

**EXPLORING THE USE OF EVIDENCE BASED HEALTHCARE DESIGN IN
SOUTH AFRICA USING COLOUR, LIGHT AND BIOPHILIA TO
UNDERSTAND THE EFFECTS OF INTERIOR DESIGN ON THE PERCEIVED
RECOVERY AND WELLBEING OF PATIENTS IN HOSPITALS**

by

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DECLARATION OF ORIGINALITY

I hereby declare that the Research Report submitted for the _____ degree to The Independent Institute of Education is my own work and has not previously been submitted to another University or Higher Education Institution for degree purposes.

Abstract

Our daily surroundings and the environments we are in everyday profoundly influence our physical and psychological wellbeing (Waller & Finn, 2004). Healthcare facilities have for many years been designed and focused on creating hygienic safe spaces as well as functionality; however in the 21st-century healthcare facilities need to focus on the overall well-being of the patient. The question is, does the current design of hospitals stimulate or regress patient perceived recovery/outcome.

This study is an exploration of improving Health Care Facilities (HCF) specifically in SA, through EBHD as the foundation theory/concept, and incorporating Color Theory, Light theory and Biophilic Design to aid in the perceived recovery process as well as the overall well-being of patients, while also exploring healing environments.

For this qualitative research the researcher utilized a cross-sectional timeline for secondary research methodology using 3 data-collection methods specifically: observation, documentation, and records (Lalehzari, 2021).

Cintocare Hospital and Netcare Sunninghill Hospital are the two hospitals studied and analysed against a set list of criteria (Figure 1: List of Criteria). A visual analysis was conducted at both facilities and the design discussed detailed. Common themes or similarities and variances are identified between the two analysed facilities. It is then determined if the design of the two hospitals are informed by EBHD and the percentage thereof.

The study was limited by the Novel Coronavirus (COVID-19) pandemic and the government imposed restriction of movements to curb the spread of the virus. Based on this the researcher was unable to answer the research question as access to medical facilities were hindered. However from the data collected, it can be deduced that the design of a HCF has a direct impact on the recovery and overall well-being of patients. From the research activities, it is evident that there is a definitive and much needed transformation of design in the creative consideration in the development of medical facilities and hospitals.

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LIST OF ABBREVIATIONS:

EBD - Evidence Based Design
EBHD - Evidence-Based Healthcare Design
HCF - Healthcare Facilities
HE -Healing Environments
SA - South Africa

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Title:

Exploring the use of evidence based healthcare design (EBHD) in South Africa (SA) using colour, light and biophilia to understand the effects of interior design on the perceived recovery and wellbeing of patients in hospitals and essentially creating healing environments (HE)

1 Introduction:

Specialists, including Waller and Finn (2004) have asserted that the environments in which we surround ourselves with on a daily basis, such as school, work, home, and church profoundly influence both our physical and psychological well-being. The elements within an interior space can arouse positive or negative feelings within an individual and result in the appropriate response to those feelings (Taylor, 2016).

Healthcare facilities (HCF) have for decades been designed to create a hygienic and safe space with a focus on functionality as it is concerned about facility equipment, technology, ease of mobility of moveable objects without error and effects on the safety of patients, however in the 21st-century healthcare facilities need to re-direct focus on the patient, their well-being, and recovery (Reiling, Hughes and Murphy, 2008). The question is whether the current design of hospitals in SA stimulate, contribute to or regress patient perceived recovery, outcomes and well-being. The researcher explored the Evidence-Based Healthcare Design (EBHD) theory as well as healing environments (HE) to gain an understanding of what the ideal design for hospitals are and how they impact patients perceived recovery and well-being.

Through the exploration of EBHD as well as HE the researcher will investigate theories and concepts with principles that have been proven through EBD (EBD) to have a direct influence on patients and their perceived normal state of health recovery and wellbeing. Three concepts and theories that will be explored in order to understand the impact and or effects that these factors have on patient recovery and outcome are color psychology, light theory and biophilic design. The researcher investigated what EBD is and how it can enhance patients experience and perceived recovery/outcomes in HCF, after which

specific elements and factors that support this theory such as the psychology of color, the element of light and biophilia and biomimicry will be analysed, explained and applied to support the research question.

Understanding EBHD and HE as well as the concepts of colour psychology, light theory and biophilic design and the principles that aid in providing a HE, will allow the researcher clearly identify HE. The researcher wishes to identify two hospitals in SA, one that has successfully implemented a HE approach and one that has not been designed within the approach. A comparison will be conducted, after which an analysis will be carried out to identify the progress of hospitals in other countries with regards to EBD and HE.

1.1 Contextualisation & Rationale

South African hospitals have previously been designed around the logical order of the HCF, and while many HCF although, the current practice in SA remains the status-quo, Chad Brandon Paul (2020) recognised that this is due to specialist healthcare designers being omitted from the day-to-day operations in the running of the hospital. Healthcare designers understand what is needed spatially but lack understanding of the realistic functionality of the spaces, the experience of the patients and their healing process as well as the advancements of the medical field (Paul, 2020).

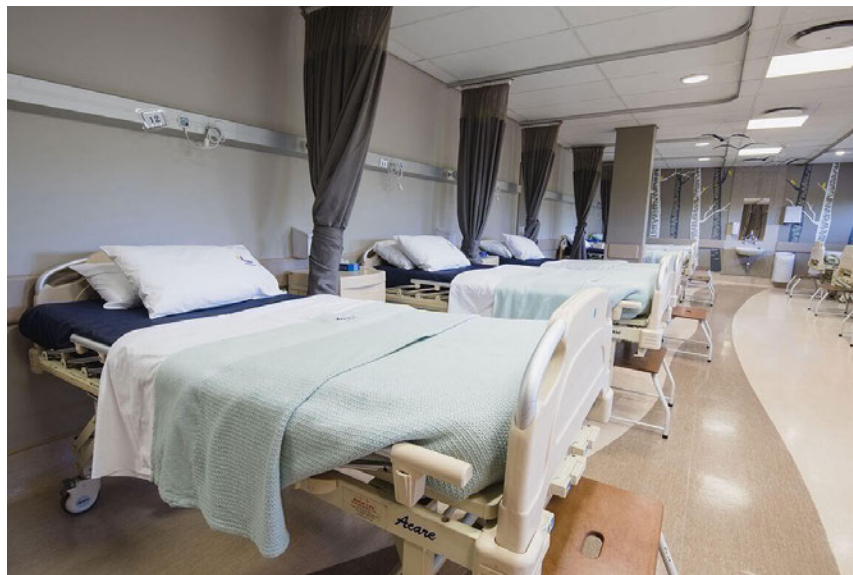


Figure 1: Cure Day Hospital, Erasmuskloof (Erasmuskloof, 2019)

Due to budgetary constraints or scarcity in SA HCF (mostly public hospitals) upgrades in these environments are prolonged to every ten to fifteen years instead of five to seven years. When upgrades are eventually done the focus is on medical equipment and the basic design elements of the HCF like furniture, windows and a fresh coat of paint (Paul, 2020).

Formerly the selection of hospitals were chosen based on convenience, however due to the new movement of hospitals recognizing the association of patient well-being through design, prospective patients are found to gravitate to hospitals that encompass a HE (Paul, 2020). Although the decision is not solely based on the factor of design, and given that the majority of the population does not have the comfort of having access to public HCF which apply EBHD and encompass HE, designers in the healthcare sector need to take cognizance of the patients in the facilities. Thus, architectures and interior designers working on such projects need to gain a holistic and patient experience through engaging and applying more cost-effective tools and principles to create HE in HCF within the country. Fast-paced advancements and the improvement of innovations and change technologies, make it important for designers to continue looking at the data-drive information in the industry in order to keep up with the subtle changes and thus create HE that translate into meeting and enhancing the needs of user's well-being.

Through this research paper the researcher anticipates adding to knowledge of EBHD; and aims to contribute to improved design of HCF in SA. Providing a more refined understanding of the theories, concepts, principles and tools of EBHD and HE, designers are able to find better and more cost-effective design solutions for hospitals in SA both public and private sectors in order to reach the advancement of design, focusing on patient recovery and wellbeing and as a result create better HE.

1.2 Problem Statement

The elements within an interior space can arouse positive or negative feelings and result in the appropriate response to those feelings (Taylor, 2016). Our physical and

psychological well-being are profoundly influenced by the environments in which we live and work daily (Waller & Finn, 2004). Do the physical environmental factors in hospitals, pertaining to interior design such as light, decor, space and aesthetics, affect the patients perceived recovery and well-being?

1.3 Purpose Statement/Research Goal:

In the past architects and designers focused solely on functionality, 21st-century healthcare facilities need to focus on the patients and their needs.

The main purpose of this study will be an investigation into the improvement of HCF, particularly in SA, using design factors and elements such as plants, color, light, decor, space and aesthetics, in hospitals to aid in the perceived recovery process as well as the overall well-being of the patients using EBD.

1.4 Research Question

How can evidence-based healthcare design, considering factors such colour psychology, light and biophilia, aid in the perceived recovery and overall well-being of patients in hospitals in South Africa?

1.4.1 Sub Questions

What is Evidence Based Design and what are healing environments?

What is the current design of hospitals in South Africa and does it contribute to patient recovery?

How do factors such as colour, light and biophilia affect patients and their experience and recovery within hospitals?

What kind of design can change the circumstances and experience of the hospital and which areas will have the most impact?

2 Literature Review

2.1 Conceptualisation:

There are a few key terms that have been identified and mentioned in this research paper that are important to this study. These concepts help shape the study are important to be familiar with to fully understand the research.

2.2.1 Evidence-based Design:

Evidence-based Healthcare Design:

Evidence Based Design, commonly referred to as EBD is a form of specialised form science that focuses on the collection of data that is utilised for the design process of hospitals (Ulrich, Zimring, Quan, Joseph, & Choudhary, 2004).

2.2.2 Healing Environments:

Healthing Environments are the environments that surround us or the conditions we are placed in that aid in creating opportunities to achieve physical and/or mental wellbeing (NCI Thesaurus).

Healing environments are places that allow for the interaction between people and environments to result in positive health within the built environment (Huisman, Morales, van Hoof and Kort, 2012).

2.2.3 Patient Wellbeing:

Patient wellbeing is about the positive experience of patients in hospitals while being in the hospital and after being discharged. Wellbeing refers Wellbeing is the state of an individual being comfortable, healthy and happy and include good mental health, life satisfaction and prosperity. The state of being well in mind, body and soul (Corin, 2019).

2.2.4 Colour Psychology:

The use of colour within an environment to evoke different emotions in individuals by using the psychology of meaning and feelings associated with different colours (Craig, 2015).

2.2.5 Biophilia:

Biophilia means 'love of nature' and is a concept that suggests that humans have an innate need to connect with nature, be close to nature, and feel as though nature surrounds them. This concept also suggests the implementation of indirect and direct elements of nature into an environments design through the use of plants, views of nature and even art pieces that mimic nature (Alaspa, 2017).

2.2.6 Light Theory:

Studies have shown that better performance of complex tasks are directly linked to higher light levels, and also that age determines levels of light required by an individual. It is suggested in studies that daylight is not necessarily superior to artificial light for performance, but unlike artificial lighting, daylight does provide benefits in regulating circadian rhythms and maintaining overall health (Joseph, 2006).

2.2 Overview

There are many factors to consider in creating HE within HCF, however this study is guided through only a few theories and concepts. Using EBHD to guide decisions in designing HCFs will allow for designs that are focused on the user, their needs and recovery. Theories such as color psychology, biophilic design and light theory are more specific factors with tools and principles that can be implemented to design the best HE to enhance patient recovery and well-being. Across all theories in my paper, from EBD to Light Theory the sources are compatible and share opinion and thus will strongly support and influence this research paper moving forward.

2.3 Theoretical Foundation:

A literature review was conducted on articles and journals with relevance to this study. The theories analysed in this section are EBD/EBHD, color psychology, light theory and biophilic design. These four theories are crucial to this study as it will provide both the researcher and the reader with tools and principles needed to design HE in HCF. It is important to consider these theories as it will affect the well-being of patients and could potentially be linked to sick building syndrome (SBS). SBS is a condition caused by

being in a building or enclosed space that is poorly designed and has poor indoor conditions; which include poor ventilation, light quality, mold and fungus to name a few (Davis, Cunha, 2021). There are varying symptoms of SBS, one of which could affect one's respiratory and neurological system and skin . Amongst the wide range of symptoms are throat irritation, dizziness, forgetfulness, headaches, runny nose, trouble focusing, body aches, fever, irritability, itchy rashes, and difficulty in breathing (Joshi, 2008).

2.4 Literature Review:

It has been established that the spaces we encounter everyday evoke different feelings through its design and thus humans respond to these feelings appropriately (Taylor, 2016). The design of hospitals has the potential to either promote healing and recovery or they can regress the recovery process. This literature review will look into articles and journals by different authors, and include; "Review of the Research Literature on Evidence-Based Healthcare Design" by Ulrich, Zimring, Zhu, DuBose, Seo, Choi, Quan and Joseph (2008), "Effects of color in interior design" by Aleksandra A. Ćurčić, Aleksandar Keković, Dušan Randelović and Ana Momčilović-Petronijević (2019), "Biophilia and Healthcare" by Bryan Alaspa (2017), "Impact of Light on Outcomes in Healthcare Settings" by Anjali Joseph (2006). These articles will provide the researcher with the appropriate information to support the research problem, purpose, and question.

Exploring how EBHD specifically looking at color psychology, biophilia and light, helps gain a better understanding of the effects of interior design on the experience and perceived recovery or outcome of patients in hospitals.

It will additionally form as the basis of the theoretical foundation of this research paper, exploring what EBHC is and its contribution to enhancing patients experience and perceived recovery/outcome in hospitals, after which investigating specific elements and factors that support this theory such as color psychology, light theory, biophilia will be analysed, explained and applied to support the research question.

2.4.1 Evidence Based Design

The report being reviewed “Review of the Research Literature on Evidence-Based Healthcare Design” by Ulrich, Zimring, Zhu, DuBose, Seo, Choi, Quan and Joseph (2008), serves as an expanded and updated version of a 2004 report, “The Role of the Physical Environment in the Hospital of the 21st Century” (Ulrich, Zimring, Quan, Joseph, & Choudhary, 2004). Evidence Based Design, commonly referred to as EBD is a form of specialized form science that focuses on the collection of data that is utilized for the design process of hospitals. It is specifically pivotal in measuring the physical and psychological effects of the built environment on the users of the facilities. The evidence recorded thus far in EBD healthcare suggests that physical setting of an environment that is well-designed plays an integral role in creating safer, more healing environments for patients (Ulrich, Zimring, Zhu, DuBose, Seo, Choi, Quan and Joseph, 2008).

The reviewed report is organized into three types of outcomes where section one focuses on patient safety issues, such as infections, medical errors, and falls; section two looks at other patient outcomes, like pain, sleep, stress, depression, length of stay, spatial orientation, privacy, communication, social support, and overall patient satisfaction; and section three looks at staff outcomes, such as injuries, stress, work effectiveness and satisfaction. This review will focus on the second section of the study as it concerns the patients experience and outcome (Ulrich et al., 2008).

The report confirms the importance of using design elements and interventions to improve the outcomes of patients.

In the medical field, a trial or experiment that is randomised and controlled is considered the strongest research design for credible empirical evidence.

Although there are factors within the built environment that will alter several environmental factors simultaneously, there are certain design elements that only alter a single environmental factor, and certain interventions could be given randomly to a few patients while not to others (Ulrich et al., 2008). These elements include nature distractions, art, light and color and reduced noise. Specifically pertaining to nature

distractions, this report has identified multiple randomised clinical trials that provide sturdy evidence to support the effects of biophilia on patients perceived recovery.

In EBD when there are not many studies that are controlled randomised trials, the environmental factors under trial is strengthened and evidence is enhanced when patterns are consistent with predictions from knowledge and theory across a few studies in regard to healthcare outcomes and patient recovery. The validity of a factor becomes strong when the outcomes are consistent and are aligned with an existing prediction or hypothesis acquired from existing knowledge (Ulrich et al., 2008).

Extensive research has confirmed that patients in hospitals experience a great amount of stress, and although some of that stress is unavoidable, some of the stress is as a result of poorly designed healing environment. Similarly, to stress, patients suffering from depression are also affected by the built environment and the design thereof. This study places emphasis on the importance that design plays in aiding such patients with design variables to fasten their recovery, consider their well-being and enhance their experience, to which there are simple, subtle solutions. There are several hospital design variables that can contribute to patient outcome and experience in EBD healthcare. The first is the auditory environment which encompasses sound proofed flooring, walls and music. The second is the visual environment, characterized by the nature views, natural light and artwork on walls as well as sculptures. The third is safety, encompassing overall ventilation and quality of air. The fourth is way finding, including all signage, floor plans, the information desk and the entrance of the building. Sustainability comes in at fifth, and is in reference to waste management, energy-saving features and building materials. In sixth, Patient rooms, comprising of a consideration from patient control of light and temperature to acuity into adaptable rooms to discard the need for patient movements as a result of conditional changes and the cognizance of multi verses single-bed rooms. The seventh pays attention to family support spaces such as outdoor patient gardens with seating, comfortable waiting areas and overnight beds alongside patient beds. The eighth are spaces for staff support like comfortable break areas, decentralized nursing workstations and proximities of both medications

and supplies. Last but not least, spaces for physician support such as the acoustics of the rooms for operations, meeting room quality and the coherent quality of the workstation locations (Ulrich et al., 2008).

Further through the investigation on whether EBD can aid in the perceived recover of hospital patients, this report informed the study extensively and is later elaborated on. The importance of this report to my research is its extensive information about each variable such as natural light vs artificial light as well as views of nature and the implementation of biophilia. It will support my research paper about what EBD is, what it includes and how to implement the variables as well as what further studies need to be done.



Figure 2: Study of the surrounding environment effects on patient recovery and wellbeing (Bellieni & Bellieni, 2016).

2.4.2 Color Psychology

Effects of color in interior design by Aleksandra A. Ćurčić, Aleksandar Keković, Dušan Randelović and Ana Momčilović-Petronijević (2019) is a study on how color affects our psychology and what meaning, emotion or feeling is attached to different colors. This paper looks at color in the use of homes, schools, offices as well as hospitals. Color is perceived as a rudimentary quality of perception (Ćurčić, Keković, Randelović and Momčilović-Petronijević, 2019).

This paper discusses the importance of colors in our interior spaces and the effects that these colors have on patients physically and psychologically. The article discusses color psychology effects on productivity and disposition of employees, recovery of patients in hospitals and efficiency of student work in schools. However, for the purpose of this literature review the psychology of the different colors will be stated and then linked only to the affects of these colors in hospitals, and specifically on patient's recovery. The main aim of the article was to analyze the effects that different colors, used in a space on the users of that space (Ćurčić et al., 2019).

Different colors evoke differing emotions varying in settings, this is called color psychology. In order to promote a healing environment, the colors selected must be used correctly and the amount should be balance, not using it too much or too little. There are hues that are considered warm and others that are considered to be cool colors. The warm colors, defined as bold and energetic, are red, orange, yellow, and certain shades of green. Since warmer colors stimulate the nervous system it will influence heart rhythm, blood pressure and breathing, by increasing it. The cool colors are green, blue, indigo and violet have an opposite effect to warm colors, influencing the nervous system, by reducing pulse, blood pressure and breathing (Ćurčić et al., 2019).

Specific attention needs to be paid on the effects and emotions that colors cause when designing interiors. The following are primary colors used in design with an explanation on their impact on symbolism and feelings:

Red, the most vibrant color in spectrum, expresses love, power and warmth. It attracts users' attention and is the strongest warm color, used to convert a space to look both stimulating and compact. Blue represents peace and harmony, and is a symbol of hope, faith and loyalty, It is calming to the central nervous system by reducing the blood pressure and pulse, however increasing concentration. Yellow represents optimism, joy and warmth as it is considered the most joyful color in the spectrum; and spurs alertness and concentration. It is beneficial to the nervous system as it stimulates the heart rate, blood pressure, breathing however triggers fear. Orange has the energy of red and cheerfulness of yellow, indicating that it is a stimulating color. Orange improves appetite, contributes to treatment of depression, and stimulates the heart. Green represents rest, nature and refreshment with healing powers making it a dominant color in hospitals; it reduces pressure, relieves insomnia and more. Pale green is the most calming color in the spectrum. Purple is a mysterious color, reflecting sensitivity and has a refreshing effect while suppressing hunger and metabolism regulation. Indigo light waves are crucial for fighting skin disease and high fevers. Black a mixture of all, symbolizes power and death. It causes mood swings from its unfriendly and unapproachable nature. White however symbolizes purity and truth, and its clean nature creates a soothing environment. It is an equal balance of all spectrum colors representing negatives and positives of all colors (Ćurčić et al., 2019).

The age of a patient plays an important role in the choice of color, decorations and artwork used within the space occupied by that individual. Older patients prefer lighter calming colors such as blue, while younger children prefer the use of vibrant colors and interesting forms to refresh the space. In the study by Ćurčić et al (2019) study it was deduced that 45 percent of patients with mental disorders disapprove and completely dislike red and orange. Creating a positive space using color is not always a universal factor (Ćurčić et al., 2019).

RED	ORANGE	YELLOW	GREEN	BLUE
Power Excitement Strength Power Passion Energy	Confidence Warmth Innovation, Friendliness Energy Bravery	Optimism Warmth Happiness Creativity Friendliness	Health Hope Nature Growth Freshness Prosperity	Trust Loyalty Dependability Logic Serenity Security
PURPLE	PINK	BROWN	BLACK	WHITE
Wisdom Luxury Wealth Spirituality Sophistication Royalty	Imaginative Passionate Transformation Balance Creativity	Serious Earthiness Reliability Authenticity Warmth Support	Sophistication Security Power Authority Substance	Cleanness Clarity Purity Simplicity Freshness

Figure 3: Example of color psychology meaning and feelings evoked (Ciotti, 2020).

This paper of colour psychology and its affects on users will support my study going forward as it provides a better understanding of what colour is best suited based on the space and supports my investigation that colour psychology as a variable of EBD can in fact enhance patient experience and recovery as well as shorten the period that the patient is admitted through its effects.

2.4.3 Biophilic Design

Biophilia and Healthcare by Bryan Alaspa (2017) is an article that discusses how to implement biophilic design into hospitals and why it is important to aid patients, staff and visitors. This paper will be focusing on sections concerning the patient only.

Although very few people like being in the hospital and healthcare workers do their best to accommodate for patient's comfort, there is a subtle and easy way to make things a little better and the answer is plants. Several studies indicate that the use of biophilia and the implementation of plants in healthcare facilities help patients, staff and visitors by connecting them to nature (Alaspa, 2017).

Biophilia, which means 'love of nature', is a term that was coined by Edward.O. Wilson in the 1980's suggests that humans have an innate need to connect with nature, be close to nature, and feel as though nature surrounds them. Being around nature allows

humans a sense of calm, feeling better about themselves the world and their situation (Alaspa, 2017). Integrating indirect and direct elements of nature into an environment design creates an increase in productivity, creativity, effectiveness, and a generally healthier environment as well as reducing stress, blood pressure levels and heart rates. The article focuses on how the use of biophilia can lead to better healthcare and how it can improve the experience and outcome for people in hospitals. It states that being in the hospital is already a stressful experience thus waking up in a room with white walls, floor and ceiling does not promote healing. Studies have shown that biophilia implemented in hospitals integrates rooms with a view of nature i.e. a forest, a landscaped garden or an atrium which can reduce recovery time for patients from illness, injury and operation (Alaspa, 2017).

When using biophilic design in healthcare facilities studies have shown that the recovery times for post-operative patients decreased by 8.5%, as well as reduced the use of pain medication by 22 percent (Heath 2019). Patients with a nature view spent an average of 7.96 days in hospital while patients without it spent 8.71 days, proving that the view influences the recovery of the patient. Although not every patient can have a window with a view of nature there are subtle things that can be done indoors such as using plants in hallways, rooms and waiting areas as well as using natural or colors found in nature and materials in these areas. Other elements that can be implemented are gardens or indoor atriums that patients can access and even wall art and photographs on walls can create that connection with nature, thus promoting healing (Alaspa, 2017). According to Alaspa (2017) a hospital could potentially save up to \$93 million by providing a view of nature and boosting their healing process.



Figure 4: Sharp Memorial Hospital with view of nature (Falkenthal, 2014).

As a conclusion the article suggests ways and elements that can be used to incorporate biophilia in the interior design of healthcare facilities to promote well-being and patient recovery. These suggestions are: Changing the views to views of nature, use nature inspired colour schemes and materials, use plants and use photos of nature (Alaspa, 2017).

Changing views and providing patients a view of nature from their rooms instead of views of urban areas will give patients a calming feeling.

Colour schemes and materials inspired by nature are an indirect biophilic design, including the colors browns and greens among others and materials include various woods. It further suggests that only areas that mostly impact patients should incorporate these schemes, and not all areas of the facility.

Placing potted plants in patient rooms or near and around patient rooms as well as areas used by patients create a direct connection between the patient and nature. Placing green walls in corridors where patients pass saves horizontal space while providing the nature connection.

Painting and images of flowers, plants, and nature in the important areas to patients have been shown to produce the same benefits as that of live plants or live nature views, thus providing the same connection to nature (Alaspa, 2017).

This article by Alaspa (2017) contributes to my research paper as it explains biophilia and provides specific elements within design that aid in the perceived recovery of patients in hospitals. This paper is an important literature as it informs the paper, specifically the linkage of biophilia in certain sections of healthcare facilities and will allow me to prove my argument and answer my main question and sub-questions.

2.4.4 Light Theory

The paper “Impact of Light on Outcomes in Healthcare Settings” written by Anjali Joseph in 2006 was conducted by reviewing other peer reviewed journal articles and research reports that were published in many disciplines namely: medicine, psychology, architecture, ergonomics, and lighting design periodicals and books. The article provides the key findings and a brief conclusion before proceeding with the body of the article, which helps the reader decide if this article is appropriate or not for them. Light is very important to humans, besides needing light to see things and do things, light affects humans psychologically and physiologically. There are many reasons why light is important that multiple studies have proven such as reducing depression, improving alertness, decreasing fatigue, and modulating circadian rhythms to name a few (Joseph, 2006). The paper discusses how light impacts health and performance in humans and also looks at the link between light and health outcomes in healthcare facilities.

Studies have indicated that better performance of complex tasks are directly linked to higher light levels, and also that age determines levels of light required by an individual. Studies further suggest that daylight is not necessarily superior to artificial light for performance, but unlike artificial lighting, daylight does provide benefits in regulating circadian rhythms and maintaining overall health (Joseph, 2006).

According to Joseph (2006) there are four main mechanisms through which light impacts human health and performance: Enabling performance of visual tasks,

controlling the body's circadian system, affecting mood and perception and facilitating direct absorption for critical chemical reactions within the body. Joseph proceeds to expand on each of these mechanisms in the rest of the paper. This literature review will focus only on sections that pertain to patients, such as controlling the body's circadian system.

Controlling the body's circadian system:

When light falls onto the retina in the eye and is transmitted to the hypothalamus in the brain, it controls the circadian rhythm (biological events that repeat themselves at regular intervals. Sleep-wake cycle) of the body which synchronise the body's internal clock to 24 hours. During the process of light passing through the appropriate channels, a hormone called melatonin is secreted by the pineal gland. Melatonin carries "time" information to all parts of the body through the bloodstream. The melatonin levels in an individual's body determines their level of energy; feelings of depression occur when daylight or artificial light are inadequate due to the natural suppression of melatonin production failing. When melatonin levels are high it causes drowsiness and when it is low it creates a state of alertness (Joseph, 2006).

Controlling the body's circadian rhythm means that both artificial and natural light affect multiple patient outcomes and health, in the paper Joseph (2006) discusses reducing depression, decreasing length of stay in hospitals, improving sleep and circadian rhythm, lessening agitation, and easing pain. Light can affect all these outcomes of patients in hospitals. There are strong studies that show that patients with bipolar disorder experience a reduction in depression when exposed to bright light (Joseph, 2006). Other studies have shown that natural bright light have a similar effect in reducing depression.

In studies it was seen that female patients placed in sunny rooms stayed a shorter period than those in dull rooms (2.3 days : 3.3 day) (Joseph, 2006).



Figure 5: Natural and artificial light in hospital room (LightSources, 2020)

From this paper it can be concluded that in healthcare facilities it is important to use a combination of, as well as the appropriate exposure of daylight and artificial light to accommodate and aid in the overall well-being and health of patients in hospitals. Visual comfort encompasses a narrow spectrum of daylight factors, luminance and luminance intensity, and their effects on people (Ulrich, Berry & Quan, 2010). Patients and staff are significantly impacted by the access to daylight (or the lack thereof) in healthcare facilities (Ulrich, Berry & Quan, 2010). An experiment done on patients suffering from winter depression disclosed that morning light is twice as effective as evening light when treating the patients (Joseph, 2006).

This paper, by Joseph is very useful to my study in providing me with the appropriate information to determine between the two types of lighting and their impact on four different mechanisms in which they promote health and well-being in healthcare facilities. The studies and information in this paper confirms and supports the impact that light has on the perceived recovery of patients in hospital using evidence.

3 Research Design and Methodology:

Saunders research onion is a methodology decision making tool that aids in identifying decisions that need to be made when developing a research methodology. Decisions are made from the outside of the onion inwards, peeling a new decision right to the middle of the onion. Saunders' onion is a tool that assists in thinking out and implementing methodology holistically (Crossley and Jansen, 2021).

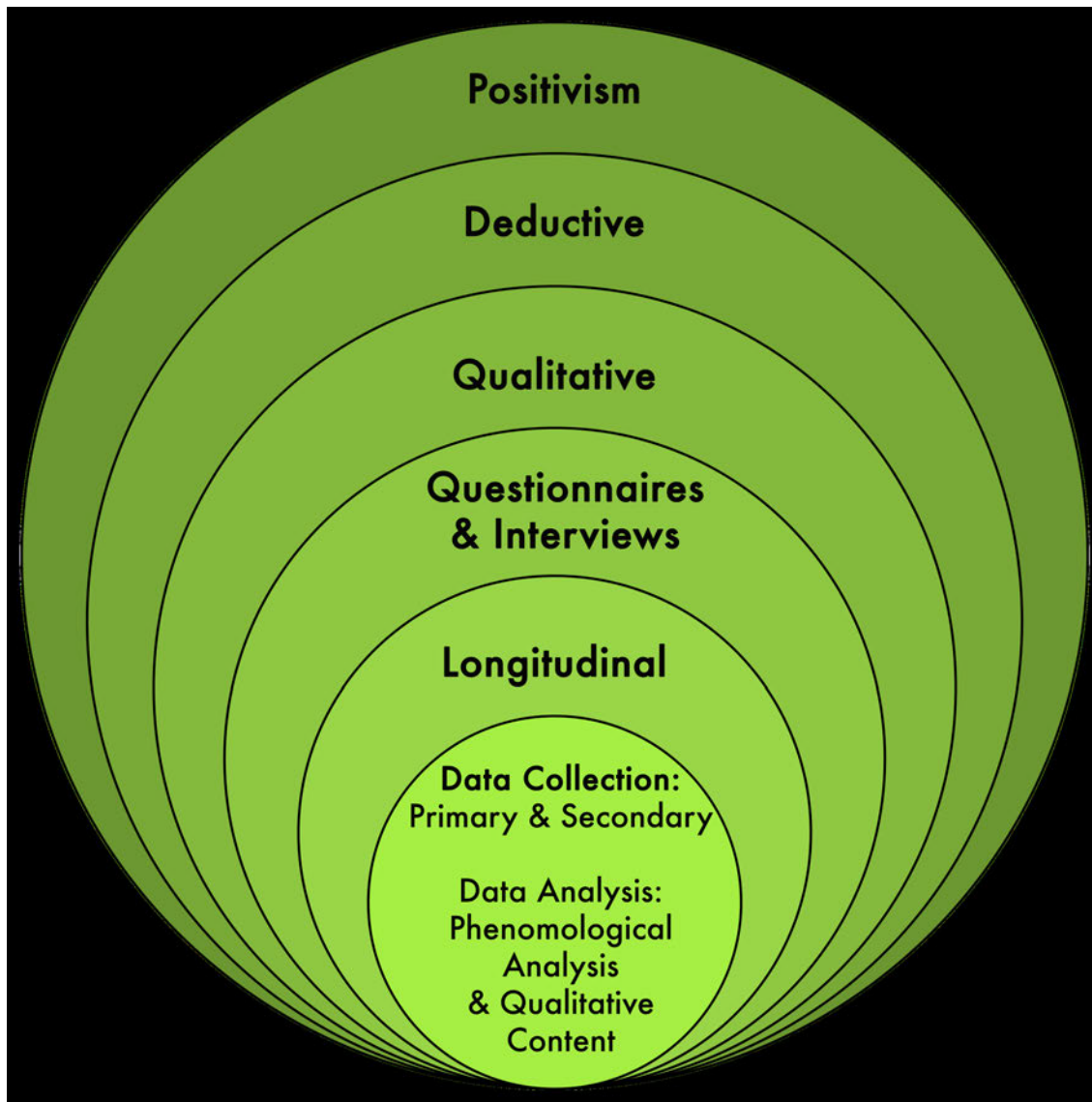


Figure 6: Saunders' Research Onion (2007) (Crossley and Jansen, 2021).

The research methodology of this study is to explore EBHD with a qualitative approach, a positivist ontological perspective with specific focus on color psychology, light theory and biophilic design making use of a deductive approach using a qualitative method building on the knowledge of EBD and how it can improve hospital outcomes in SA through research of seminal works, literature, and cases studies with a cross-sectional timeline. This paper makes use of both primary and secondary research using a purposive sampling to sample the HCF patient population and analyzing this data using phenomenological analysis and qualitative content analysis (Crossley and Jansen, 2021).

3.1 Paradigm and Justification

Positivism states that through observations, experiments, and logical proof (Hasa,2011), authentic qualitative data can be identified and tested to predict human behaviour (Lin, 2005). In the aforementioned study, EBD is used to understand the causal relationships between patients in hospitals and the design of the environment they are in. The surrounding environment in hospitals and the design thereof, have a direct impact on patients, their emotions and behaviours. This causal relationship between patients and the environmental design was observed through theories like color psychology, biophilia and effects of light and art and how these factors contribute to the experience and perceived recovery/outcome of the patients.

Our daily surroundings in various environments (home, school, work) profoundly influence our well-being both psychologically and physically. HE are the environments that surround us or the conditions we are placed in that aid in creating opportunities to achieve physical and/or mental well-being (National Cancer Institution Thesaurus). Logical proof was deduced from studying HE and their role in patient recovery. In South Africa many hospitals are still designed purely for functionality and access and does not support the well-being of patients, resulting in affecting the perceived recovery of the patients.

3.2 Design Approach

Data was collected through a qualitative data collection method, data collected include case studies, current building observations and findings from relevant journals and a variety of relevant published information (du Plooy-Cilliers, et al, 2014). A Qualitative approach, in the form of analysis into case studies, articles and journals adds proven and reviewed knowledge to the study and allow for an understanding of evidence documented regarding patients and their needs. Studying the needs of patients through reports and case studies that have documented experiments and proof of EBD provided this study with the textual aspect of the qualitative approach, while analyzing two different hospitals, through online visual searches, as precedent studies, allows for the visual aspect of the qualitative approach and thereby contributing to the primary data collection method. This study requires textual and visual data thus qualitative data collection was the best method for this study (Crossley and Jansen, 2021).

3.3 Research Design

This study will be making use of a deductive approach as EBD, color psychology, light theory and biophilic design are all theories that exist and the researchers aims to only add to the existing knowledge in order to potentially assist in the improvement of hospitals in SA (Crossley and Jansen, 2021). The exploration of elements and tactics such as color psychology, lighting, views and biophilia would form the epistemological inquiry, reached through previous studies as well as further investigation (du Plooy-Cilliers, et al, 2014).

The researcher's aim for this study is to describe and, define the phenomenon of the chosen theories in more detail, it is within this scope that the study will use a descriptive research strategy to describe certain behavioural patterns in patients (du Plooy-Cilliers, et al, 2014).

The use of case studies is the most appropriate data-collection method for the descriptive research strategy as it will assist analysis patterns of patient's recovery easily considering the cross-sectional timeline. Case studies used by the researcher consisted of experiments done on patients to explore the use of colour psychology, light

theory and biophilic design and studies done to prove EBD (du Plooy-Cilliers, et al, 2014).

The study will be non-empirical as it will rely on, and work with logical assumptions and beliefs about the identified theories in this study through analyzing case studies, relevant literature gathered from the deductive strategy as well as observing the current design of two different hospitals in SA. The two chosen hospitals were analysed from the exterior only due to COVID-19 regulations; to analyze the current state of design and compare it to the theories identified in this study. Given that the analysis was of current design, a cross-sectional timeline was utilized (Crossley and Jansen, 2021).

4 Research Plan

4.1 Population:

This study will include two different hospital buildings as a part of its population, which will be used to measure the design of the two hospitals against the principles and tools established in the literature study. The population of this study will be two hospitals in Gauteng, SA. The two hospitals were visited, however, analysis was conducted from the outside as well as through internet images, and the current design of the hospital was observed to analyse whether the hospital's design is informed by EBD and the other theories in this study.

4.2 Sampling:

In this qualitative research, purposive sampling will be used to meticulously select hospitals that can be analysed against specific criteria for the desired outcome. Purposive sampling, which may be referred to as judgment, subjective or selective sampling, is a sampling technique that the researcher selects a participant or representative sample with specific characteristics in order to achieve the specified outcome.

The desired characteristics for the hospitals are one in which the use of EBHD can be identified and the other that is not well informed by the theories articulated in this study.

The researcher will select two hospitals in SA that can be compared against the identified criteria. Hospital A is a hospital that is designed based on several grounds established in EBD and the other theories, while hospital B is a hospital that has not yet been informed by and designed according to EBHD criteria.

4.3 Data-collection Methods:

The qualitative research approach gathers data from both primary and secondary research, allowing strategic analysis of subjective findings.

4.3.1 Secondary research, was conducted in the form of internet searches, books and published works to gain insight on previously conducted research in order to support the study of EBHD, color psychology, biophilic design, light theory and contextualized to SA. Two case studies will be found on the internet and the researcher will be sure to acquire them from a reliable, scholastically seminal source (du Plooy-Cilliers, et al, 2014).

4.3.2 Primary research was conducted in the form of observations of hospital A and hospital B chosen for this study and the photographs taken from the exterior to collect the data needed for the research.

4.4 Data Analysis Methods:

A combination of Interpretive Phenomenological Analysis and Qualitative Content Analysis will allow the understanding of the experience of the subjects as well as the identification of themes and patterns in participant behaviour. The study is subject-centered, thus the aforementioned methods being the best to understand the behavioural patterns of patients relating to the interior elements (Warren, 2020).

5 Summary:

The use of EBHD is not a new theory and it is becoming the foundational knowledge on which designers look at to aid the design of HCF. Although EBHD it is still a developing field of analysis, there has been substantial research and experiments done to support this theory. The data collected in the finding of EBD test and experiments are used to inform design decisions when designing HCF (Ulrich, Berry & Quan, 2010). In this paper the researcher looks at the use of colour psychology, biophilic design and light theory to further expand on and support the literature on EBD. The use of design factors such as color, light and biophilia provides the study with the specified criteria and principles to measure the rest of the research on. The researcher will further use these principles to identify the appropriate case studies, precedent studies and building for the primary and secondary research.

Although there are quite a few ethical considerations and limitations the researcher will ensure that the study proceeds ethically by collecting and interpreting all data with integrity and caution. The methodology chosen in this paper is the most appropriate as it will allow the researcher to collect data at a distance if needed and without imposing on participants and rather by observation of a building. The methodology is appropriate as it will help the researcher gain the correct information required through a qualitative method in the limited time.

It has been established that our daily surroundings in various environments (home, school, work) profoundly influence our well-being both psychologically and physically. It is important, that when designing hospitals consideration is extended on HE and understanding and awareness of the needs of the patients (Ulrich, Berry & Quan, 2010). Logical proof will be deduced from studying HE and their role in patient recovery. In South Africa many hospitals are still designed purely for functionality and access and does not support the well-being of patients, resulting in affecting the perceived recovery of the patients (Paul, 2020). There is, limited information for this study in the SA context, however the researcher will endeavor to obtain appropriate information and

correlate it to the SA context for future use of information to aid in decision making during the design of SA hospitals.

6 Findings and Interpretations of Findings

The main objective of this study is to explore the opportunity of improving HCF specifically in SA, using EBHD as the foundation theory to aid in the perceived recovery process as well as the overall well-being of the patients, and for the purpose of this research paper will only include Color Theory, Light Theory and biophilic design while also exploring healing environments.

In this chapter we will illustrate and interpret the findings deduced from the data collection and data analysis process. The data was collected from two studies analysing Cintocare Hospital and Netcare Sunninghill Hospital against a list of criteria (Figure 1: List of Criteria). A visual analysis will be done on both hospitals and a detailed discussion of the design thereof will be presented. Subsequent to analysing the two hospitals, a comparison is executed identifying common themes or similarities and variances. It will then be determined whether the designs of the two hospitals are informed by EBHD and the percentage thereof.

7 Interpretations of Findings:

There are two case studies discussed and interpreted in this section, this allows the researcher to clearly see all the data collected and thereafter interpret the findings. Below, the two studies are discussed in the context of the criteria list, in the below section. Table illustrates the legend used for the visual analysis of the images of each hospital.

Table 1: Visual Analysis Legend

Evidence-Based Healthcare Design		Colour Pshychology	
Audio Environment	E1	Red	C1
Visual Environment	E2	Yellow	C2
Safety	E3	Orange	C3
Wayfinding	E4	Black	C4
Sustainability	E5	Blue	C5
Patient Rooms	E6	Green	C6
Family Support Spaces	E7	Purple	C7
Staff Support	E8	White	C8
Physician Support	E9		
Biophilic Design		Light Theory	
Room view of nature	B1	Natural Light	L1
Using Plants	B2	Artificial Light	L2
Natural Colour	B3		
Natural Materials	B4		
Indoor Gardens or Atriums	B5		
Wall art & Photographs	B6		

7.1 Case Study 1: Netcare Sunninghill Hospital

Netcare Sunninghill Hospital in Sunninghill Sandton, South Africa was established between 1994 & 1996 and it a multi-disciplinary HCF equipped with state of the art medical equipment. The facility has a 24-hour emergency department with an accredited level 2 trauma unit which includes a helicopter landing pad (Netcare Hospital, 2021). The hospital houses 279 multidisciplinary beds, 12 Emergency Department beds, four Resuscitation Unit beds, 87 ICU beds and 25 High Care beds bringing it to a total of 407 beds in the hospital (Netcare Emergency Department, 2020). The HCF cares for approximately 22 000 emergency department patients annually (Netcare Emergency Department, 2020).

The highly skilled professional staff and surgeons employed offer a vast variety of medical disciplines such as: Anesthesiology, Cardiology, Cardiothoracic surgery, Dentistry, Dermatology, Otorhinolaryngology, General practice, General surgery and Gynecology to name a few (Netcare Hospital, 2021).

Presented below, are images of the hospital with specified criteria indicated from the image. After visually analysing the images the researcher will discuss the findings that the images illustrate.



Image 1 (Netcare Hospital, 2021)

E2

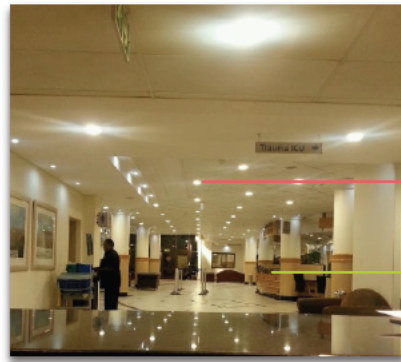


Image 2 (Netcare Hospital, 2021)

L2

B4



Image 3 (Netcare Hospital, 2021)

B4

E4



Image 4 (Netcare Hospital, 2021)

E6

L1



Image 5 (Netcare Hospital, 2021)

L2

B4

E1

E4

C5



Image 6 (Netcare Hospital, 2021)

E7

C0

B2



Image 7 (Netcare Hospital, 2021)

E9

B6

L1

C6



Image 8 (Netcare Hospital, 2021)

L2

E6

B6

E2

C0

7.1.1 Evidence-Based Healthcare Design

E1- Audio environment - Soundproof flooring and walls, music and noise are all factors of the audio environment. There are no soundproof walls or flooring and due to research limitations it is not clear if there is music playing in the hospitals. In Image 5 one can see several people gathered in at the reception desk which could possibly be noisy for patients if this area is close to patient rooms.

E2- Visual environment - Views of nature, natural light and artworks make up part of the visual environment, stimulating patients visually using visuals that imitate or of nature. Image 1 is a photograph of the exterior of the hospital which displays the windows of part of the building showing that natural light source is limited, given that the windows are narrow. Image 2 is the children's room which has a painted wall with an outdoor scene.

E4- Wayfinding - Signage, floor plans, information desk and a clear entrance make wayfinding easy for users of a space. The wayfinding board shown in image 3 has a color legend which should be easily understood, however this may be confusing due to the overload of information on one board thus not making it very clear.

E6- Patient Rooms - Patient having control of lighting and temperature, acuity adaptable rooms and multi verses single-bed rooms, which create a more comfortable environment for patients. Images 4 and 8 show single-bed rooms for patients who prefer privacy, it is however not clear if the room is acuity adaptable. (Acuity-Adaptable Units (AAUs) are rooms with a

treatment model that allows all stages of patient care to come to the patient's unit from the time of admission to discharge).

E7- Family Support Spaces - outdoor patient gardens with seating, comfortable waiting areas and overnight beds alongside patient beds. A waiting area for family at Sunninghill Hospital is shown in image 6 with a few single seaters and a low round coffee table in the center. The cushion on the single seaters look comfortable, however for long periods of waiting this setup might not be the best for users.

E9-Physician support - acoustics of operation rooms, meeting room quality, the coherent quality of the workstation locations and consultation rooms. The consultation room in image 7 is spacious enough to accommodate three people with a large work space.

7.1.2 Colour Psychology

C1- Red - love, power, warmth, attracts attention, stimulating and compact, reducing pulse, blood pressure and breathing. Using red in the motto signage in image 6 fits the word passion perfectly as it shows the passion and power of the hospital.

C2- Yellow - optimism, joy, warmth, alertness and concentration, stimulates heart rate, blood pressure, breathing. The word Participate in image 6 shows optimism of all parties participating in patients care-taking and recovery. It additionally indicates that the small detail of color adds to the design of the area

C5- Blue - peace, harmony, symbol of hope, faith and loyalty, reducing blood pressure and pulse, increases concentration. The blue used in image 5 and 8 are used to create hope in the children's rooms and the waiting area. There is however not enough blue used.

C6- Green - rest, nature, refreshment, healing powers, reduces pressure, relieves insomnia, pale green is most calming. Using green in the consultation room enhances a feeling of healing and calm to the patients visiting this room, and reduces pressure for the doctors in the space.

7.1.3 Bioplic Design

B2- Using Plants - rooms, hallways, patient rooms and waiting areas are the ideal place to display plants and flowers although just placing plants at different spots is not biophilic design, it does however contribute, though not sufficiently. In image 6 there is a potted plant in the waiting room to add an element of nature, it is however the only plant seen inside the hospital in all the pictures used for this study.

B4- Natural Materials - Wood, granite and stone are some of the materials that are associated with nature. In images 2, 3, 5 and 7 There are different types of wood or wood imitations. Sunninghill Hospital has a variety of wood in multiple areas around the hospital, in attempts to create a connection to nature.

B6- Wall art & photographs- Photographs, artworks and wall art of nature or imitating nature allows users to create a connection with nature; and contributes to patient's feelings of calmness and other users to view

nature. There, is however not many wall art or photographs in the hospital from the evidence in the images used in this study. The wall painting in the children's room is one of the only paintings of nature found in the hospital. In Image 6 there is painting hung up in the consultancy room of a city landscape with a sunset.

7.1.4 Light Theory

L1- Natural Light - Light coming from the sun through windows and skylights. There are only two windows found in the visual analysis above in images 4 and 7 which does not allow for a sufficient natural light to enter into these spaces.

L2- Artificial Light - Light from artificial sources, fluorescent lighting and light emitted diode (LED) lights. It is evident that, in all the studied images, specifically image 2, 5 and 8 that the majority of light used is artificial to light up all areas of the hospital. The artificial lights used however in certain areas like in image 2 does not illuminate the area to mimic that of natural light.

7.2 Case Study 2: Cintocare Hospital

Cintocare Hospital in the east of Pretoria in the Menlyn Maine precinct. Cintocare is a specialised surgical hospital that was officially opened on the 1st of December 2021, which specialises on ear, nose, throat, head, neck, spinal, facial and vascular surgery and has no emergency facility. Aside from It being the first 5-star rated green hospital in Africa, it is also rated fifth in the world in offering specialised surgical mix and clinical business model, employing sustainable design and management features (Writer, 2021).

The building is 29 000m² and has 7 levels which comprises of three parking levels, three consulting and clinical levels and one level for the plant room. There are 15 consulting rooms, 5 theatres and 1 hybrid theatre and the hospital houses (accommodates) 100 beds that can be expanded to 160 beds (Writer, 2021).

There are multiple clinical specialities and other medical services offered at Cintocare namely; neurological and spinal surgeons, maxillofacial and oral surgeons, ear, nose and throat surgeons, plastic and reconstructive surgeons and a vascular surgeon, specialist physicians, paediatricians, an intensivist, radiology, pathology, physiotherapy, audiology, and speech and swallowing therapy (Writer, 2021).



Image 9 (Writer, 2021)

E2
B2
E5



Image 10 (Writer, 2021)

L2
E9

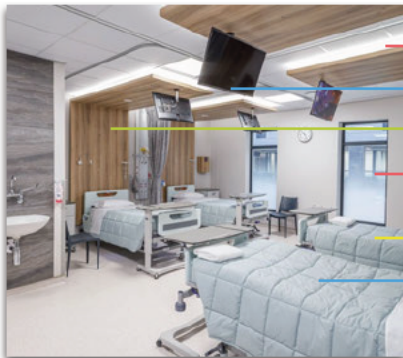


Image 11 (Writer, 2021)

L1
E1
B4
L1
C5
E6



Image 12 (Writer, 2021)

E2
B1, B2
B3, B4
E7
E1
C2, C3, C6



Image 13 (Writer, 2021)

B4
E4



Image 14 (Writer, 2021)

E3
L2
E2
L1
E9
E6



Image 15 (Writer, 2021)

B1
E7



Image 16 (Writer, 2021)

L1
E2
B6
E6

7.2.1 Evidence-Based Healthcare Design

E1- Audio environment - Sound proof flooring and walls, music and noise are all factors of the audio environment. It is not clear if there are any sound proof flooring or walls, and noise would be coming from the atrium and family support areas. Music can also be played in this area, as indicated in image 12 the area appears to be a good distance from patient rooms and physician spaces thus not disturbing patients.

E2- Visual environment - Making use of views of nature, natural light, and artworks to create a connection between patients and nature. Image 9, 12, 14 and 16 all encompass an element of the visual environment. In image 9, outside shows how many windows the building has, thus indicating how much natural light enters the building. Image 12 is an atrium for all hospital users to enjoy. Images 14 and 16 show the amount of natural light entering the patient rooms in addition to the views from the patient rooms.

E3- Safety- Overall ventilation and air quality are important in HCF and support in the recovery of patients. There are ventilation ducts in the roofs of image 11 and image 14 which are the patient rooms.

E4- Wayfinding - Signage, floor plans, information desk and a clear entrance make wayfinding easy for users of a space. The wayfinding board in image 13 is legible and simple, it is also placed at the elevators for ease of navigation in the facility

E5- Sustainability- Waste management, energy-saving features, and sustainable materials. The hospital has a level specifically dedicated to the plant room.

E6- Patient Rooms - The ability for patients to control lighting and temperature, acuity adaptable rooms and multi verses single-bed rooms to

create comfort and customization for patients. Patient rooms are shown in image 11 and 16, and illustrate that patient rooms are adaptable, however the fixed furniture does not allow it to be a multi versed space, as shown in image 11.

E7- Family Support Spaces - outdoor patient gardens with seating, comfortable waiting areas and overnight beds alongside patient beds. Image 12 and 15 show spaces in which families can sit both outdoors and indoors. There are other spaces in the hospital on other levels that support family comfort. The setups in image 12 look comfortable and there are various seating options for users to choose from.

E9-Physician support - acoustics of operation rooms, meeting room quality, the coherent quality of the workstation locations and consultation rooms. The operation room in image 10 is well lit, spacious and has quality equipment. In Image 14 a slight view of the workstation can be seen, and it is a good workspace, the workstations are located well outside every patient room door.

7.2.2 Colour Psychology

C2- Yellow - optimism, joy, warmth, alertness and concentration, stimulates heart rate, blood pressure, breathing. This color is used as an accent color in small details in the facility.

C3- Orange - energy, cheerfulness, stimulating, improves appetite, treats depression, stimulates the heart. The chairs and accessories in the atrium and other waiting areas bring a sense of cheerfulness and energy to families and other users of the space.

C5- Blue - peace, harmony, symbol of hope, faith and loyalty, reducing blood pressure and pulse, increases concentration. The color blue is brought

through in the accessories in the patient rooms such as the bedding, creating a sense of calmness and hope.

C6- Green - rest, nature, refreshment, healing powers, reduces pressure, relieves insomnia, pale green is most calming. A great deal of green is used in the HCF, for example the furniture pieces and the plants placed all around the HCF allowing a connection with nature and a sense of refreshment and healing.

7.2.3 Bioplic Design

B1- Room view of nature - forest, landscaped garden and an atrium all give the patient a sense of connection with nature. As displayed in image 12 and 15, there is an outside garden and an indoor atrium for patients and families to interact with; and image 16 clearly shows the view that patients experience from their rooms.

B2- Using Plants - rooms, hallways, patient rooms and waiting areas are the ideal place to display plants and flowers. There are many living plants used in the atrium in image 12 and image 9 also shows living plants used as an exterior design of the building.

B3- Natural Colours - Green, brown, peach and blue are natural colours that are used in all spaces of the HCF.

B4- Natural Materials - Wood, granite and stone are some of the materials that are associated with nature. Different types of wood are used all spaces of the HCF as shown in images 11, 12, and 13. Creating a connection with nature through materials brings peace and calm to patients and families.

B5- Indoor gardens or atriums - There are indoor atriums such as the one in image 12 as well as an outdoor garden s in image 15 which are accessible to all HCF users.

7.2.4 Light Theory

L1- Natural Light - Light coming from the sun through windows and skylights. As seen in image 9 there are many windows allowing ample natural light into the entire building. All patient rooms have ample natural light, of which the majority is provided by natural light during the day.

L2- Artificial Light - Light from artificial sources light fluorescent light and LED lights. There are also different kinds of artificial light used in Cintocare and the advantage of these different lights are that it can give a similar effect to that of natural sunlight.

8 Findings in Context

The findings in this section have been supported by the literature in the previous section and have well informed the outcomes. It was vital for the researcher to understand all literature before proceeding to analyze any data and summarize findings. Below is a table that breaks down all information provided in the literature review and used as a list of criteria in the data collection phase of this study In order to observe particular objects or articles in the visual analysis. The above visual analysis of the two studies all findings are stated and then ticked off in the criteria list below (Table 2). With this list of criteria the researcher was able to create a conclusion to the study and answer the research question.

Table 2: EBHD criteria checklist

EBHD CHECKLIST (Rated from 1-5, 1 being poor and 5 being strong)		Netcare Sunnighill Hospital	Cintocare Hospital
Evidence-Based Healthcare Design	E0		
Audio environment - Sound proof flooring and walls, music, noise	E1	1	3
Visual environment - Nature views, natural light, artworks	E2	2	4
Safety - Overall ventilation, quality air.	E3	0	2
Wayfinding - Signage, floor plans, information desk, clear entrance	E4	3	3
Sustainability - Waste management, energy-saving features, sustainable materials	E5	0	3
Patient Rooms - Patient control of light and temperature, acuity adaptable rooms, multi verses single-bed rooms	E6	2	3
Family Support Spaces - outdoor patient gardens with seating, comfortable waiting areas, overnight beds alongside patient beds	E7	2	4
Staff Support - comfortable break areas, decentralized nursing workstations, proximities of medications and supplies	E8	0	0
Physician support - acoustics of operation rooms, meeting room quality, the coherent quality of the workstation locations	E9	2.5	4
Colour Psychology			
Warm Colours: bold and energetic, increases heart rhythm, blood pressure and breathing,	C0		
Red - love, power, warmth, attracts attention, stimulating and compact, reducing pulse, blood pressure and breathing	C1	1	0
Yellow - optimism, joy, warmth, alertness and concentration, stimulates heart rate, blood pressure, breathing	C2	1	1
Orange - energy, cheerfulness, stimulating, improves appetite, treats depression, stimulates the heart	C3	0	2
Black - power, death, causes mood swings, unfriendly, unapproachable	C4	0	0

Cool Colours - calming, clean, relaxed, refreshed, spark creativity, health, beauty, security			
Blue - peace, harmony, symbol of hope, faith and loyalty, reducing the blood pressure and pulse, increases concentration	C5	2	2
Green - rest, nature, refreshment, healing powers, reduces pressure, relieves insomnia, Pale green is most calming	C6	2	3
Purple - mysterious, sensitivity, refreshing, suppressing hunger, metabolism regulation, Indigo fighting skin disease and high fevers	C7	0	0
White - purity, truth, soothing	C8	0	0
Biophilic Design	B0		
Room view of nature - forest, landscaped garden, atrium	B1	0	3
Using Plants - rooms, hallways, waiting area,	B2	1	4
Natural Colours - Green, brown, peach, blue	B3	0	2
Natural Materials - Wood	B4	2.5	5
Indoor gardens or atriums	B5	0	4
Wall art & photographs connecting to nature	B6	2	0
Light Theory	L0		
Natural Light- Light from sun through windows and skylights.	L1	2	5
Artificial Light- artificial sources, fluorescent light and LED lights.	L2	2	4
Final Score		28	61

Table 2: EBHD criteria checklist

9 Research Question Addressed

On the basis of the final score in the criteria checklist, it is evident above that Cintocare is a hospital that is more informed by EBHD and that the facility is more supported and focused on the overall wellbeing of the patients. Due to the nature of this study which was limited by COVID-19 regulations, the researcher was not comprehensively able to answer the research question yet, without access to medical reports, however judging by the ratings of the hospital in the data collection phase as well as a qualified interior designer it can be deduced that the design of a HCF has a direct impact on the recovery and overall well-being of patients. Through the above findings it can also be seen that a few of the characteristics of the HCF are in coherence with the literature in the previous section, which, from the research does prove that Cintocare is a hospital informed by EBHD and is thus more prone to having patients recover quicker and obtain overall wellbeing

From my research endeavors, it became evident that there is a definite and much needed transformation of design in the creative consideration when developing medical facilities and hospitals.

10 Trustworthiness :

Trustworthiness is the term used for validity and reliability in qualitative research which is determined by four factors; credibility, transferability, dependability, and confirmability. Credibility refers to the accuracy of the researchers' interpretation of the data collected from the participants. The credibility of data is increased when more time is spent with participants to gain a better understanding of the participants (du Plooy-Cilliers, et al, 2014:258-259). With the appropriate permission, the researcher hopes to visit the two chosen sites more than once over a period of three months to ensure more credible data is collected.

Transferability is after the finding(s) or outcomes can be applied to other situations and receive similar outcomes, this allows results to be carried over beyond the life of the specific research (du Plooy-Cilliers, et al, 2014:258-259). Reading the case studies and other literature and then conducting a comparison to analyze similarities and patterns

within the data allows the researcher to measure the transferability of the information gathered.

The dependability of data refers to the quality at which the process of integration between data collection, analysis and interpretations (du Plooy-Cilliers, et al, 2014:258-259). The study will be conducted in a strategic and concise manner to achieve a logical flow of accurate findings if it meets criteria of dependability.

The findings and interpretation of the researcher should be well supported by the data collected to ensure confirmability. When the findings are supported by data collected it provides evidence that more people have come to the same conclusions (du Plooy-Cilliers, et al, 2014:258-259). By finding more than one source of the appropriate information to support a specific topic allows the researcher to use transferability to accurately execute confirmability.

11 Anticipated Contribution:

The researcher anticipates that this research paper and the finding thereof add to the academic knowledge of the EBHD phenomenon and delivers a deeper understanding of it, aiming to contribute to the design decisions of interior designers in SA when designing HCF and encourages the advancements of HCF in SA.

12 Ethical Considerations:

The participants affected by this study need to be informed of the study and what it entails. The researcher is required to get informed consent from the individuals who will be giving a tour of the hospital and letting the researcher in to the hospital. This participant would most likely be the head of the hospital. Participant consent forms are attached below (Annexure J) (du Plooy-Cilliers, et al, 2014:264-271).

The researcher will make use of case studies and thus there are no ethical considerations required for this section, however due to the need for visual documentation from the hospital, the researcher will need to ensure confidentiality of secondary participants (participants not directly involved but are in the environment) and the primary participants (individuals who have agreed to aid in the data collection) by cutting out and blurring faces or any information that can identify an individual

(Annexure K and Annexure J). It is also important to consider that the secondary participants may potentially be patients in the hospital, thus making them a vulnerable group (du Plooy-Cilliers, et al, 2014:264-271).

Due to the use of case studies and the purposive sampling strategy, the selection of the two hospitals may be considered as biased as the researcher has certain outcomes to achieve through the two selected buildings. (du Plooy-Cilliers, et al, 2014:264-271).

13 Limitations:

As my study is on hospitals and particularly the patients in hospitals there are a few limitations presented. The ethical and legal aspects of obtaining clearance and consent from hospital practitioners and patients will be difficult as information in the medical sectors are highly confidential and participants often do not agree to participate. An anonymous survey, indicating only age and gender could be done to gather basic information, although reasoning and explanations might be more valuable to this study and the time constraints are also a variable.

Due to the COVID-19 pandemic gaining access to hospital facilities will be challenging as the hospitals only allow staff and patients in. The researcher could suggest a site visit during a time, that the hospital is least busy or suggest a virtual walkthrough of the interior space and capture screenshots of the spaces.

The information on South African hospitals and the design thereof are limited and it is challenging to find seminal authors on this topic. The topic of EBHD and HE have not been much explored within a SA context and will thus limit this study in gathering sufficient information.

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Annexure A: Final Research Report Summary Document Template

TITLE: *What is my study about?*

Using evidence based design to understand the effects of interior design on the perceived recovery of patients in hospitals

Research Purpose/Objective	Primary Research Question	Research Rationale	Seminal Authors/Sources	Literature Review – Conceptual Framework	Paradigm	Approach	Data Collection Method(s)	Ethics	Key Findings	Recommendations
To identify how & where interior design can aid in regards to the perceived recovery of patients/covid patients in hospitals similar to retail.	How can evidence based design aid in understanding the effects of interior design on its users and thus aid in the perceived recovery of patients/covid patients?	It will enable us to better design hospitals in order for patients to recover faster thus creating better hospital systems	(Ulrich, Berry & Quan, 2010) (Berry & Hamilton,2018) (Taylor, 2016) (Craig, 2015) (Will, 2018)	Theme 1: Design problem with hospitals Theme 2: Evidence-based Healthcare Design Theme 3: -Colour Psychology -What is the problem -How will we get answers -Design tactics	Paradigm <i>Positivism/EBD</i> used to understand causal relationships between hospital patients & design of the environment.	<i>Qualitative</i>	-Visual Analysis -Images -Journal -Article -internet sources	-Dealing with sensitive information -Falsifying information -Bias		much needed transformation of design in the creative consideration when developing medical facilities and hospitals. The research knowledge on EBHD is very limited. Cintocare is more informed by Netcare Sunninghill
					Population					
					Population Parameters Netcare Sunninghill Hospital & Cintocare Hospital					
					Sampling	Data Analysis Method(s)	Key Contribution			
aiding in the perceived recovery process of patients in hospitals. Showing how interior design can contribute to perceived recovery	-What is the current design? -Design tactics that will aid? -evidence-based design -What kind of design can change the circumstances	Evidence-based healthcare design Biophilic design Colour Psychology Healing Environments Light	Evidence-based healthcare design Colour Psychology Light Theory Biophilic Design	Theme 4: -Light Theory -artificial vs natural Theme 5: -Biophilic Design -Direct & indirect use of nature -Connection to nature Theme 7: Theme 6:	Ontology Reality=EBD can be used to determine the effects of interior design on a patients perceived recovery Methodology open-ended interview questions, questionnaires and relevant journals, articles and book publications. recovered and current hospitalized patients, relevant doctors as well as a variety of published information	Non-probability Purposive sampling, which is also referred to as judgment, subjective or selective sampling,	Unit of Analysis Hospital Design through images Data Analysis Method(s) Qualitative Content Analysis Interpretive Phenomenological Analysis	based on personal experience so personal preference & personal health. Diff situations = diff results private vs public hospital(specify)	Will help in the design of hospitals in the future to design for best perceived recovery & understand what is required in the space other than medical equipment	



ANNEXURE B – RESEARCH REQUEST FORM (IIE007)

REQUEST TO CONDUCT RESEARCH ON OR ABOUT STUDENTS, STAFF, SITES OF ARTEFACTS OF THE INDEPENDENT INSTITUTE OF EDUCATION (THE IIE)

General instructions:

- This is a non-editable form; only ungreyed fields in the tables can be filled in. Some fields provide spaces for ticks, while others provide spaces for text to be entered or dates to be selected.
- Context-specific instructions appear in some sections.
- Only tick relevant boxes. All relevant dates must be selected by those and only those to which the date selection is relevant. Not all text fields will be relevant to all candidates. Where a text field is not, please mark it with an 'N/A' to indicate that the empty field was not overlooked.
- Text fields, though small in appearance, automatically expand as required by the text. Tables are also adjusted accordingly as a result.
- Headings and contextual delimitation appear in black text in the tables. The text you insert in the applicable fields in the tables will appear in blue. This cannot be changed.

Note for candidates who are not affiliated to The IIE as a student, staff member or contractor:

This form, and all other relevant documentation, should be completed and forwarded electronically to research@iie.ac.za and marked for the attention of the Dean: Research and Postgraduate Studies. Where applicable, you must provide the required accompanying documentation with this form, such as an ethics clearance certificate, a participant or respondent consent form and your measurement instrument.

Note for candidates affiliated to The IIE as a student, staff member or contractor:

Find out who the person responsible for managing research is at your campus. It is their job to send your completed research request form to the office of the Dean: Research and Postgraduate Studies. Where applicable, you must provide the required accompanying documentation with this form, such as an ethics clearance certificate, a participant or respondent consent form and your measurement instrument.

About the researcher												
Title	Prof	☐	Dr	☐	Ms	X	Mrs	☐	Mr	☐	Mx	☐
First name(s)	Reshaelen Eustelvia											
Last name	Lutchman											
Student number (if applicable)	[REDACTED]											
SA ID number	[REDACTED]											
Passport number (if applicable)	NA											
Home address						Postal address						
[REDACTED]						Tick if same as home address						X
[REDACTED]												

Code:	████	Code:	████
Telephone number		Cell phone number	██████████
Email	████████████████████		

About the researcher's affiliations

Institutional affiliation

If research forms part of a qualification or institutionally sanctioned research project

Institution enrolled at	Vega Pretoria
Qualification name	BA Honours in Interior Design
Faculty or area of study	Art & Design

About the supervisor or promoter

Title	Prof	☐	Dr	☐	Ms	☐	Mrs	☐	Mr	X	Mx	☐
First and last names	JD Eksteen											
Email address	████████████████████											

Corporate or organisational affiliation

If the research forms part of a project sanctioned by a company or association or organisation

Employer	Vega
Physical address	34 Ingersol Rd, Menlyn, Pretoria
	Code 0081
Contact number	██████████
Researcher's position or designation	Honours Student

About the head of the company, association or organisation

Title	Prof	☐	Dr	X	Ms	☐	Mrs	☐	Mr	☐	Mx	☐
First and last names	Ria Van Zyl											
Email address	████████████████████											
Researcher's position or designation	Head of research committee/Honours coordinator											

About the research

Purpose of the proposed research <i>Tick the appropriate option</i>	Undergraduate study	
	Postgraduate study	X
	Private company or agency	
	IIE Celebrate Teaching and Learning	

	Other (if other, explain below)	
	Click or tap here to enter text.	
Qualification or output type <i>For example, a Master's degree or a journal article</i>	Honours research paper	
Full title of the research	EXPLORING THE USE OF EVIDENCE BASED HEALTHCARE DESIGN IN SOUTH AFRICA USING COLOUR, LIGHT AND BIOPHILIA TO UNDERSTAND THE EFFECTS OF INTERIOR DESIGN ON THE PERCEIVED RECOVERY AND WELLBEING OF PATIENTS IN HOSPITALS	
Value of the research	to add to the academic knowledge of evidence-based healthcare design phenomenon and provide a deeper understanding of it hoping to contribute to the design decisions of interior designers in South Africa when designing healthcare facilities and encourage the advancements of healthcare facilities in South Africa.	
Proposed date of completion	21-11-2021	
Proposed date of submission of research findings to The IIE	29-11-2021	

About the methodology

Indicate by ticking the appropriate block and answering the relevant sections.

Questionnaire	☐	Interviews	☐	Observations	X
Existing	☐	Structured	☐	Number of observations	2
Own	☐	Semi-structured	☐	Two hospitals will be observed to analyse the current design and design elements in the space and compared to the principles identified in the data collected	
Open-ended	☐	Number of interviews	...		
Number of respondents	...	Focus group or workshop	☐		
Briefly identify, describe or explain the questionnaire. Click or tap here to enter text.		Participants per focus group	...		
		Number of focus groups	...		
		Briefly expand on the interview, workshop or focus group questions. Click or tap here to enter text.			
Purposive	X	Random	☐	Snowball	☐
Convenient	☐	Stratified	☐	Census	☐
Other (if so, state)		Click or tap here to enter text.			
Other methods <i>If so, state the method and expand on how it will be used</i>		Click or tap here to enter text.			

List of the student or staff groups, sites or artefacts under study	Hospital A: Netcare Sunninghill Hospital Hospital B: Cintocare Hospital
Average time participants or respondents will be involved in research activities	No specific time as it is an online visual analysis.

About the ethics considerations for the research

Aspects considered	Informed consent	X	Anonymity	☐	Confidentiality	X
	Committed to give feedback on the study	☐	Voluntary participation	X	Vulnerable group involved	X
	<i>Elaborate on vulnerable groups</i>		Secondary participants in the photographs could potentially be patients in the hospital.			
Documentation submitted with proposal* <i>Select the applicable options</i>	Ethics clearance certificate or letter					X
	Instrument(s) (interview schedule or questionnaire)					☐
	Participant or respondent consent form that includes information sheet for participants or respondents					
	Audio-visual consent form (if applicable)					

Conditions for conducting research on or about students, staff, sites or artefacts of The Independent Institute of Education

1.	A copy of the final paper must be submitted electronically to The IIE's Dean for Research and Postgraduate Studies at research@iie.ac.za no later than 30 days post finalisation.
2.	The researcher(s) is not permitted to either refer to The IIE or any of its educational brands or to the name, logo, brand or any other identifiers of The IIE or any of its educational brands in any way, including, but not limited to, in questionnaires, surveys, interviews, proposal or research reports. The IIE or educational brand in question must be referred to in a generic manner, for example, 'A private provider'.
3.	The researcher(s) will need to obtain informed consent in writing from all of the participants in his/ her sample if the study is not anonymous.
4.	If the Learning Management System (LMS) of The IIE is used, the researcher(s) is not permitted to refer to it by name. Learn needs to be referred to in a generic manner, for example "the Learning Management System of a Higher Education provider."
5.	A copy of this letter must be forwarded to the relevant person(s) at the brand or The IIE that would be involved in the study.
6.	Research must be conducted in such a way that the normal programme and operations of the site/ offices is not interrupted.
7.	The principal/ manager of a site must be consulted about an appropriate time when the researcher(s) may carry out the research at the site.
8.	The researcher(s) may only use this data for these research purposes and in no other way.
9.	Should the researcher(s) wish to publish this research or in any way make the results public, for example by publishing the results on a social media platform, this committee will need to approve a request to this end first.
10.	No names or identifying information of participants may be used within the research and the research must be voluntary.
11.	Photographs of human subjects may only be taken if relevant to the research and informed consent from the participants or respondents was obtained, and, even with informed consent, the photographs may not be published.
12.	The researcher is responsible for supplying and utilising his/ her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions or the offices visited for supplying such resources.
13.	If any of The IIE reports or policies are used as part of the research, all identifying information needs to be removed.
14.	Please make it clear that the information will not be used punitively in any way and participants may in no way be counselled or advised based on this.
15.	The reference number of the permission letter, if permission is granted, must appear, in one format or another, on all research documentation distributed amongst IIE staff or students.

Declaration by the researcher	
1.	I declare that all statements made by myself in this application are true and accurate; and
2.	I accept the conditions associated with the granting of approval to conduct research and undertake to abide by them.
17/06/2021	
Signature of the researcher	Date

Declaration by the supervisor/promoter/lecturer	
I declare that	
1. the above researcher is enrolled at the institution/ employed by the organisation to which the undersigned is attached; 2. and that the research proposal and or study has been approved by the Ethics Committee of The Independent Institute of Education; and 3. and that the questionnaires/structured interviews/tests meet the criteria of: • Educational accountability; • Proper research design; • Sensitivity towards participants; • Correct content and terminology; • Acceptable grammar; and • Absence of non-essential/superfluous items.	
X _____	Click or tap to enter a date.
Signature of the supervisor/promoter/lecturer	Date

The Independent Institute of Education (Pty) Ltd is registered with the Department of Higher Education and Training as a private higher education institution under the Higher Education Act, 1997 (reg. no. 2007/ HE07/ 002). Company registration number: 1987/ 004754/ 07.

Annexure C: Vega ethics checklist



Vega Ethics checklist: RESE8419/p/w

Student Details												
Title	Prof	☐	Dr	☐	Ms	☒	Mrs	☐	Mr	☐	Mx	☐
First name(s)	Reshaelen Eustelvia											
Last name(s)	Lutchman											
Title of study	Exploring the use of evidence based healthcare design using colour, light and biophilia to understand the effects of interior design on the perceived recovery of patients in hospitals and creating healing environments											
Qualification	BA Honours in Interior Design											

Supervisor Details												
Title	Prof	☐	Dr	☐	Ms	☐	Mrs	☐	Mr	☒	Mx	☐
First and last names	JD Eksteen											

Co-supervisor Details (if applicable)												
Title	Prof	☐	Dr	☐	Ms	☐	Mrs	☐	Mr	☒	Mx	☐
First and last names	Armand Meyer											

Explaining your research process						
Philosophical paradigm	Positivism	☒	Interpretivism	☐	Constructivism	☐
	Realism	☐	Objectivism	☐	Pragmatism	☐
	Functionalist	☐	Subjectivism	☐	Humanist	☐
	Other:					
Research design:	Interview	☐	Questionnaire (self administered)	☐	Focus group	☐
	Ethnography/ Observation	☐	Artefact analysis/website/ social media analysis	☐	Action Research	☐
	Case Study	☒	Design Research (Practice based)	☐		☐
	Other (if so, state)	☐	Click or tap here to enter text.			
Brief explanation of the population and number of participants/items	This study will include two different hospital buildings as a part of its population. This population will be used to measure the design of the two hospitals against the principles and tools established in the study. The population of this study will be two hospitals in SA one tertiary (Academic) hospital and one district hospital.					
Target group sampling methods/ artefact	Purposive	☒	Random	☐	Snowball	☐
	Convenient	☐	Stratified	☐	Census	☐

Annexure B: Vega ethics checklist

(No under 18's or vulnerable groups allowed)	Explain selection process	Purposive sampling will be used to meticulously select hospitals that can be analysed against specific criteria for a desired outcome.
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Ethics

Documentation submitted with proposal	Gatekeeper's letter (institutional consent)	X
	Completed Annexure E if you conduct research on IIE sites/students/staff	
	Instrument(s) (interview schedule or questionnaire)	☐
	Participant or respondent consent form	
	Audio-visual consent form (if applicable)	

Campus ethics committee recommendation

Proposal has been reviewed by the supervisor and necessary ethics considerations have been included.

- ☐ Accepted as is and provide letter
- ☐ Accepted with provisions: Nature of provision: [e.g. Instrument is not sufficient / included and need to be signed off by the supervisor](#)
- ☐ Major issues: Student should not continue with fieldwork. Actions to be taken: [Click or tap here to enter text.](#)

Supervisor signature

	Click or tap to enter a date.
--	-------------------------------

Co-supervisor/Campus ethics panel member signature

	Click or tap to enter a date.
--	-------------------------------