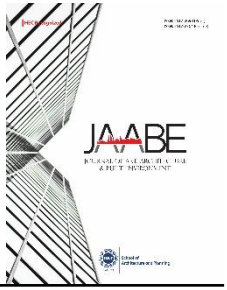
Journal of Art, Architecture and Built Environment (JAABE)
Volume 5 Issue 1, Spring 2022
ISSN(P): 2617-2690 ISSN(E): 2617-2704
Homepage: https://journals.umt.edu.pk/index.php/jaabe

Article QR



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DOI: https://doi.org/10.32350/jaabe.51.03

History: Received: August 11, 2021, Revised: February 12, 2022, Accepted: April 28, 2022

Citation: Ubaid Ullah, Ali, I., & Pasrk, J. S. (2022). Development of a designer's checklist for the designing of an optimal healing environment in primary, secondary, and tertiary healthcare facilities (HFCS). *Journal of Art, Architecture and Built Environment*, *5*(1), 52–66. https://doi.org/10.32350/jaabe.51.03

Conflict of Interest: Author(s) declared no conflict of interest

A publication of
School of Architecture and Planning
University of Management and Technology, Lahore, Pakistan

Development of a Designer's Checklist for the Designing of an Optimal Healing Environment in Primary, Secondary, and Tertiary Healthcare Facilities (HFCs)

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Abstract

The purpose of this research is to develop a designer's checklist encompassing the various categories of healthcare facilities (HCFs). This checklist is based on the research available about the elements/factors of the healing environment. An evidence-based design was used to conduct this study. Online database searches on Google Scholar, JSTOR, Scopus, and PubMed using various keywords, such as healing environment, evidence-based design, patient safety, infection, medical errors, patient falls, stress reduction, social support, single bedroom, views of nature, daylighting, music therapy, and noise levels in a healthcare setting were used for data collection. The collected data was analyzed based on the level of evidence and sorted accordingly for the development of three types of a designer's checklist encompassing optimal healing environments. All the elements/ factors of environmental design were coded according to their level of evidence and were sorted into three categories: 1) Fair level of evidence (F) comprising expert opinions, case series, and case reports, 2) Good level of evidence (G) comprising cohort studies and case-control studies, and 3) Excellent level of evidence (E) comprising randomized controlled trials and systematic reviews. To create an optimal healing environment, this study proposes three different levels of healing environments corresponding with the three levels of HCFs as follows: 1) healing environment Level-I for tertiary HCFs includes elements/ factors of environmental design with E, G, and F levels of evidence, 2)healing environment Level-II for secondary HCFs includes elements/ factors of environmental design with E and G levels of evidence, and 3)healing environment Level-III for primary HCFs includes elements/ factors of environmental design with E level of evidence.

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This study makes the designing and renovation of HCFs to create an optimal healing environment easily measurable and achievable.

Keywords: checklist, healing environment, healthcare facilities (HCFs), hospital design, measurement

Introduction

Background and Objective

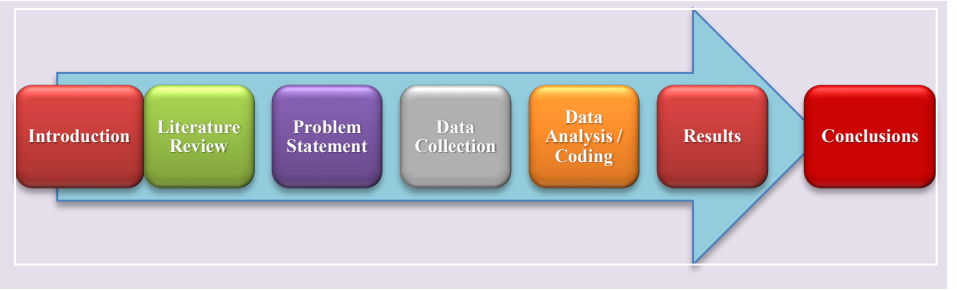
The concept of a healing environment is not new. It has been present since antiquity and has been reinforced by today's evidence-based design (EDB) research. The current healing environment and EBD research consists of case studies, post-occupancy evaluation (POE), literature reviews, experiments, and reports, with the limitation posed by the absence of a comprehensive checklist of healing environmental quality of a hospital space. A growing body of research has now established, both on academic and professional healthcare levels that the environment can be a good healer and it can also hinder the healing process (Chaudhuryet al., 2005). Since EBD has provided the required scientific data on the subject to be validated, this field of study is growing rapidly. In 1998, the Center for Health Design contracted Johns Hopkins University to analyze all research published in this field. The analysis showed a connection between design interventions and medical outcomes that met the rigors of the medical establishment, such as where to place sinks to encourage hand washing and how to position rooms and windows to reduce the length of stay.

The survey was repeated with Texas A&M and Georgia Tech in 2004. Moreover, the analysis was based on 1200 studies in 2008 (Whitemyer, 2010). Many of the HCFs have adapted their facilities to the healing environment, using different elements/factors of environmental design (Barnhart et al., 1998; Carpman et al., 1990; Daykin & Byrne, 2006; Huelat, 2007; Choi, et al.,2012). The purpose of this research is to develop a checklist for healing environment design in terms of Level-I, Level-II, and Level-III healing environment, corresponding to the three basic levels of HCFs, that is, tertiary, secondary and primary level, respectively. The level of the corresponding healing environment for each level of HCFs is termed as the optimal healing environment in this research. Furthermore, the established model of healthcare delivery system is accepted, which proposes the efficient use of resources and the required level of healing to be offered by HCFs.

The research flow chart used in this study is shown below in Figure 1.

Figure 1

Research Flow Chart



Literature Review

The current literature about EBD and healing environment contains the following lists of design elements/factors (Ulrich et al, 2010) developed two types of lists of design interventions that affect health outcomes. The first one "A model of the participant and organizational outcomes of the healthcare-built environment" is a general model which includes a very detailed description of built environment attributes and outcomes. These are not referenced and thus no level of evidence is provided. The second one "State of EBD Research for Patient Outcomes" provides a list where design interventions are grouped into seven broad categories including "audio environment". Health outcomes related to each category are described in terms such as 'strong evidence', 'empirical', and 'not yet supported directly by empirical studies'. The limitation of this study is the absence of elements or outcomes as well as the fact that an evidence-based approach has not been used by the authors, which makes it difficult to know what aspects of the healing environment, are of primary importance (Basner, 2014). Another study by Sadler et al. (2009) provides the lists of design interventions with their outcomes and references; however, the level of evidence is not mentioned in these checklists. (Ulrich et al., 2008) provided a list of health outcomes and design or environmental interventions with two levels of evidence: the first is direct (or indirect evidence) and the second is strong evidence. There is another study by Huisman et al. (2012) which provides the outcomes with four levels of evidence, although the related design intervention is not mentioned by the authors.

Problem Statement

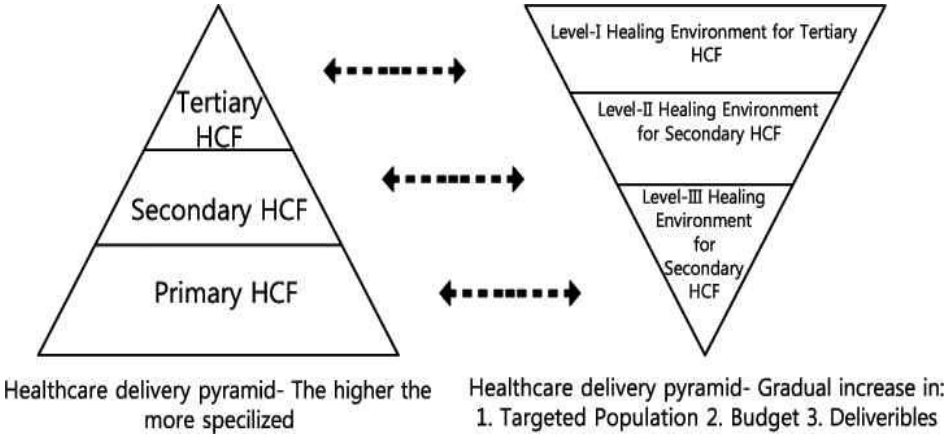
The existing research about the healing environment and EBD has the following limitations: 1) there is no comprehensive checklist of design elements/ factors which have a proven impact on health, 2) the level of evidence for a specific design element concerning health outcomes is not mentioned, and 3) the extent to which design intervention is required at primary, secondary and tertiary levels of HCFs remains unknown.

Optimal Healing Environment

Although countless design interventions can affect the health directly or indirectly, the extent to which these interventions are needed for a particular level of HCFs keeping in view the budget, the delivery level, and the required health outcomes is debatable. Based on the healthcare delivery models of primary, secondary, and tertiary healthcare, this study proposes three different levels of a healing environment corresponding with the three levels of HCFs. These levels are based on the healthcare delivery model of primary, secondary, and tertiary healthcare and are termed as optimal healing environments in this study. The pyramid (see Fig 2 below) on the left side shows the progressive specialty of healthcare delivery, while the reverse pyramid on the right shows the population, budget, and level of healthcare delivery as opposed to the traditional model. In this model, the healing environment level required at each level of HCFs is proposed.

Figure 2

Optimal Healing Environment and the Corresponding Healthcare Setting



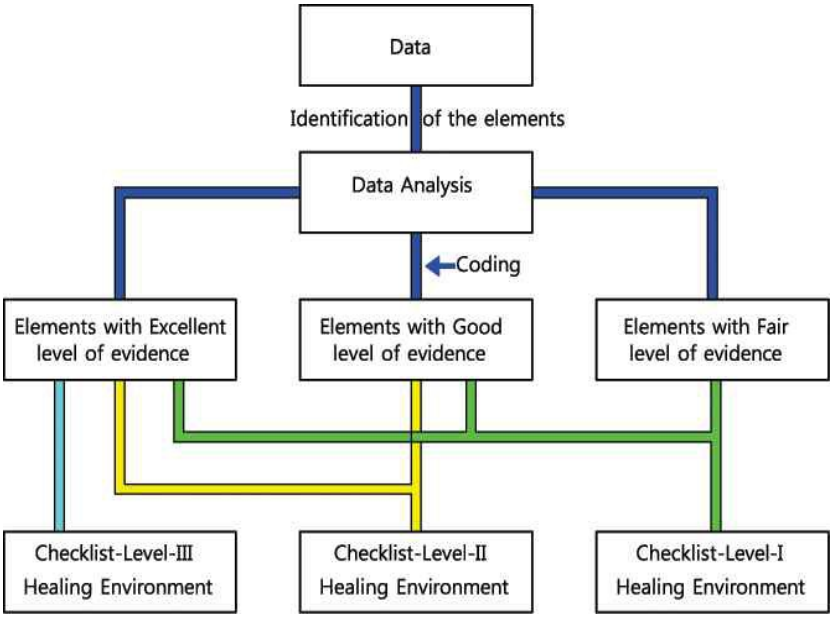
Methodology

Data Collection

The primary source of data collection were the online computerized database searches on Google Scholar, JSTOR, Scopus, and PubMed using keywords such as evidence-based design, patient safety, healing environment, infection, medical errors, patient falls, stress reduction, social support, single-bedded room, nature and daylighting, music therapy, and noise levels in healthcare.

Figure 3

Conceptual Framework



Three ways for data collection using online databases were used. They are stated as follows:

i. A single keyword search was performed on these databases to find the relevant published research.
ii. Secondly, a combination of two or more keywords was used to find the relevant data.
iii. Finally, search was performed using the names of researchers or authors who are well known in the field of healing environment and EBD.

The search method is summarized in Table 1 below.

Table 1

Search Methods Using Online Databases

Search Method	Database Names (Google scholar, JSTOR, Scopus, and PubMed)
Single keyword search	For example, healing
Keyword combination search	For example, healing environment
Search by authors	For example, Ulrich, Rogers

Data Analysis

Inclusion and Exclusion

The collected data were analyzed for inclusion or exclusion based on the following factors:

1. Only those publications were selected which focused on HCFs.
2. The search was limited to only English-language publications.
3. Publications which were purely medical/ surgical in terms of healing and evidence were excluded.

The selected publications were analyzed for the elements/ factors of the built environment, the effect they produce, the health outcomes related to a specific element /factor, and the level of evidence on which these outcomes are based.

Coding

The selected elements were assigned a code corresponding to the level of evidence as Excellent (E), Good (G), and Fair (F). The E level of evidence was assigned to the studies based on randomized controlled trials and systematic reviews, the G level of evidence was assigned to cohort and case-control studies, and the F level of evidence was assigned to the elements and their related outcomes based on case series, case reports and expert opinions, as shown in Table 2below.

Table 2

Coding of Environmental Elements

Elements of Design	Effect	Health Outcomes	Level of Evidence and Reference
Windows	Daylight	Reduced depression	Excellent (18)
		Reduced pain and Stress	Good (35)
	View of nature	Reduced pain	Excellent (32)
Natural/ Artificial lighting provision	Bright light	Decreased medical errors	Good (5 and 7)
Artwork	Positive distraction	Reduced stress, pain relief	Excellent (12 and 34)
Floor and wall materials	Easy to clean	Infection control	Excellent (34)
Wall and ceiling materials	Sound absorbing	Reduced stress, improved sleep, satisfaction, re-hospitalization	Excellent (34)
		Decreased medical errors	Good (4)
Gardens and plants	Physical access	Reduced stress and increased social support	Good (28, 36)
	Visual access	Reduced stress, pain and length of stay	Excellent (14, 32, 33)
	Physical/ visual access	Helps orientation while moving through the facility	Fair (33)
Design strategies for fall prevention	Non-slippery floors, appropriate door openings, proper placement of rails and accessories, and appropriate heights of toilet and furniture.	Reduced falls	Fair (6)

Elements of Design	Effect	Health Outcomes	Level of Evidence and Reference
Single bedrooms	Encourage family member company time	Reduced falls	Fair(34)
	Increased isolation	Reduced hospital infections	Excellent (9, 13)
	Noise barrier	Reduced noise	Good (25, 29, 38)
Legible layout	Cognitively comprehensible way finding	Reduced frustration and stress	Fair (8, 19, 39)
Acoustic wall	Decreased overhearing/ noise	Reduced stress, improved sleep, increased privacy, sense of control over social interaction	Good (17, 34)
Room layout	Same handed rooms	Reduced medical errors	Fair (2, 33)
Ceiling	Visual stimuli	Reduced pain	Excellent (15)
Orientation of patient rooms	Sunny rooms	Reduced length of stay	Good (3, 10)
Indoor quality	Ventilation, dust, smell, relative humidity, and air quality	Health and comfort	Good (1, 23)
Hand washing facilities	Accessible and proper in Number	Reduced infection	Good (21, 24)
Music	Specific types of Music and natural sounds, such as birds	Reduced pain	Good (22, 27)

Note: Level of evidence (30): F= Fair level of evidence: expert opinions, case series, and case reports, G= Good level of evidence: cohort studies and case-control studies, E= excellent level of evidence: randomized controlled trials and systematic reviews.

Development of a Designer's Checklist

Based on the coded elements, three types of a designer's checklist were developed for the primary, secondary, and tertiary HCFs, as shown in Fig 2 and Fig 3 below.

Level-III Healing Environment Checklist

An optimal healing environment for primary healthcare includes those elements/factors of the built environment which have the highest value evidence (the E level of evidence). Elements from the studies based on randomized controlled trials and systematic reviews generated the highest level of evidence and assigned level of evidence in this study. This checklist includes the elements/factors of the built environment which are essential for all levels of HCFs, as shown in Fig4.

Figure 4

Three Levels of a Healing Environment

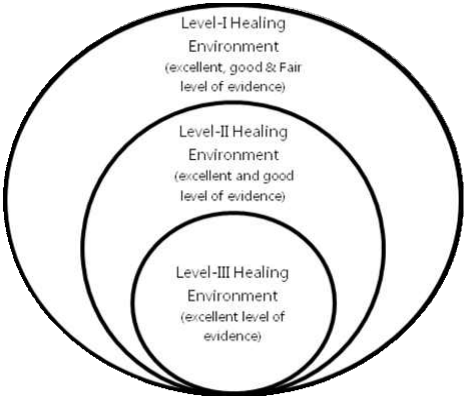


Table 3

Checklist for Level-III Healing Environment (for the primary HCFs)

Elements of Design	Required Effect	Level of Evidence
Windows	Daylight	Excellent
	View of nature	
Artwork (specific types)	Positive distraction	
Floor and wall materials	Easy to clean	

Elements of Design	Required Effect	Level of Evidence
Wall and ceiling materials	Sound absorbing	
Gardens and plants	Visual access	
Single bedrooms	Increased isolation	
Ceiling	Visual stimuli	

Level-II Healing Environment Checklist

An optimal healing environment for secondary healthcare includes elements/factors of the built environment evidenced from randomized controlled trials and systematic reviews, given an Elevel of evidence in this study. It also includes elements/factors evidenced from cohort studies and case-control studies, given a G level of evidence in this study.

Table 4

Checklist for Level-II healing environment (for the secondary HCFs)

Elements of Design	Required Effect	Level of Evidence
Windows	Daylight	
	View of nature	
Artwork (specific types)	Positive distraction	
Floor and wall materials	Easy to clean	
Wall and ceiling materials	Sound absorbing	
Gardens and plants	Visual access	Excellent
Single bedrooms	Increased isolation	
Ceiling	Visual stimuli	
Natural/ Artificial lighting provision	Bright light	
Gardens and plants	Physical access	Good
Single bedrooms	Noise barrier	
Acoustic wall	Decreased overhearing/ Noise	

Elements of Design	Required Effect	Level of Evidence
Orientation of patient rooms	Sunny rooms	
Music	Specific types of music and natural sounds, such as birds	

Level-I Healing Environment Checklist

Finally, the healing environment proposed for a tertiary healthcare setting in this study includes elements/ factors of the built environment evidenced from randomized controlled trials and systematic reviews, given an E level of evidence in this study. Moreover, it also includes elements evidenced from cohort studies and case-control studies, given a G level of evidence in this study, as well as elements evidenced from case series, case reports and expert opinions, given an F level of evidence in this study.

Table 5

Checklist for Level-I Healing Environment (for the tertiary HCFs)

Elements of Design	Required Effect	Level of Evidence
Windows	Daylight	Excellent
	View of nature	
Artwork (specific types)	Positive distraction	
Floor and wall materials	Easy to clean	
Wall and ceiling materials	Sound absorbing	
Gardens and plants	Visual access	
Single bedrooms	Increased isolation	
Ceiling	Visual stimuli	
Natural/ Artificial lighting provision	Bright light	
Gardens and plants	Physical access	Good
Single bedrooms	Noise barrier	
Acoustic wall	Decreased overhearing/ Noise	
Orientation of patient rooms	Sunny rooms	

Elements of Design	Required Effect	Level of Evidence
Music	Specific types of music and natural sounds, such as birds	Fair
Design strategies for fall prevention	Non-slippery floors, appropriate door openings, proper placement of rails and accessories, and appropriate heights of toilet and furniture.	
Single bedrooms	Encourage family member company time	
Legible layout	Cognitively comprehensible way finding	
Room layout	Same handed rooms	

Conclusions

1. The major purpose of this study was to provide an architectural and interior design view of the built environment of HCFs and to identify elements /factors of the built environment evidenced for their effectiveness and outcomes (directly or indirectly) on the patients, thus influencing the healing process.
2. This study did not include elements/ factors of the built environment which are purely operational in nature, as well as the factors related purely to healthcare staff and management activities.
3. The classification proposed in this study provides a structure relating causal elements to health outcomes. These are grouped under three levels of evidence, that is, Excellent (E), Good (G), and Fair (F).
4. Moreover, one health outcome can be affected by more than one built environment element/factor (for instance, stress levels are affected by noise, temperature, and lack of contact with green areas /gardens).
5. Conversely, one built environment element/ factor may produce several health outcomes, for instance, light affecting expression and medical errors.

6. Finally, the checklists developed in this study are not exhaustive and, therefore, do not cover the entirety of the subject. Rather, they provide a structure for further research in the domain of architecture and interior design based on EBD and healing environment design.

References

Barnhart, S. K., Perkins, N. H., & Fitzsimonds, J. (1998). Behaviour and outdoor setting preferences at a psychiatric hospital. *Landscape and Urban Planning*, *42*(2-4), 147-156. https://doi.org/10.1016/S0169-2046(98)00083-8

Basner, M., Babisch, W., Davis, A., Brink, M., Clark, C., Janssen, S., & Stansfeld, S. (2014). Auditory and non-auditory effects of noise on health. *The lancet*, *383*(9925), 1325-1332. https://doi.org/10.1016/S0140-6736(13)61613-X

Carpman, J. R., Grant, M. A., & Simmons, D. A. (1990). Avoiding the hidden costs of ineffective way finding. *Health Facilities Management*, *3*(4), 28-30.

Chaudhury, H., Mahmood, A., & Valente, M. (2005). Advantages and disadvantages of single-versus multiple-occupancy rooms in acute care environments: a review and analysis of the literature. *Environment and Behavior*, *37*(6), 760-786. https://doi.org/10.1177/0013916504272658

Choi, J. H., Beltran, L. O., & Kim, H. S. (2012). Impacts of indoor daylight environments on patient average length of stay (ALOS) in a healthcare facility. *Building and Environment*, *50*, 65-75. https://doi.org/10.1016/j.buildenv.2011.10.010

Daykin, N., & Byrne, E. (2006). *The impact of visual arts and design on the health and wellbeing of patients and staff in mental health: A systematic review of the literature*. Centre for Public Health Research.

Huelat, B. J. (2007). *Wayfinding: Design for understanding*. The Center for Health Design: Concord.

Huisman, E. R., Morales, E., van Hoof, J., &Kort, H. S. (2012). Healing environment: A review of the impact of physical environmental factors on users. *Building and Environment*, *58*, 70-80. https://doi.org/10.1016/j.buildenv.2012.06.016

Sadler, B., Joseph, A., Keller, A., &Rostenberg, B. (2009). Using evidence-based environmental design to enhance safety and quality. *Cambridge, Massachusetts: Innovation Series*, *2009*, 1-25.

Ulrich, R. S., Berry, L. L., Quan, X., & Parish, J. T. (2010). A conceptual framework for the domain of evidence-based design. *HERD: Health Environments Research & Design Journal*, *4*(1), 95-114. https://doi.org/10.1177/193758671000400107

Ulrich, R. S., Zimring, C., Zhu, X., DuBose, J., Seo, H.-B., Choi, Y.-S., Quan, X., & Joseph, A. (2008). A review of the research literature on evidence-based healthcare design. *HERD: Health Environments Research & Design Journal*, *1*(3), 61-125.

Whitemyer, D. (2010). *The Future of Evidence-Based Design. International Interior Design Association* IIDA.http://www.iida.org/content.cfm/the-future-of-evidence-based-design