Variables	**Patients**									**Visitors**								
	VH5	**H4**	**I3**	**NH2**	**NHAA1**	**NR(F)**	**SWV**	**IBEH**	**Rank**	**VH5**	**H4**	**I3**	**NH2**	**NHAA1**	**NR(F)**	**SWV**	**IBEH**	**Rank**
Relaxation	324	217	14	02	01	125	558	4.46	**1**	130	24	00	00	00	32	154	4.81	**1**
Visual Delight	222	235	52	09	36	125	554	4.43	**2**	95	52	00	00	00	32	147	4.59	**2**
Mood Improvement	181	289	41	06	03	125	520	4.16	**3**	60	80	00	00	00	32	140	4.38	**5**
Cognitive Restoration	181	217	84	14	00	125	496	3.97	**5**	80	64	00	00	00	32	144	4.50	**4**
Stress Reduction	203	271	32	11	01	125	518	4.14	**4**	85	60	00	00	00	32	145	4.53	**3**
Sum (Σ)								**21.16**									**22.81**	
	Mean = 21.16/5 = 4.23									**Mean = 22.81/5 = 4.56**								

Source: Author's Field Survey (2024)

(iii) Complimentary Biophilic elements Needed

Biophilic elements play important role in the health recovery of patients within the study area. Hierarchically, results show that the complimentary biophilic element needed in thegeneral hospitals include water features (38.9%); more plant (18.3%); large outdoor garden (17.9%); courtyard (10.5%); rocks (8.3%), outdoor space (4.4%) and natural light (1.7) as shown in Table 4. Thus, the import remains that the most prominent biophilic element preferred by respondents is water feature.

Table 4: Complimentary Biophilic Elements Needed in the General Hospitals

S/No	Biophilic Elements	Frequency (N)	Percentage (%)
I	More Plant	42	18.3
Ii	Larger Outdoor Garden	41	17.9
Iii	Rocks	19	8.3
Iv	Courtyards	24	10.5
V	Water Features	89	38.9
Vi	Outdoor Spaces	10	4.4
Vii	Natural Light	04	1.7
	Total	**229**	**100.0**

Source: Author's Field Survey (2024)

IV. Conclusion

This study had assessed biophilic elements in the general hospitals in Ibarapa region of Oyo State, providing insight into the available biophilic elements, usage, and impacts on the health of patients and visitors.However, there are significant areas for improvement, including lack of adequate biophilic elements,and limited accessibility features. To create a truly patient-centered and effective healthcare facility, it is essential to address these shortcomings and prioritize the incorporation of biophilic elements, accessibility features, and regular maintenance. By doing so, the hospital can provide a supportive and therapeutic environment that promotes overall well-being and enhances patient outcomes.

V. Recommendations

Based on the findings in this study, it has been revealed that healthy living of patients and medical practitioners is a product of several complex and interrelated elements. Essentially, various strategies have identified to improve quality health care delivery within the general hospitals in Ibarapa region.Thus. It is recommended thatemphasis should be harnessed to create outdoor gardens and courtyards for people to relax and connect with nature. The use of more indoor plants in waiting areas, wards and offices to bring greenery inside should be encouraged and water features should be introduced.To create aesthetically pleasing views of greenery of natural landscapes, it is necessary to orient patients' room accordingly. The use of biophilic materials like wood or stone for furniture and finishes should be prioritized with the general hospital.

It was observed during the fieldwork that biophilic elements were poorly maintained. Therefore, educational training should be conducted for hospital staff on the benefits and maintenance of biophilic elements. Furthermore, patients and visitors should be educated about the importance of nature for health and well-being. To achieve maximal usage of biophilic elements, environmental experts and stakeholders on the health care sector should advocate for policies that require biophilic elements in the design of new hospitals or renovation of existing ones. This will also require synergy between governments, hospital administrators and architects to embed biophilic design into the planning process.

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