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The Death of Modern Hospitals: Towards a Comprehensive Approach for Restorative Healthcare Environmental Design

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Abstract

This study criticises the design strategies of today's so-called sustainable hospitals which mainly focus on reducing the hospitals' adverse impact on the environment and energy consumption rates. Based on a review of the historical literature, the study offers an alternative approach to creating a true sustainable hospital, a restorative environment that connects human health with nature by combining *salutogenic* and *biophilic* design principles with restorative environmental design strategies. The positive impacts of biophilia, the inherent human affinity to affiliate with nature, on both humans and nature have been demonstrated through rigorous and empirical studies over the past 40 years. In 2008, Restorative Environmental Design (RED) was introduced by Stephen Kellert to integrate biophilia and environmental design principles to have a more beneficial impact on both building users and the surrounding environment. Still, implementing this approach in design practice is a challenging mission. Green building and evidence-based design principles are the main guidelines used by architects and planners to design hospitals, but little attention is given to improving the relationship between building users and nature. Further research is therefore required to facilitate implementing the RED approach in healthcare design. RED is based on Stephen Kellert's *biophilic* design attributes which need to be tailored to fit the complex needs of healthcare architecture and to consider restorative environment design principles. This study addresses common ground between *biophilic* design and *salutogenic* design by taking a comparative approach, exploring two case studies of recently constructed hospitals in Australia and Singapore to generate a comprehensive design framework. The targeted Restorative Healthcare Environmental Design (RHED) should be tested as a suggested model in introducing *biophilic* design to the healthcare design and planning community in a realistic and practical way. However, a more comprehensive assessment of the proposed framework is needed.

Introduction

Today, the global community shares a set of challenges and threats about health and well-being. Climate change, the noticeable spread of debilitating chronic diseases, waves of nature-driven or human-made epidemic threats, geriatric illness due to an ageing population, mental health concerns including anxiety, stress and depression lead to an endless list of irreversible social, cultural and economic issues. Meanwhile, over recent decades significant breakthroughs in medical treatment and diagnosing technologies, have been realised. However, chronic and lifestyle-related diseases are on the rise, and our hospitals are struggling to keep up with the consequent accelerating demand.²³

The built environment of modern hospitals still plays a marginal role in the healing process, following design principles of the late modern era of the 1950s and 1960s. Such an architectural withdrawal has led to the predominance of medical

and technological determinants over the design of hospitals; on the other hand, fulfilling emotional, psychological and social needs of patients, supporters and caregivers has either diminished or been neglected.²⁴ However, two promising design approaches are emerging in the healthcare design arena: *salutogenic* and *biophilic* design.

The theory of *salutogenesis* resulted from extensive research by Antonovsky during his long journey in *unravelling the mystery of health*. He assumed that good emotional, psychiatric and somatic health is maintained through the ability to cope with changing circumstances during a human's life.²⁵ While *Biophilic* design is stemmed from Ulrich suggestion in his psycho-evolutionary theory that exposure to safe, natural areas is inherently restorative because such settings were associated with survival during humanity's long evolutionary history.²⁶ Such an ancient bond between innate human affinity and natural systems and processes is defined as *biophilia* (love of nature).²⁷

Salutogenic and *biophilic* design principles ideally serve the agenda of Restorative Environmental Design (RED) which highlights two overarching concepts: 1) nature can play a significant role in restoring the health and well-being of humanity, and 2) in response, human beings can change their lifestyle to show mutual respect and restoration to nature. This approach redresses an essential gap in the hypothesis of sustainable design, as "green" architecture will not suffice if its users do not enjoy it and find it worthy of maintaining in the long run.²⁸

This study is driven by a key question: How does hospital architecture play a role in restoring the psychological, cognitive and social capacity of its users? The terms 'healing', 'therapeutic' and 'curing hospitals' have been widely used in the past decade. This study uses a mixed methods approach to the literature review of the recent body of empirical and clinical research that seeks to investigate the correlation between nature, and human health and well-being in multi-settings. It also takes a descriptive approach to exploring a set of contemporary, environmentally driven design trends in healthcare. The study pays attention to those trends which acknowledge integration between man and nature as a part of the healing process. Finally, a proposed framework is suggested for employing these approaches in designing the hospitals in the future.

Problem statement: The crisis of modern hospitals and the prospects of 'healing space'

The history of a healing environment and the crisis of modern hospitals

Until the 16th century, people depended on their contact with nature to experience a multi-sensory context dominated by environmental features such as light, sound, odour, wind, weather, water, vegetation, animals, and landscape.²⁹

Traditional architecture provides a set of well-perceived examples of life-enhancing architecture which addresses all human senses simultaneously and fuses our image of self with the surrounding natural world.³⁰

Historically, therapeutic nature was the embodiment of human pre-modern culture and still exists in some regions worldwide. Apart from western civilisation's degradation of nature, the far eastern principals of Feng Shui aim to create a balance between nature and the built environment.

Architectural phenomenologists claim that haptic architecture of the traditional and historic building has a much more substantial impact on cognitive, intellectual and social behaviour than the poor, materialistic and fragile architecture of the modern era.³¹

Psychological determinates of the crisis in modern hospitals

In contrast to the pre-modern healing environment, the architecture of today's hospitals undergoes two major determinates. Firstly, it is located within a high-density urban environment, which causes many people to become saturated with the sense of vision which surpasses all other human senses within a man-made context apart from connection to the natural environment.³²

Pallasmaa, a Finnish architect and theoretician, further argued that western architecture across most healthcare buildings was manipulated to feed our desire for control and power through focused vision, while traditional, mostly eastern, architecture tends to lessen our focus and liberate the gaze from its patriarchal lens.³³

Secondly, human segregation from the natural world has occurred in parallel with technological advances in the 19th and 20th centuries.³⁴

Several studies addressed the offensive manner of handling psychological and spiritual aspects in modern architecture due to a fascination with technology.³⁵

In the hospital environment, our separation away from nature, in its most literal sense, occurred during the mid-20th century, when hospital design was entirely dedicated to confined, industrial and sterile spaces.³⁶ Moreover, the seduction of modern architecture set buildings apart from users' needs. Pallasmaa stated:

“The buildings of our own time may arouse our curiosity with their daring or inventiveness, but they hardly give us any sense of meaning of our world or our own existence.”³⁷

Theoretical framework: Healing environment and Restorative Environment Design (RED)

In response to the crisis of modernism, an incremental increase in the investigation of the impact of nature on human well-being has been witnessed in recent years. The term 'healing environment' was referred to by Sticherl as “*a physical setting that supports patients and families through the stresses imposed by illness, hospitalization and medical visits*”.³⁸

Restorative Environmental Design (RED) was one of the earliest approaches to redefine the integration of natural elements within the built environment and used as a tool to promote psychological restoration. It also represents an emerging response to the continuous inadvertence of modern architecture to the needs of both its users and the natural environment.³⁹

RED stemmed from two distinctive theoretical and empirical premises, which constitute a holistic perspective regarding a suitable environment for human adaptation, resilience and restoration: Attention Restoration Theory (ART) by Kaplan, and resilience domains theory (RDT) by Jonas et al.⁴⁰

Attention Restoration Theory (ART)

This theory assumes that every human has depleted psychological, cognitive and social resources when responding to stressful daily activities. Kaplan claims that exposure to natural elements, especially water, vegetation and fresh air, can play a restorative role by providing interest-driven attention or fascination for humans in their encounter with the environment.

Resilience Domains Theory (RDT)

The healing capacity of humans is highly related to their resilience and restoration across four domains: physical, mental, emotional and spiritual (Figure 1).⁴¹

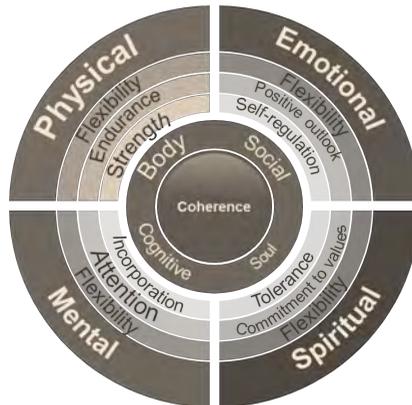


Figure 1: Four domains of human resilience and restoration.⁴²

These domains can be reflected in the RED hypothesis. Thus, our study recommends using these dimensions to map the design framework of a nature-related healthcare environment that can evoke the genetic interaction between humans and nature, to provide a balanced and coherent healing environment for patients and staff within medical settings.⁴³

Biophilic and salutogenic healthcare design: The missing framework

The merits of a 'patient-centred' approach, prioritising patients over process, can be traced back to the courageous reform of hospitals by Florence Nightingale two centuries ago. Despite its humanistic origins, the concept of patient-centric care in modern hospitals diverged to support the work of physicians, with patients viewed as individuals who received care rather than being active participants in their journey of recovery and well-being.⁴⁴

More recently, some emerging approaches to post-modern hospital design dedicated more attention to the features of 'patient-centred care', such as evidence-based design, the *salutogenic* design of the Plane tree, *biophilic* architecture and others. These features were developed to provide an adequate physical design for hospitals regarding usability, accessibility and controllability; access to external areas to promote a sense of normality; supportive environments for effective communication between patients, staff and relatives; and to facilitate more 'access' to the natural environment.⁴⁵

Among emerging trends, *salutogenic and biophilic* hypotheses offer a comprehensive understanding of the relationship between humans, the built environment and nature.

Salutogenic design

According to *salutogenesis*, health-promoting resources have three related domains to enhance human life and provide a sense of coherence: (1) comprehensibility (to compromise and negotiate life challenges), (2) manageability (to manage daily physical realities in order to maintain homeostasis), and (3) meaningfulness (to desire living and to resist the entropy of sickness and extinction) (see Table 1). These domains can provide holistic theoretical guidelines for the objectives of health-promoting architecture beyond the specific findings of experiments and design interventions.⁴⁶

In reflecting on hospital design, the extrapolation of *salutogenic* theory is an overarching criterion in decision-making design when dealing with stress-sensitive patients.⁴⁷

<i>Salutogenic domains</i>	<i>Architectural application</i>	<i>Impact on patient/staff</i>	<i>Key literature</i>
Comprehensibility	Common rooms	Control	Andrade et al., 2017 ⁴⁸
	Interactive healing gardens	Contribution	Jencks ⁴⁹
	Public activities (gardening, feeding pets, etc.)	Social enrichment	Garnham ⁵⁰
Manageability	Fewer nurse stations	Security	Andrade et al., 2016 ⁵¹
	Private patient rooms	Independence	Chaudhury, Mahmood, and Valente ⁵²
Meaningfulness	Home-like settings	Sense of belonging	DuBose et al. ⁵³
	Meditation gardens	Meaning for life	Cleveland ⁵⁴
	Spiritual spaces	Hope	McCaffrey and Liehr ⁵⁵

Table 1: Domains of salutogenic healthcare design and its impact on patients and staff

Biophilic design

The *biophilic* relation with nature is a fundamental biological need that influences human health, productivity, well-being and even existence.⁵⁶ A *biophilic* design approach hopes to go beyond the standard goals of green architecture in merely lowering the environmental impact of buildings. This approach can reinforce the confident and secure connection between nature and humans to promote mutual restorative enrichment.⁵⁷ Hence, Kellert proposed 70 *biophilic* attributes that could potentially influence the design of the built environment.⁵⁸ (see Table 2).

Biophilic elements ⁵⁹	Possible attributes to use (samples) ⁶⁰	Benefits in key literature
Environmental features	Colour, water, air, fire, sunlight, plants, animals, natural materials	Stress reduction. ⁶¹ Relaxation and attention restoration. ⁶²
Natural shapes and forms	Arches, vaults, domes, tree and columnar support, shapes resist straight lines and right angles, natural shapes and forms Bio-geometry	Pleasure and satisfaction. ⁶³ Attention and cognitive restoration. ⁶⁴ Promoting health. ⁶⁵
Natural patterns and processes	Growth, central focal point, patterned wholes, transitional spaces, fractals, hierarchically organised scales	Mental restoration and inspiration. ⁶⁶ Positive distraction. ⁶⁷
Light and space	Natural light, place connections, filtered and diffused light, spatial variability, inside-outside spaces	Less period of stay in hospital. ⁶⁸ Pain relief, social restoration. ⁶⁹
Place connections	Avoiding placelessness, sense or spirit of the place, integrating culture and ecology, Indigenous materials Landscape orientation	Reduced mental fatigue. ⁷⁰
Evolved relations to nature	Prospect and refuge, order and complexity, enticement and curiosity Change and metamorphosis, affection and attachment, exploration and discovery	Improved concentration, attention and perception of safety. ⁷¹ Reduced boredom, irritation, fatigue. ⁷²

Table 2: Patterns and attributes of biophilic design

Thus, both *salutogenic* and *biophilic* design features can work in harmony to create a therapeutic healing environment within our hospitals. Thus, we suggest using *salutogenic* principles as an overarching guideline to inform the proper implementation of *biophilic* attributes and patterns. Based on the recommendations of empirical findings (Table 2), resultant settings will restore the depleted resources of patients and medical staff in different zones within the hospital (see Table 3).

Salutogenic domains	Targeted benefits ⁷³	Supporting biophilic element(s)	Possible zone(s)
Comprehensibility	Give a dynamic feeling of security, confidence and control over a predictable external and internal environment	Place connections Natural patterns and processes Environmental features Light and space	Clinics waiting for areas, emergency triage zone Daycare surgery Maternity and birthing units
Manageability	Enhance patient's resources for recovery, the sense of independence and the subsequent atrophy of essential life skills,	Natural patterns and processes Environmental features Light and space	Inpatient nursing units Long-stay nursing homes Recovery and intensive care units
Meaningfulness	To promote a sense of belonging and inspire the search for human's identity and respect for socio-cultural mores	Evolved relations to nature Natural shapes and forms	Patients/family common rooms Healing and meditation gardens Roof gardens

Table 3: Integration between salutogenic and biophilic design to create restorative settings within the different zones in healthcare facilities

Implementation in healthcare architecture

Equipped with understanding the patient, a nature-centred philosophy in *salutogenic* and *biophilic* design, the health architects paid more attention to the therapeutic impact of architecture to promote the recovery of patient resources.⁷⁴

As a result, a new generation of healthcare facilities were based on recalling the human senses to be part of the game. The designers of hospitals tended to deify the incorporation of natural light and ventilation, views to the outside, connection to green spaces, and colour and spatial strategies to create healthcare environments that are both supportive and therapeutic.⁷⁵

This study selected two pioneering case studies of salutogenic and biophilic hospitals to inform the outline of the design framework of healing hospital in the next section.

The Lady Cilento Children's Hospital in Brisbane, Australia was a leading *salutogenic* hospital in 2010. This project went further than merely applying good views and daylight into the building. It explored the concepts of story-making, psychology, neuroscience and endocrinology as health-promoting tools.⁷⁶ (Figure 2).

The hospital layout and spatial settings were inspired by a "living tree" model to generate a group of light-filled atriums and a network of double-height spaces branch out. The implementation of natural biomimicry was employed to satisfy the psychological and emotional restorative needs of the hospital users. Likewise, Khoo Teck Puat Hospital in Singapore was nominated as a role-model of *biophilic* hospital architecture with abundant planting, attracting native wildlife.⁷⁷ (Figure 3).



Figure 2: *Salutogenic* design of the Lady Cilento Children's Hospital in Brisbane, Australia.⁷⁸



Figure 3: *Biophilic* design of Khoo Teck Puat Hospital, Singapore.⁷⁹

The core aim of designing this hospital is to make it fully merged with nature and to act as a rainforest-like built environment. This nature-driven design responds to several senses, from sight of abundant greenery and water features to the smell of those plants and the sound of falling water.

Both case studies showed unintentional application and mixing the principles of both salutogenic and biophilic design. Both buildings are live examples of sustainable healthcare environments which use natural elements as restorative and healing agents for patients, family and staff, and the broader community. Nevertheless, the delay in widespread implementation of design approaches in healthcare settings is due to the lack of a comprehensive framework to achieve the sought after balance between users' needs and the requirements of nature for restoration and recovery. A primary reason for this delay in design approaches is the absence of association between design approaches, and the research agenda for medicine and environmental psychology.

Discussion: Mapping a comprehensive framework of Restorative Healthcare Environmental Design (RHED)

Human resources undergo an endless cycle of stress and restoration throughout the course of human life. Thus, the healthcare-built environment, according to RED theory, can play a significant role in the cycle of restoring the four domains of human resources, which become depleted during the process of resisting illness or suffering from injuries or pain. Furthermore, a need for more intense restoration increases during the phases of vulnerability in a healthcare environment. In this study, we have attempted to construct a comprehensive framework for designing a restorative and healing environment based on modifying the RED model for adoption in hospitals (Figure 4).

To construct such a framework, three questions need to be answered: (1) What are the components of this framework and how will they operate to work in harmony with evidence-based design and a patient-centred approach to healthcare? (2) Where precisely is this approach most likely to succeed within the hospital environment? And (3) For whom are they most likely to fit?

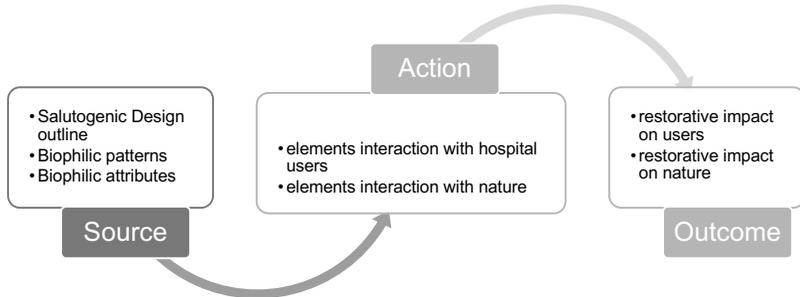


Figure 4: Proposed Restorative Healthcare Environmental Design (RHED) mechanism

RHED framework components and mechanism

The suggested framework can be generated by combining a group of theories and design approaches for environmental psychology, human behaviour and analysis of neural processes that occur in the brain.⁸⁰

The three domains of restoration in *salutogenic* design formulate the overarching objectives of this framework (i.e. to achieve a comprehensive, manageable and meaningful healing environment). Design patterns, attributes and settings for *biophilic* design are tools which should be used to achieve the abovementioned objectives. The two theories of restorative mental well-being (ART and RDT) will act as the theoretical guidelines for future empirical and clinical studies to find the proper solutions for achieving a restorative healthcare environmental design (RHED) within different hospital settings.

Settings of RHED

The parameters of RHED can differ according to the intensity of stressors and the types of depleting factors regarding user's resources. Accordingly, it is recommended that RHED techniques take place in specific areas within hospitals, where stress, depression and anxiety symptoms are most likely to affect patients, families or caregivers. Meanwhile, hospital zones can generally be classified into five categories according to the intensity of stressors. They include: (1) high risk emergency departments, intensive care units and operation theatres, (2) day surgery and chronic treatment units (e.g. oncology), (3) diagnostic clinics, imaging departments create anxiety for patients due to the extended waiting period and anticipation of unfavourable outcomes, (4) common spaces including lounge areas and social spaces can play a crucial role in mitigating the level of stress within hospital zones, and (5) outdoor therapeutic gardens can be an indispensable source of restoration and recovery.⁸¹

Beneficiaries of RHED

Both *salutogenic* and *biophilic* approaches re-orient hospital design to seek a healthy and restorative environment for all users. Most crucially, RHED can support

patient's health, well-being and restoration rather than focusing on the causes of disease and designing hospitals that only treat sickness.⁸²

These approaches also enhance the physical, mental and emotional well-being of medical staff to avoid burnout, stress and lack of focus to avoid medical errors.

Figure 5 summarises the RHED framework that synthesises both *salutogenic* and *biophilic* design approaches in response to the needs and settings of both patients and medical staff within the five abovementioned categories of medical parameters, according to the level of tension and stress within each category. The diagram shows briefly the outcomes of earlier research literature that connects between the hospital's main users (patients and staff) and nature in five different categories of spaces within the hospital. Such a connection has various degrees of restorative impact on the physical, emotional, mental and spiritual needs of both patients and medical staff.

Conclusion and implications for practice

This paper has shown that traditional healthcare facilities until the pre-modern era inherently implemented some design techniques to create a built environment that both promoted health and was nature related. The reasons behind the current crisis in 'modern' hospitals in relation to the aggressive separation of users from the natural environment and presumable threats are highlighted. Thanks to the evolution of the green design movement in the 1990s, connections were established between improving environmental quality and human physical, psychological and social well-being in the built environment.⁸³ This research drew attention to the theory of Restorative Environmental Design (RED) which tends to restore the relationship between humans and nature within the built environment. Also, this study suggested that *salutogenic* and *biophilic* design principles, based on extant research from other disciplines as well as case study research, can ideally play a restorative role in mitigating symptoms of psychological and mental illness, for both patients and medical staff in different healthcare settings. However, the review of earlier studies showed there is no comprehensive setting to link these elements or patterns with much needed spaces within our hospitals.

This study has sketched a blueprint of a holistic framework of Restorative Healthcare Environmental Design (RHED) as a suggested approach of employing *salutogenic* and *biophilic* design elements to create an active healing environment within hospitals. It is recommended that RHED should be applied in certain areas within hospitals, where stress, depression and anxiety are most likely to affect patients, families or caregivers. A more comprehensive demonstration and assessment of the proposed framework is however needed. RHED requires empirical testing to prove what type of restorative environment is needed within each healthcare setting, and when and how much time should be provided for hospital users to experience such an environment.

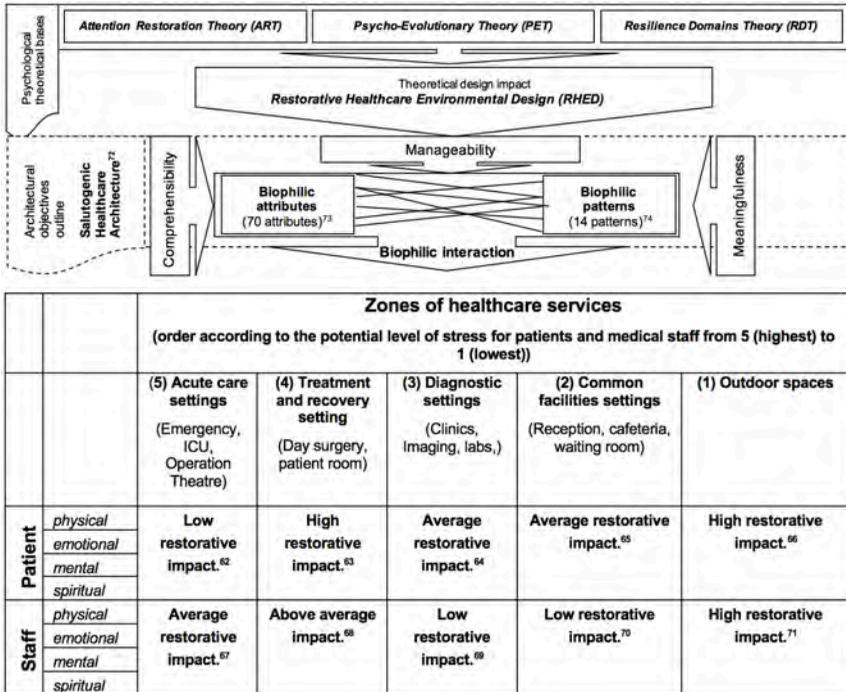


Figure 5: Proposed Restorative Healthcare Environmental Design (RHED) framework.

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