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Theoretical Issues and Conceptual Framework for Physical Facilities Design in Hospital Buildings

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ABSTRACT

This study reviewed the theoretical issues relating to morphological and psychological design issues in hospital building design evaluation. The study of morphological configurations design issues, concentrates on the elements of building, shape/form, the structure of the environment, the structural efficiency and the architectural appearance of the hospital building forms. The psychological design issues focused on the essential issues relating to Proximity, Privacy and Wayfindings. Through the literature review of previous models such as, Khan (2012) Operational Efficiency Model, Haron, Hamid and Talib Usability Framework, (2012), Zhao, Mourshed & Wright (2009) Model, Alalouch, Aspinall & Smith Model (2016) and Hill & Kitchen (2009). A conceptual framework for physical facilities design evaluation and satisfaction in hospital buildings was developed. The study, however, provides useful information for the development of a design framework that can inform policy on hospital buildings.

1. Introduction

1.1 Background to the Study

In an ideal situation, the healthcare physical facilities in Nigerian hospitals are expected to deliver the highest quality of healthcare services to clients^[1]. But this ideal is never met due to the initial design consideration of the existing facilities in terms of number of patients per ward, spaces, sizes and availability, organization, location, accessibility, privacy, and proximity among other variables, which could no longer meet up with the current demand for healthcare services. Since this has seriously affected the patients well-being and reduced the staff performances^[2-5], research is needed to develop

policy strategies for renovation and construction of new hospital buildings and environmental facilities to improve the current healthcare situation.

The key drivers that result in the study of hospital physical facilities design include aging facilities (built in the 1950s and 1970s) that no longer support efficient and safe care delivery; advances in treating complicated diseases; rapidly emerging technologies that fundamentally change care delivery processes; and the growing importance of patient and family-centred care^[6]. This underscored the need to create optimal design of the hospital physical environments which could reduce medical errors, rates of infection, injuries from falls and staff stress, among others. It is, therefore, important to ad-

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dress some of these problems. Researchers and designers working in this field should put more effort in enhancing users' experience in the hospital environment. Hospitals are important components of the healthcare system; the attention on their architectural and spatial designs from user's perspectives needs more qualitative and quantitative researches^[7].

Measures from many researchers in both the developed and developing nations have been identified through the literature to examine the various aspects of healthcare physical facilities addressing design issues and satisfaction from both the patients, caregivers and healthcare professionals' perspectives. For example, the study conducted by^[2] focused on the performance of hospital inpatient ward spatial configuration in relation to visibility. The findings show the importance of visibility as experienced by the users in hospital ward; and^[8] focused on design such as layout typologies, space connection to another building, shape and arrangement of spaces as factors that determined overall hospital satisfaction. While^[9] measured the design issues relating to exterior space quality, orientation, green spaces, building aesthetics, interior space quality, spatial physical comfort, quietness, views and lighting, cleanliness, good signs/information points, adequate seating, overcrowding, and privacy for conversations. These studies failed to critically develop conceptual framework that examine the relationship between the special configurations, the psychological design issues underlying the user's satisfaction in hospital buildings. Hence, this study becomes necessary.

2. The Literature Review

2.1 The Morphological Design Configuration

The study of morphology focuses mainly on the use of space syntax which contains a set of techniques and theories and is applied to the study of spatial configuration^[10]. The study concentrates on the elements of building, shape/form, the structure of the environment, the structural efficiency and the architectural appearance of building forms^[11-12]. The movement flows in the building environment are mainly determined by the spatial configuration of the physical facilities which places more emphasis on physical form and human behaviour^[13] and influence users' sensory perceptions, and affect staff efficiency and productivity^[14].

Also, the morphological spatial configuration approach from hospital perspectives and architectural configuration of a space is more than just the geometric organization. According to^[7], hospital buildings are im-

portant components of the healthcare system; therefore, proper attention must be paid to their architectural and spatial designs. However, the morphology of hospital spatial facilities focused on different specializations of physical flow in the hospital environment which is considered as the interplay between spatial, organizational and the configuration of work processes and routines within the hospital environment^[15]. The workplaces are more centred on specific hospital physical facilities locations and the activities around them, whereas the landscape of the hospital environment is more defined by movement between interior and exterior spaces. According to^[16], interior spaces within buildings are defined by the architectural elements of structure and enclosures which include doors, ceilings, walls, windows, doorways, and stairways. Interior elements are fit for visual and functional purposes that incorporate aspects of materials, construction, and technology.

Many studies have examined the different aspects of hospital workplace environment using the concept of space syntax. Only few of these studies have empirically studied the morphological design of hospital physical facilities. For example,^[15] analysed hospital workplace environments from architectural configuration and time-space properties perspectives. The authors offered a limited range of variation of spatial configuration and workflow. An interview method of data collection was conducted using different hospital physical facilities such as nurses' stations, the medicine room, emergency ward (both internal, external, and technical conditions) and spatial conditions and workflow practice for each unit was evaluated. The finding showed that users of the facilities were satisfied with overall spatial condition and workflow pattern of the facilities and the result highlights the interrelationship between occupational patterns, spatial configuration, and the users.^[2] Addresses the spatial configuration of a hospital inpatient ward in relation to the degree of visibility as an important aspect of patient care in the ward. The findings of the study have some implications for improving the performance of spatial organization of hospital inpatient wards in terms of visibility.

Similarly,^[17] conducted a study to understand the contribution of space syntax to the improvement of operational efficiency and analysis of patient flow in healthcare settings. The model suggests that physical and visual accessibility of spatial layout, through their effects on patient movement, service delivery, and way-finding, may help reduce travel time, waiting time, service delivery time and, by increasing patient satisfaction, improve operational efficiency in healthcare settings^[17]. In a

similar tone,^[18] focused on a new approach to the flows system analysis in the Careggi University Teaching Hospital in Florence. The study showed the potentiality of an evidence-based approach combining both the social and spatial aspects concerning the people's movement compared to the traditional functional approach. The architectural use of these forms alongside their influence on our man-made environment is of general importance. They defined the overall shape of the building structure and its internal configuration^[19] which can be interpreted as building sizes, shape building densities, spatial forms, frontage patterns, physical connections, and arrangement of interior furniture, location, accessibility, and connection to the neighbourhood and landscape facilities, among others^[19]. The morphological configuration of spaces can be further classified as external and internal configuration of the physical facilities.

2.2 The Psychological Design Features

Studies have shown that psychological design issues are vital and require more attention when planning the hospital environment especially when planning for psychiatric and children hospitals^[20-21]. The psychological design attributes identified from the literature are privacy, proximity and way-finding. These issues are discussed below;

2.2.1 Design for Privacy

^[22] described architectural privacy as a visual and acoustic isolation supplied by an environment. The focus here is on visual privacy as a function of the arrangement of spaces. Patients' privacy in hospital settings is widely recognized as important factors for patients' well-being and satisfaction.^[20] defines privacy preference as the biased interpersonal boundary by which people regulate interaction with others.

On a psychological level, the importance of privacy for system-maintenance and system-development has been acknowledged by both theory and research^[23-24]. Fulfilling people's needs for privacy is linked to their well-being and the evolution of recent trends^[24-26] has further emphasized the concept of patients' privacy and its importance for patients' well-being. A survey by^[27] of 140,000 hospital patients also showed privacy to be of primary concern to patients. Healthcare providers have a duty to treat patients with respect to protect their personal data. Single-sex accommodation being with other patients of the same gender is an important component of privacy and dignity. This type of accommodation can take a number of different forms, for instance, the sin-

gle-sex wards, single-sex bedded bays and single rooms. The hospital should provide a combination of these different types of accommodation.

In addition to segregation based on gender, the patients prefer to have the ability to make their personal space private when necessary^[24]. Empirical study conducted by^[9] reported that overcrowding, and privacy for conversation determines the environmental physical quality of a healthcare environment. Similarly,^[28] conducted a survey in a maternity health centre and found that, despite being treated politely, lack of auditory and visual privacy led women to not using a maternity facility. Hence, provisions to ensure privacy in health facilities are warranted.

2.2.2 Design for Proximity

The study of proximity in hospital physical facilities seems to be a very scarce area of study^[24]. The proximity of patients and staff is considered as the absolute traveling distance to their nearest hospital and the distance travelled between the hospital's physical facilities^[17]. Also, studies have shown that visiting rates are strongly correlated with travelling distance from the hospital and utilization of inpatient and outpatient hospital care areas^[24].^[21] regarded proximity as an important concept that determines the attributes of the physical setting of a healthcare layout environment. Similarly,^[29] interrogated the relationship between hospital services, physical facilities and level of satisfaction with services and facilities which showed there was significant relationship between the treatment rooms and lobby areas, which supports the argument that it is important for patients to have the two areas in close proximity. In addition, the study of^[30] pointed out young children's need to experience proximity environment. However, design for proximity should be done in accordance with the principle of proximity of perceptual organization which stated that stimuli or objects that are in close proximity to each other can be clearly perceived when being grouped together^[30; 24]

2.2.3 Design for Way-finding

The problems in way-finding for patients and visitors are common in hospitals^[24]. These difficulties can result in feelings of agitation, disorientation and a loss of control^[31]. Way finding may help reduce travel time, waiting time, service delivery time and increasing patient satisfaction, thereby improving operational efficiency in healthcare settings^[17;24]. Although colour coding is often used to assist in way-finding, one group of authors warns that it is often misunderstood by patients and visitors

to the hospital [32]. However, the studies of way-finding have been examined in various aspects of hospital physical facilities studies. [33] explored the impact of these architectural hospital design factors on patient satisfaction in psychiatric facilities. The findings showed that design assessment regarding wayfinding is a valuable input to support evidence-based design in the hospital environment.

[21] found out that wayfinding is an important concept that determines the attributes of the physical setting of a healthcare layout environment. [34] pointed out that way-finding is a crucial physical design element of an elder-friendly hospital. Further studies by [35] showed that wayfinding is an interior physical design component of outpatient healthcare facilities. Similarly, [36] included way-finding as hospital design factor in an attempt to assess the impact of architectural design on psychosocial well-being among patients and staff in the context of a new complex continuing care and rehabilitation facility. In addition, [37] considered way-finding around the hospital as a factor that enhanced the physical facilities of the patient and care environment which also improved patients' overall satisfaction.

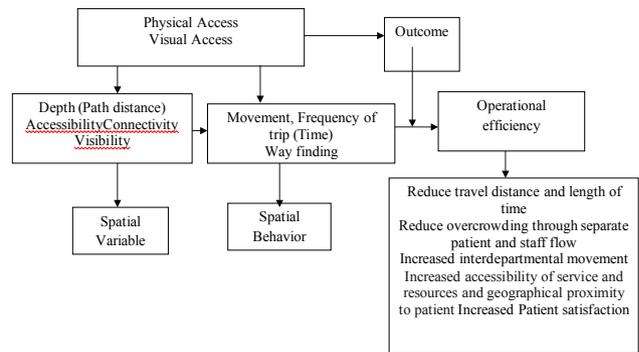
2.3 Theoretical Framework for Hospital Facilities Design

The models and theories adopted in this study documented the relevant design issues relating to the hospital physical facilities design evaluation and satisfaction. Most of the theories stressed recognizable cues that are understood by potential users of the building. The models and theories identified from the literature include the [17] Operational Efficiency Model, [38] Usability Framework the [39] Model, [40] Model and [41] Model (2009).

2.3.1 The Khan, (2012) Model

[17] model used the constructs of space syntax to analyse patient flow in healthcare settings and suggested that physical and visual accessibility of spatial layout affect patient movement and service delivery. An easily accessible and visible spatial layout may have direct or indirect positive effects on patient's movement, frequency of trip, visibility and way-finding. These may increase operational efficiency in the hospital settings. The model will be applied to give clear evaluation of the morphological design configuration in the proposed model, such as shape, form, arrangement of interior furniture, location, accessibility, connection to the neighbourhood, attached facilities and amenities, design components facilities and landscape facilities (Figure 1.0)

Table 1. Khan, (2012) Model For Constructs of Space Syntax



2.3.2 Haron, Hamid and Talib (2012)

[38] developed a model to understand the improvement in spatial layout of hospital which led to more efficient, effective, user-friendly work-facilitating environment that improved the comfort level of outpatient's facilities. The findings indicated a positive users' experience of quality of care, usability of physical environment design that fulfils their needs and strong relationship between the usability physical environment criteria and overall patient satisfaction. The model will be applied in this study, to evaluate the design features relating to morphological configuration of spatial usability in terms of organization, layout location and movement pattern among others which is one of the objectives of this study (Figure 2.0).

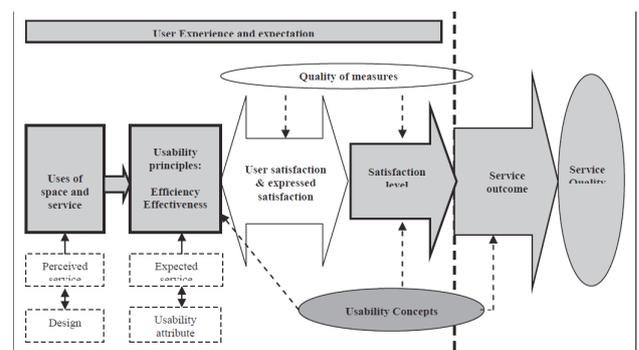


Figure 1. Haron, Hamid and Talib Usability Concept in Healthcare Design

2.3.3 Zhao, Mourshed & Wright, (2009)

The third model, developed by [39], focused on patient-centred design of healthcare facilities and indicated that the physical environment of a hospital is influenced by how various activities are laid out and linked with the indicators, such as safety and wellbeing, organizational, spatial configuration, energy and environment which determine the user satisfaction. Findings from their study suggest that the developments in health care delivery and in allied fields have implications for the design of space layouts and result-

ing buildings, in ways crucial for efficiency and productivity. The model will be applied in this study, to evaluate the design features relating to user's satisfaction (Figure 3.0)

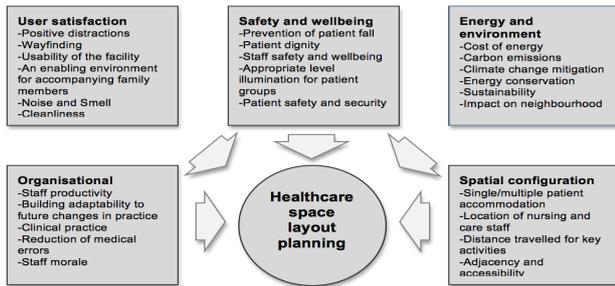


Figure 2. Zhao, Mourshed & Wright Model of patient-centred design of healthcare facilities, (2009)

2.3.4 Alalouch, Aspinall & Smith Model

^[40] developed model for hospital design criteria at three levels such as; ward design, ward spatial arrangement; patient's privacy and patient's visual privacy. The aim is to assess how policies and guidance documents in the UK have dealt with architectural privacy in hospitals. However, the model provides a unique source for the minimum hospital ward design criteria that are related to patient's privacy and also provides a design aid to further enable architects and healthcare building providers to make better informed decision regarding design proposal of hospital wards ^[40].

(AEDET) has a clear structure to categorize all design criteria which were distilled from the four NHS toolkits. The (AEDET) is based on the design quality indicator (DQI). The DQI has been developed to evaluate design quality of buildings in the four key stages of building development. The model was applied in this study to evaluate the design criteria for privacy within the internal spaces provided in the inpatient wards of the physical facilities design of the hospital buildings in the developing nations. The model is represented in the figure 4.0.

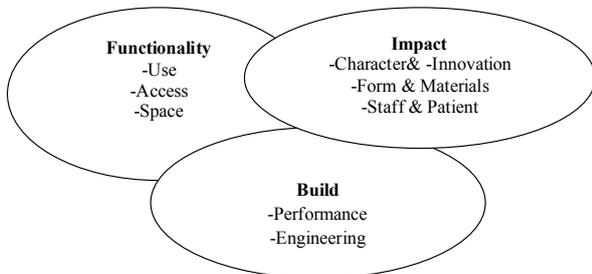


Figure 3. AEDET Structure Based on Design Quality Indicator developed by Alalouch, Aspinall & Smith, (2016)

2.3.5 Hill & Kitchen (2009)

^[41] developed a theory to underpin the concept of sat-

isfaction with the healthcare in patient facilities such as physiotherapy. The theory of patient satisfaction with physiotherapy was developed by exploring the concepts of need and expectations that are proposed as being important determinants of the construct in relation to the physiotherapeutic approach to care. Such a theory is important in physiotherapy because it can inform current practice and its evaluation and have implications for future patient care.

^[41] also developed a model to describe patient satisfaction with outpatient physiotherapy. The model identifies possible factors leading to satisfaction and provides an explanation for the relationship between expectations and satisfaction as a basis for patients' evaluation of their physiotherapy care.

From the theoretical framework, the first three theories reviewed can be applied to the present study because they can be useful to assess the user's perception of hospital physical facilities design with a view to developing framework that can inform design decisions on the hospital buildings.

Finally, the studies of theories in this research call for the need to integrate individual opinion on the interaction between people and the physical environment. There is no doubt that these theories will guide the issues to address the assessment of the user's perception of the

3. Methodology

The research is based on a critical review of the current state-of-the art of the healthcare building design. Advanced literature review was done to look at various design issues relating to the study of the morphological configuration of physical facilities such as (space layout design) among others and the psychological design issues such as (Privacy, proximity and wayfindings) underlying the study of spaces in the hospital buildings and its environment. Several strategies were employed to identify potential studies/articles for the review. An information portal has been used to identify relevant catalogs, reference databases, citation databases, journals and conferences. Relevant journals, magazines and newspapers in the topics of healthcare design, patient safety and patient recovery were identified through Google search as well. Detailed review was conducted on the 41 of the 65 literatures. The objective was to understand how these identified design factors affect the healthcare physical facilities satisfaction.

4. The Conceptual Framework For The Study

The framework for this study is derived from the literature review and theories discussed in the previous sections of this study. This study developed a framework that can be

used to examine the relationship among user's characteristics, design of the physical facilities and the level of user's satisfaction with the hospital physical facilities in the study area. The pictorial presentation of the model is shown in Figure 5.0. Two design characteristics are involved here; the morphological design configuration and the psychological design characteristics of the physical facilities.

This present study defines the morphological design configuration of the physical facilities as external and internal configuration. The external configuration refers to the physical plan layout of the building and spaces, quality standard of materials for exterior façade, accessibility of building, frontage patterns, building impression and aesthetic, size of window, building shape, spatial forms, exterior space quality and landscape, among others. The internal configuration is defined by features such as shape/form, organization of interior furniture, spatial visibility within the ward spaces, decoration & artwork of spaces, space sizes and proportion, interior movement flow within the ward spaces, flexibility of spaces, attached facilities and amenities, materials of interior architectural elements, which include doors, ceilings, walls, windows, doorways and stairways, among others.

However, a comprehensive model that examine the relationship between the user's perception of the physical facilities design, users' socio economic status and the effect on individual satisfaction is still missing in the literature. This research is an attempt to propose a model that could describe the relationships.

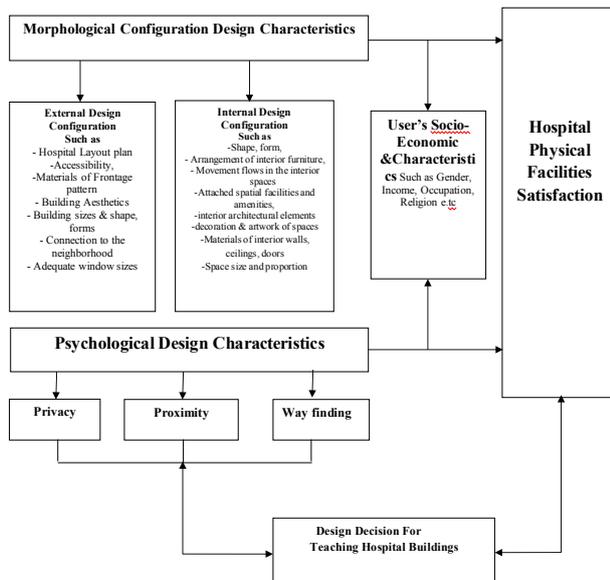


Figure 4. Author's Conceptual Framework Derived from Haron, Hamid and Talib, 2012, Zhao, Mourshed&Wright Model, 2009 and Khan, (2012) For Constructs of Space Syntax

5. Conclusion

This study have succeeded in reviewing the theoretical issues relating to morphological and psychological design issues in hospital building design evaluation. Through the literature review of previous models such as, [17] Operational Efficiency Model, [38] Usability Framework, [39] Model, [40] and Hill & Kitchen (2009) [41]. A conceptual framework for physical facilities design evaluation and satisfaction in hospital buildings was developed.

In conclusion, the relationship between the designs of the physical facilities such as the morphological configuration, the psychological design characteristics of the physical facilities and satisfaction with the hospital physical facilities have been displayed with respect to individual socio-economic characteristics. It shows that the design of the physical facilities determines the hospital's satisfaction which could inform Hospital buildings design decision.

This study did not only develop a framework that will inform design decision on hospital buildings but also share the information relating to crucial design issues of the health care physical facilities. The study also helps in the transformation of design procedure needed in providing safe care environment for patients and good working condition for its staff; thereby increase the user's satisfaction of hospital buildings. It can also serve as reference document that will support the needs of the health care professionals and workforce in the future.

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