

**An exploration of the relationship between the intentions of the hospital
designer and the primary users' experience.**

by

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Dissertation submitted in fulfilment of the requirements for the degree

Master of Technology: Interior Design

In the Faculty of Informatics and Design
at the Cape Peninsula University of Technology

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Date submitted: July 2019

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ABSTRACT

Healthcare facilities such as hospitals are some of the most complex types of buildings, and it is important to take into account that these facilities serve a diverse group of users who often have competing needs. Literature reviewed indicates that the focus of healthcare design has predominantly been placed on the needs of the patient, with less research on the environment of the medical staff as users, and their experiences thereof. This study explores the intentions of the hospital designer and the primary user experiences, specifically those of nurses, with regard to design criteria in healthcare design for hospital wards. The research follows a qualitative approach consisting of observational studies and interviews, informed by design approaches in the literature. An explorative approach is taken to understand what the design intentions were, how the primary users experience the design intentions and to what extent the intentions and experiences correspond. Findings indicate that the intentions of the designer do not always correspond with the primary users' experience. This suggests that, although some primary users are consulted during the design phase, their experiences may still differ to that of the intentions set out by the designer. Recommendations are made regarding the need for visual and verbal communication during the design process as well as highlighting the role of the designer as facilitator in participatory design methods with primary users.

Keywords: Healthcare design, primary user experience, participatory design

ACKNOWLEDGEMENTS

I wish to thank:

- My supervisor, for her continuous guidance and support over the past two years.
- My co-supervisor, for offering up his Monday evenings to assist and guide his post-graduate students.
- My parent, for giving me the opportunity to study, and for their unwavering support.
- My brother, for always believing in me.
- My partner, for keeping me motivated.
- The Lord, for giving me daily strength and motivation.

DEDICATION

This thesis is dedicated to all the healthcare professionals in my family who work in healthcare facilities and provide the best care possible.

“Design is not just what it looks like and feels like. Design is how it works” – Steve Jobs (2003).

GLOSSARY

Interior designer	<p>The services of an interior designer may include:</p> <ul style="list-style-type: none">• “Confirmation that preliminary space plans and design concepts are safe, functional, aesthetically appropriate, and meet all public health, safety and welfare requirements, including code, accessibility, environmental, and sustainability guidelines.• Selection of colours, materials and finishes to appropriately convey the design concept, and to meet socio- psychological, functional, maintenance, life-cycle performance, environmental, and safety requirements.• Selection and specification of furniture, fixtures and equipment.• Preparation of construction documents, consisting of plans, elevations, details and specifications, to illustrate non-structural and/or non-seismic partition layouts; power and communications locations; reflected ceiling plans and lighting designs; materials and finishes; and furniture layouts” (Anon, 2019).
Ambient environment	<p>“Ambient features include attention to lighting, air quality, and noise” (Karlin & Zeiss, 2006).</p>
Architectural features	<p>“Architectural features are the relatively permanent aspects of the hospital environment, which include the physical plan, layout, size, and shape of the units” (Karlin and Zeiss, 2006).</p>
Interior design features	<p>“Interior design features are the less permanent aspects of the hospital environment” (Karlin & Zeiss, 2006).</p>
Way-finding	<p>“...a person’s spatial behaviour or orientation. Spatial orientation is the static relationship to space or the environment. The concept of spatial orientation is the predecessor of way-finding” (Huelat, 2007).</p>
Greenfield site	<p>“Greenfield sites are areas of land, usually agricultural or amenity land, which are being considered for urban development” (Murray-White, 2018).</p>
Primary user	<p>“The direct, ‘hands on’ users...who may be fulltime users and who may need workstations dedicated to their use” (Eason, 1988).</p>
Secondary user	<p>“The occasional users...” (Eason, 1988).</p>

Tertiary user

“People who are likely to be affected by the operation of the system but are not direct users of it” (Eason, 1988).

Spatial accessibility

“Spatial accessibility is much more than being able to achieve a desired place. It is also necessary that the site allows the user to understand their function, their organization and spatial relationships, as well as participate in activities that occur there” (Andrade and Ely, 2012 as cited in Dischinger, Ely and Piardi, 2012).

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CHAPTER 1: INTRODUCTION

“Environments built for human habitation must be carefully designed to fulfil the needs of the intended occupants” (Kopec, 2012:xv).

This thesis describes research that was undertaken to explore the intentions of the healthcare designer in relation to the nurses as the primary users’ and their experience. The research was conducted in a private hospital’s wards, which acted as an intrinsic case study. Chapter 1 includes a discussion of the background to the research problem, followed by the research question and the aims and objectives. The research design and method are briefly addressed, followed by the limitations. The chapter concludes with the outline for the rest of the dissertation.

1.1 Background

“Nurses experience the effect of the built environment on their professional practice each day and possess a wealth of knowledge about design features that either support safe, efficient delivery of patient care or those that seriously impede care delivery” (Stichler and Cesario, 2007 as cited in Berry and Parish, 2008).

Some of the most pioneering research in the field of healthcare design was written by Florence Nightingale (1860) and Ulrich (1984). Nightingale (1860) was one of the first advocates to promote the benefits of the quality of hospital wards. She states that nursing has “been limited to signify little more than the administration of medicines and the application of poultices” and further states that “it ought to signify the proper use of fresh air, light, warmth, cleanliness, quiet...” (Nightingale, 1860). These factors affect patient care and experiences. Nightingale (1860) however, clarifies that nurses are not always to blame for negative experiences and states that: “bad sanitary, bad architectural, and bad administrative arrangements often make it impossible to nurse”.

“The healthcare building boom has created a specialty practice for architects, focusing on healthcare design” (Hozak, Nelson, & Gregory, 2016:1). Healthcare design is complex as it caters to several participants which may include the client, designers, contractors and the users, who often have “conflicting objectives and priorities” (Naccarella, Buchan, Sheahan, Reading & Cheves, 2016). Although focus is placed on healthcare design, Berry and Parish (2008) state that “...studies of the impact of facility features on hospital staff is far less common than studies on

the impact on patients” and this is seen with the increasing concept of patient-centred design and care (Greene, Tuzzio, & Cherkin, 2012:49). Race (2012) further points out that “in the healthcare setting, studies have predominantly focused on the effects of the environment on patients rather than employees”.

Ulrich, Zimring, Quan and Joseph (2004) point out that although the majority of the research regarding hospital facilities is aimed at patients, “there is a growing and convincing body of evidence suggesting that improved designs can make the jobs of staff much easier”. This is vital to consider as nursing staff form an essential part of the healthcare equation as job satisfaction and motivation directly impact patient outcomes (Race, 2012). As a result of this, Race (2012) suggests that “more attention should be given to the parts of hospital design directly affecting healthcare staff”.

1.1.1 Users

Hospitals are a place of profound human activity (Takoudes, 2015), and as we are designing for humans, it is vital to consider the various users of the space. In the field of User Experience (UX) design, the way in which a user experiences a service is studied. Lau (2015) explains that architecture is “basically user experience design on a physical and spatial level”.

In the field of information technology, Eason (1988) categorises users into three groups, namely primary, secondary, and tertiary users. Primary users are the ones who physically use the space, “full-time users”, in this case, the nurse or doctor. The secondary users are mediators, “occasional users” who are the patients. The tertiary users are the individuals who are most affected by the implementation of the service, “not direct users”, such as external stakeholders (Eason, 1988:93).

Olsson, Blakstad and Hansen (2010) group users into six categories, which can be seen in Figure 1.1.

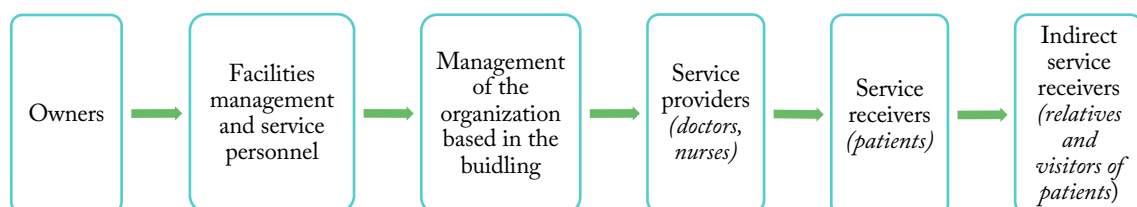


Figure 1.1: User categories adapted from *Who is the user?* (Olsson et al., 2010).

The owners of buildings may directly or indirectly be involved in the functioning of the building. The facilities management and service personnel are directly involved and are responsible for the maintenance of the facilities. The management, based within the building, is responsible for providing a service to other user groups. The service provider group consists of firstly, the management of the service providers and secondly, of the employees who provide the service. The employees include the nursing staff, who are the focus group of this study. The service receivers consist of the patients and their relatives and are known as the indirect service receivers (Olsson et al., 2010).

For this study, the focus will be on the service providers as the primary users, as “there’s no other healthcare provider who’s in the environment as much as the nurse, with the exception of some of the therapists. It’s the nurse who understands the needs of patients and families as well as other providers in the patient care setting” (Stichler, 2015).

1.1.2 Design as communication

The relationship between the designer and the intended user of the product and or service, and how they are interpreted has often been described as a process of communication (Crilly et al., 2008). In understanding the term ‘communication’, Anderson and Meyer (1988) identify human communication as the “intent to achieve meaning”. This is understood as the intent of the design and the response or experience which is thereby achieved. In an early model of design-specific communication, the trinity of designer-product-user is used. These three factors are further explored and adapted by Bittencourt, Pereira and Júnior (2015) with the introduction of *the usability of architectural spaces*. This concept relates to the trinity of “user-task-physical environment” (Bittencourt et al., 2015), where the designer understands the tasks which are to be performed by the user within a specific environment.

In understanding the relationship between the user and the physical environment, Bittencourt et al. (2015) make use of objective and subjective qualities. The objective qualities, which relate to the physical environment, include accessibility, readability, orient-ability, environmental comfort, functionality, and safety. The subjective qualities, evidenced from the cognitive aspects of the user, include familiarity, identity, independence, attachment, and satisfaction (Bittencourt et al., 2015) These qualities are used to better understand the users’ experiences in relation to the designer’s intentions. Crilly et al. (2008) conclude by stating that the effectiveness of the design “...is defined by the degree of correspondence between the intentions of designers and the interpretation of consumers” (Crilly et al., 2008).

1.2 Research problem statement

Naccarella et al. (2016) state that “hospital design is complex, occurring over a long period of time with a large number of participants - clients, users, designers, funders, regulators and contractors, sometimes with conflicting objectives and priorities”. As a result of the conflicting objectives, a discrepancy emerges in what is considered necessary by the designers in relation to the needs and experiences of the primary users.

Although designers have been focusing on the needs of patients and their relatives, less is known about the needs of the nurses as primary users’ and their experiences.

Berry and Parish (2008) note that “the physical facilities in which nurses work warrant more attention in the research literature”. Zborowsky, Bunker-Hellmich, Morelli and O'Neill (2010) support this and state: “improving the work environment of staff, specifically nurses, is an important component of the healthcare delivery equation”.

1.3 Aim of the research

This research aims to explore the intentions of the hospital designer in relation to the primary users’ experience in a private hospital’s wards.

1.4 Research questions

In responding to the aim of the study, the following research question is posed:

To what extent do the intentions of the hospital designer respond to the primary users’ experience?

To achieve the aim of the research and respond to the main research question, the following secondary questions have been formulated:

1. What were the design intentions of the hospital designer?
2. How do the primary users experience these design intentions?

1.5 Research objectives

The objectives of this research are to:

- identify the design intentions of the hospital designer
- explore the experiences of nurses as primary users
- analyse the primary users' experiences in response to the designer's intentions

1.6 Research method and design

The research design is comprised of the research method, instruments, method of sampling and the data analysis and interpretation, shown in Figure 1.2.

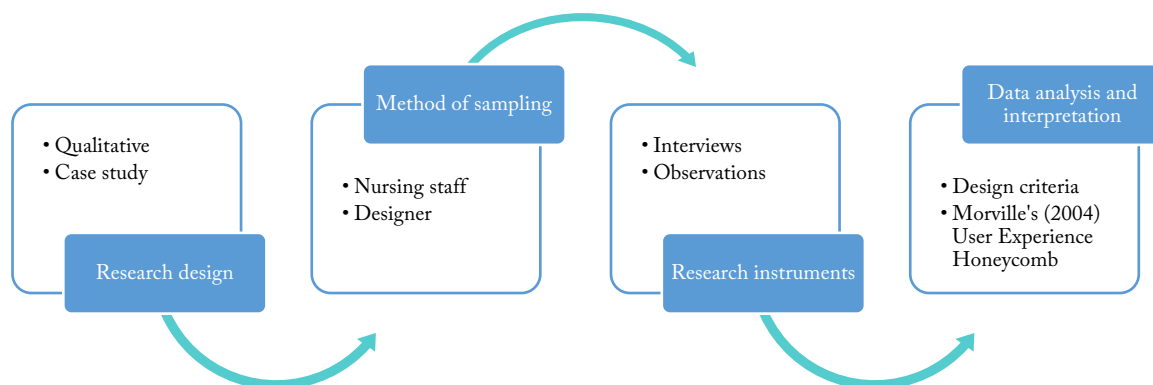


Figure 1.2: Research design and method.

1.7 Research design

In understanding the chosen paradigm, Blanche, Durrheim and Painter (2006) explain that the interpretive paradigm consists of an “internal reality of subjective experience”. The paradigm adopts a qualitative research method, which includes interaction and interpretation (Blanche et al., 2006).

A case study was used for this research, defined “as an intensive study about a person, a group of people or a unit, which is aimed to generalise over several units” (Gustafsson, 2017). A private hospital was used as the case study, which consisted of two parts, one of which was newly built in 2010. The hospital was used as a single and an intrinsic case study in which the “intrinsic interest in the case itself” (Simons, 2009) is studied in response to the main research question.

One of the advantages of studying a singular case includes being able to gain an in-depth understanding of a single phenomenon (Heale & Twycross, 2018; Farquhar, 2012), which was further achieved by selecting a purposive sample from the case study.

1.7.1 Method of sampling

A purposive sample was chosen, consisting of the nursing staff as the primary users. Six nurses were selected from the four general wards, comprised of both day and evening shift workers. Two of the nurses were approached for comment during the design of the new private section. The majority of the nurses had worked in the hospital before and after the renovations, which were done in 2010, allowing for a comparison between the older and the newer wards.

The designer in the case study also formed part of the sample population as the design aims of the hospital are set out by these skilled individuals. These aims, however, often do not meet the final user needs, and may be as a result of designers having a lot of experience, in which case assumptions regarding the design are often made (Stichler, 2015). By understanding what the design intentions were, the primary users' experience could be understood in relation to these intentions. For this project, the architect also undertook the interior design scope of work; therefore, for the purposes of this research, the architect is referred to as the designer.

1.7.2 Research instruments

As part of case study research, the three most commonly used research instruments include interviews, observations and document analysis (Simons, 2009). For this research, interviews and observations were selected.

Observations of the nursing group were conducted prior to the semi-structured interviews. The behavioural mapping method which "describes what behaviours actually occurred rather than what was planned for the space" (Nickerson, 1993) was used to capture and transcribe the observations. The design plans of four general wards were obtained from the designer before doing the observations. These plans were the maps on which the interactions, experiences, and behaviours of the nurses were recorded.

Design criteria from the literature were used as a guide to inform all the interviews. Semi-structured interviews were carried out to obtain experiences from the nursing sample group. The experiences are 'represented' and include "interviewing several people about the same phenomena" (Squire, 2008). In determining the intentions of the hospital designer, a semi-structured interview took place with the designer and a comparison was made between the findings from both participant groups.

1.7.3 Data analysis and interpretation

The findings collected from the observations and interviews from both sample groups are presented under the themes identified in the literature reviewed. These themes include the ambient environment, architectural, interior, social and specific features. The findings are compared to determine the extent to which the design intentions correspond with the primary users' experience.

The findings are further synthesised through Morville's (2004) User Experience Honeycomb model, consisting of seven principles, namely; useful, desirable, accessible, credible, findable, useable and valuable. This indicates the relationship between the design criteria and user experience in the interior design of hospital wards.

1.8 Limitations

The limitations of this study include:

1. Only the interior of the built structure and spatial design was considered.
2. The focus was placed on the nurses as the primary users.
3. The research is based on the design of the general wards and does not include the patient rooms.
4. The data was analysed in relation to user experience in interior design.

1.9 Significance of research

The study contributes to the body of knowledge of the interior of the built structure, specialising in healthcare design, where primary users are addressed and considered as part of the design process. Interior designers and architects can comprehend the importance of considering all the users of a space, particularly nurses as primary users in the design process. The framework developed can be used as a guideline for future analysis of interior spaces in relation to the end user experience.

1.10 Ethical considerations

A study permit was obtained from the National Commission on Research Science and Technology (NCRST), and consent in principle was obtained from the hospital. However, a

request was made that the hospital name remains anonymous and is therefore referred to as a 'private hospital'. Individual consent forms were obtained before the data collection process, from willing participants, and in the case where photographs have been taken, faces and places names have been blurred, ensuring anonymity, as requested by participants and the hospital.

1.11 Outline of thesis

Chapter 1 has provided the background to this study. The chapter explains that this research focuses on exploring the design intentions of the hospital designer in relation to the nurses' experience, through the research questions, aims and objectives. A brief discussion of the research methods was presented, with the sample group consisting of the designer and nursing staff. This was followed by an explanation on how the data will be analysed and interpreted.

Chapter 2 covers literature in the field of user-centred and healthcare design. The literature review highlights certain design criteria which affect primary users' experience. The design criteria are presented under five emergent themes, namely the ambient environment, architectural, interior, social and specific features.

Chapter 3 outlines the research design and method. A qualitative approach was adopted, whereby observations and interviews were used as the data collection methods. A First Cycle Coding method was used by which the data was coded. The chapter concludes with the analysis and interpretation of the data, using Morville's (2004) User Experience Honeycomb model.

Chapter 4 presents the findings under the five emergent themes, namely the ambient environment, architectural, interior design, social and specific features. These findings are synthesised through Morville's (2004) User Experience Honeycomb, demonstrating the relationship between interior design and user experience.

Chapter 5 includes a discussion of results in order of significance from the findings. A substantive and methodological reflection of the research follows, presenting recommendations for further studies. Some of the recommendations include the development of similar adapted frameworks, participatory design methods and the impact of geographical location on design.

CHAPTER 2: LITERATURE REVIEW

“For good design the end user must be involved as an active (albeit transient) participant, independently initiating and engaging with the system and carrying out tasks” (Hignett, 2013:3).

Hospitals are some of the most complex types of buildings serving a diverse group of users who have competing needs (Shumaker and Pequegnat, 1989:161). With the diverse group of users, Karlin and Zeiss (2006:1378) highlight the importance of consulting with the users throughout the design process. This is further supported by Caixeta et al. (2013:300) who state that “...user involvement can help designers understand the users’ needs and align the design of the physical space with that of services”. Marmot (2002:252) however points out that designers often influence the users with ‘visions of benefits’ at the beginning of a project but “...rarely return to assess whether or not the outcomes have been attained”.

In response to the aim of the study in which the intentions of the hospital designer and the primary users’ experience are explored, a preliminary search was done in order to initiate the research. Keywords such as ‘user-centred design’, ‘human-centred design’, ‘user-based design’, ‘user needs’, ‘experience in design’, ‘empathy’ and ‘co-design’ were used in order to obtain literature relevant to the involvement of end-users into the design of healthcare facilities.

Five main themes were identified at this early stage, and these are referred to here as design approaches, namely evidence-based, human-centred, experience-based, spatial and usability design. These approaches informed both the research design and method and led to further research. This chapter presents a comprehensive literature review obtained by searching academic databases, accessed through the university library, including EBSCOhost, Art and Architecture Complete, JSTOR, Google Scholar, ScienceDirect and, researchgate.net.

2.1 Design approaches

A set of design approaches emerged from the literature reviewed and include: evidence-based, human-centred, experience-based, empathic, spatial and usability design. These design approaches are shown in Table 2.1.

Table 2.1: Design approaches emerging from the preliminary literature reviewed.

Design approach	Authors	Key ideas
Evidence-based design	Hamilton (2007), Whitemyer (2010)	Use of current best evidence from research, practice and client
	Alfonsi, Capolongo and Buffoli (2014), Huisman, Morales, van Hoof & Kort (2015)	Measure the physical and psychological effects of the built environment on its users
	Alfonsi et al. (2014)	Framework: hypothesis, testing/analysing and outcome gathering
Human-centred design	Norman (2013)	A philosophy and set of procedures.
	Zhang and Dong (2008)	Making things useful, 'usable' and 'desirable'.
	Forshaug (2015)	'Participation of users', 'consulting end-users.
Spatial design	Poldma (2008)	The discipline of working with people and spaces
	Zhao, Mourshed and Wright (2009)	Interaction between 'human to environment' and 'human to human'.
Usability design	Haron, Hamid and Talib (2012)	Part of human behaviour study and is determined by effectiveness, efficiency and satisfaction
Experience-based design	Bate and Robert (2006)	Performance (functionality) + Engineering (safety) + Aesthetics of experience (usability)
	Bate and Robert (2006)	Making experiences accessible to the designer

All the key ideas in table 2.1 relate to the involvement of users within the design and inform the aim of this study. The five design approaches are briefly discussed in the following sub-sections.

2.1.1 Evidence-based design

Evidence-based design consists of “the best available information from credible research and evaluations of projects” (Hamilton, 2007), which is achieved together with an informed client. The evidence is obtained through developing a hypothesis, analysis and outcome gathering, which is then used as a framework (Alfonsi et al., 2014:137). In doing so, evidence-based design measures the physical and psychological effects that the built environment has on its users (Alfonsi et al., 2014). This may explain why many in healthcare design have turned to evidence-based design as a method of informing design decisions. As stated by Becker and Parsons (2007:264), this can “help attract and retain nursing staff” and improve the patient experience. An example of

improved patient experience can be understood through Ulrich's (1984) first pioneering and well-known study which investigates the recovery of surgical patients by analysing the effect of a nature scene in comparison to a dreary room with no view of nature. The study found that the patients with a view of a scene from nature had less postoperative stays, made fewer complaints to the nursing staff and consumed fewer analgesic doses (Ulrich, 1984:421). The findings from this study remain relevant today, and therefore evidence-based design can be understood as a continuous process of data gathering which will expand with time as more evidence is recorded (Alfonsi et al., 2014:142).

In addition to the evidence obtained by Ulrich (1984), Kerr (2014) notes that scientific evidence collected over the years has shown that design characteristics, namely lighting, acoustics, ergonomic designs, supportive workplaces, and improved layout, have contributed positively towards health outcomes of patients. With the focus largely being placed on the patients, Zensius (2010) comments that the environment of the staff, ranging from the nurses to the porters, has been neglected. As nursing work affects patient care (Ulrich, 2000), it is crucial to understand the needs of the staff as this may aid in future healthcare designs.

2.1.1.1 Environmental psychology

Environmental psychology, comparable with evidence-based design, is defined as “the study of symbiotic relationships between humans and their environments” (Kopec, 2012:12). The environment comprises of physical stimuli that affect our behaviour and includes lighting and noise, physical structures; hallways and furniture and symbolic artefacts described as “the meaning or image of a setting” (Kopec, 2012:14).

Environmental psychology also focuses on using research-based information. In relating environmental psychology to the design discipline, Moses (2012) There is an overlap with many design disciplines, including space planning, lighting, ergonomic design, acoustics, way-finding and interior design. These design elements contribute to the design of architectural and interior spaces, which have an influence on people (Ampt Harris and Maxwell, 2008; Foque & Lamineur, 1995:47). Environmental psychology includes the understanding of how the environment is noticed by the user (Gifford, 2012), which is attainable through observational studies.

Kopec (2012) identifies certain factors by which an environment is noticed. He identifies individual departments as ‘districts’, in which nursing stations can be thought of as “nodes from

which people travel to and from”, hallways as ‘paths’ and the walls as ‘edges’ (Kopec, 2012:259). These factors influence the way primary users experience the space. This is important in design as “layout is integral to successful design within any large facility” (Kopec, 2012:259).

2.1.2 Human-centred design

With the focus on the incorporation of the end-user, human-centred design is defined as a “process that ensures that the designs match the needs and capabilities of the people for whom they are intended” (Norman, 2013:9). This is achieved by building empathy with the individuals we are designing for (del Galdo et al., 2016:18).

Reference is often made to Maslow’s (1943) Hierarchy of Needs in order to understand user involvement when designing. Zhang and Dong (2008) created a conceptual model showing the connection between human needs and design evolution. They combined Maslow’s hierarchy of needs model (Maslow, 1943) with Küthe’s (1995) design and society model. In their study, Maslow’s (1943) hierarchy was divided into three parts, namely function-focused, consumer-focused and human-focused. The function-focused level is described as how ‘useful’ the space is, which meets the physiological and safety needs of Maslow’s (1943) hierarchy. The consumer-focused level addresses the ‘usable’ aspect of the design while the human-focused level includes needs relating to the ‘aesthetics’, “tendencies which future design is likely to care for” (Zhang & Dong, 2008:6).

Zhang and Dong’s (2008) three focuses may be understood in parallel with the three principles of good design: performance plus engineering and the aesthetics of experience (Bate & Robert, 2006:308) discussed in section 2.1.5.

2.1.2.1 Empathic design

In order to understand the human-centred design process which ensures that the design aligns with the needs of the users, del Galdo et al. (2016:18) explain that empathy, originating in the design practice, “requires deep research with real people in their natural environments”. This allows the designers to access and understand the needs of the users (Kouprie & Visser, 2009:440).

Kouprie and Visser (2009) describe the need for empathic design by using a scenario in which a group of individuals from varying professions are instructed to design a product or space for a specific user group. None of these professionals, however, belong to that specific user group. This

raises the question of how the design team will make appropriate design decisions, as their needs are different from those they are designing for; “others who are unlike themselves” (Kouprie & Visser, 2009:437). This scenario can be explained as an ‘empathic horizon’, “used to indicate the limits on a designer’s individual ability to empathise beyond certain characteristics of his or her group” (McDonagh-Philp & Denton, 2015). These characteristics may include background, age, gender, culture, education and experience.

Empathic tools and techniques are accessible to designers and can be used in understanding and advancing empathy throughout the design process. Kouprie and Visser (2009:439) categorise empathic techniques into three groups, namely research, communication and ideation.

The research aspect includes techniques that allow direct contact between the designer and the user. The designers are thus able to identify user needs and experiences. Communication is explained as a process that allows the communication of user studies to design teams. The user studies include “spending a period of time observing life in the clinic” (del Galdo et al., 2016:18), in order to observe experiences. Ideation is the process by which the designer’s own experiences emerge, in a setting that is similar to that of the user.

However, not all authors agree with the concept of empathy in design. Mattelmäki, Vaajakallio and Koskinen (2014) warn that the designer may get caught in the ‘empathy trap’, with Verganti (2009) commenting that good designers do not only listen to people but trust their reasoning and follow their instinct. Mattelmäki et al. (2014:73) caution designers and architects that “if designers are not vigilant, the attempt to be empathic might articulate popular reflections instead of innovating more radical futures”.

The caution to having empathy may, however, explain why there is often a discrepancy between the design intentions and the user experience. Although architects and designers have specialist skills and extensive knowledge, personal knowledge is only achieved when experiencing a service or product first hand (NHS Institute for Innovation and Improvement, 2009:11).

2.1.3 Spatial design

Spatial design is regarded as “one of the primordial activities in a building’s lifecycle and has an influence on the ‘human to environment’ and ‘human to human’ interaction” (Zhao, Mourshed and Wright, 2009:1). Spatial design emphasises the discipline of working with people and space

(Poldma, 2008:2), with Grobler and Le Roux (2006) commenting that the appropriation of space thus influences the spatial experience of the user.

Nacarella et al. (2016:5) list design factors, namely noise and acoustics, lighting, ventilation, storage, and odour as factors that influence a user's experience. These factors are further categorised into attraction and retention features, as certain design factors influence job satisfaction amongst nursing staff. Ampt, Harris and Maxwell (2008) discuss the impacts of the physical design of hospitals on patient recovery and staff wellbeing. In their review, similar design factors are mentioned and grouped into the ambient environment, architectural features, interior design features, the social environment and specific features. In relation to these themes, Heuberger and Special's (1997) developed a conceptual framework to be used as a systematic guide for analysing a space (Nussbaumer, 2009:23). Their framework consists of design features ranging from the broader focus; space planning, design elements and principles, to the narrower focus; lighting and furniture. These design features will be further researched to provide an understanding of the effects of these features on user experience.

2.1.4 Usability design

Usability in the built environment has been described as the functionality and ability for a space to perform the tasks that were envisioned for it, "to its efficiency, practical utility or value to the user" (Bittencourt, Pereira and Júnior, 2015:6430). This is particularly important with healthcare design, as hospitals consist of an intricate design with interrelated functions, accompanied by the constant movement of individuals and equipment (Haron et al., 2012:66). Included in the complex design is the recognition of the expanding numbers of users, each with different needs, which need to be taken into consideration. The success of the design is achieved through the satisfaction of the various users as to how the spaces within the hospital function. This will, in turn, influence the quality of the design (Haron et al., 2012:64).

The usability of architectural spaces relates to the trinity of "user-task-physical environment" (Bittencourt et al., 2015:6429). Objective and subjective qualities are used to understand the connection between the user and the physical environment. The objective qualities relating to space include accessibility, readability, orient-ability, environmental comfort, functionality and safety. The subjective qualities which are evidenced by the cognitive aspects of the user include familiarity, identity, independence, attachment and satisfaction (Bittencourt et al., 2015:6433). This allows how the user responds to the space to be better understood, and is important as "people experience space and space influences them in its turn" (Foque and Lammineur, 1995:47).

2.1.5 Experience-based design

From the preceding literature that was reviewed, evidence-based design is a process that captures the experiences of the individuals involved in healthcare which include the users, clients, designers, and contractors (Naccarella et al., 2016:14). This relates to the definition of experience-based design as “a method of designing better experiences for patients, carers and staff” (NHS Institute for Innovation and Improvement, 2009:3). Experience-based design can be understood through the principles of good design, namely performance (functionality), engineering (safety) and the aesthetics of experience (usability) (Bate & Robert, 2006:308).

Functionality is described as how well the design is ‘fit for its purpose’, followed by safety, which is determined by how reliable the design or service is. Usability is represented by “how the whole interaction with the product or service ‘feels’ or is experienced” (Bate and Robert, 2006:308). The Institute for Innovation and Improvement (2009) comment on this, remarking that equal focus has not been placed on the aesthetics of experience. By understanding the principles of good design, the possibility emerges to design experiences, rather than designing processes (Bate & Robert, 2006:308).

In addition to the user experience, Morville (2004) introduces the User Experience Honeycomb model, shown in Figure 2.2. Although this model was designed for user-experience in the information architecture (IA) industry, Lau (2015) argues that “architectural design is basically user experience design on a physical and spatial level, where the space is just another medium and buildings and structures are the interfaces and frameworks that users can interact with” (Para.5). The model consists of seven principles, namely useful, desirable, accessible, credible, findable, useable and valuable.

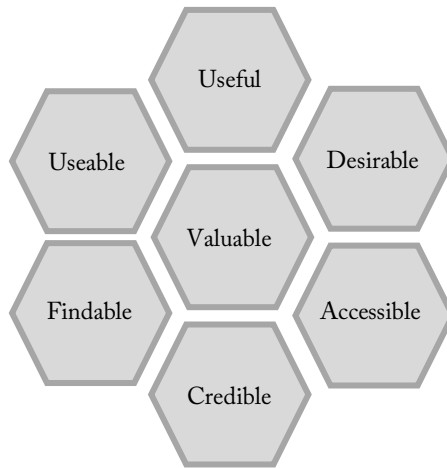


Figure 2.1: User Experience Honeycomb adapted from Morville (2004).

Through the lens of information architecture, Morville (2004) explains ‘useful’ as having the courage as designers to ask our clients whether the systems are useful. This could also apply to interior design in terms of how useful a space is. ‘Useable’ is defined as the ease of use, which is vital and necessary, specifically within a healthcare environment. ‘Desirable’, also known as emotional design, relates to the visual aesthetics of a space, which affects user experience. Morville (2004) describes ‘findable’ as allowing users to find what they need, which is important in healthcare design. However, “...way-finding systems are often an afterthought and overlay” (Devlin, 2014:424). Morville (2004) describes ‘accessible’ in the form of universal design, making the design accessible to every individual, regardless of age, size and ability. ‘Credible’ are “elements that influence whether users trust and believe what we tell them”. In the field of design, this is associated with the trustworthiness of certain design factors and the service provided.

In summary of the design approaches, it is evident that they all have the same thing common, namely the users and their environments. Evidence-based design is a continuous process in which evidence is obtained and whereby the body of knowledge will expand with time as more studies are recorded. Environmental psychology aims at understanding the relationship between individuals and their environments, with human-centred design expanding on this as a process where the design is aligned with the user’s needs. This process is achieved through empathy, whereby first-hand experience is obtained.

2.2 Design criteria

From the design approaches discussed in the previous section, a list of design criteria emerged, shown in Table 2.2. Using various research methods, the authors were able to identify certain design elements that influence the perceptions and experiences of individuals.

Table 2.2: Design criteria emerging from the literature reviewed.

Design criteria	Authors
Accessibility	Bittencourt et al. (2015)
Acoustics and noise	Kerr (2014), Kopec (2012), Moses (2012),
Ergonomic design	Kerr (2014), Moses (2012), Naccarella et al. (2016)
Flooring material	Kyrkou and Vavili (2014) Ulrich et al. (2004), Nanda, Malone and Joseph (2012)
Furniture	Malone and Dellinger (2011), Heuberger & Specials (1997), Kopec (2012)
Natural light/Sunny rooms/Windows	Naccarella et al. (2016), Ulrich (1984)
Lighting	Heuberger & Specials (1997), Kerr (2014), Kopec (2012), Moses (2012)
Safety	Bittencourt et al. (2015)
Spatial layout/planning	Moses (2012), Heuberger & Specials (1997)
Storage	Naccarella et al. (2016)
Ventilation	Naccarella et al. (2016)
Way-finding	Moses (2012)

The design criteria shown above were further researched to explore design factors that influence the perceptions and experiences of the nursing staff. Focus has predominantly been placed on patients and their visitors, in which case “...the environment of the staff, nurses to transporters, has been neglected” (Zensius, 2010).

The literature further identifies several authors who developed similar frameworks incorporating design factors from Table 2.2. Shumaker and Reizenstein (1982) identify four themes that are considered important in the design of healthcare environments; way-finding, physical comfort and physical features, privacy and territoriality, and symbolic meaning. Harris et al. (2002) expand on the sub-themes of physical comfort and physical features and add additional design elements. Karlin and Zeiss (2006) remove and add a theme: specific features and identify additional design

elements. The most recent framework generated by Ampt et al. (2008) is similar to that of Karlin and Zeiss (2006), with only a few additional design elements.

Figure 2.3 shows an adapted conceptual framework, created through a combination of the design elements from the design criteria and emerging themes from the frameworks of Shumaker and Reizenstein (1982), Harris et al. (2002), Karlin and Zeiss (2006) and Ampt et al. (2008). Certain design factors from the existing frameworks have been greyed out, indicating exclusion for the purpose of this study.

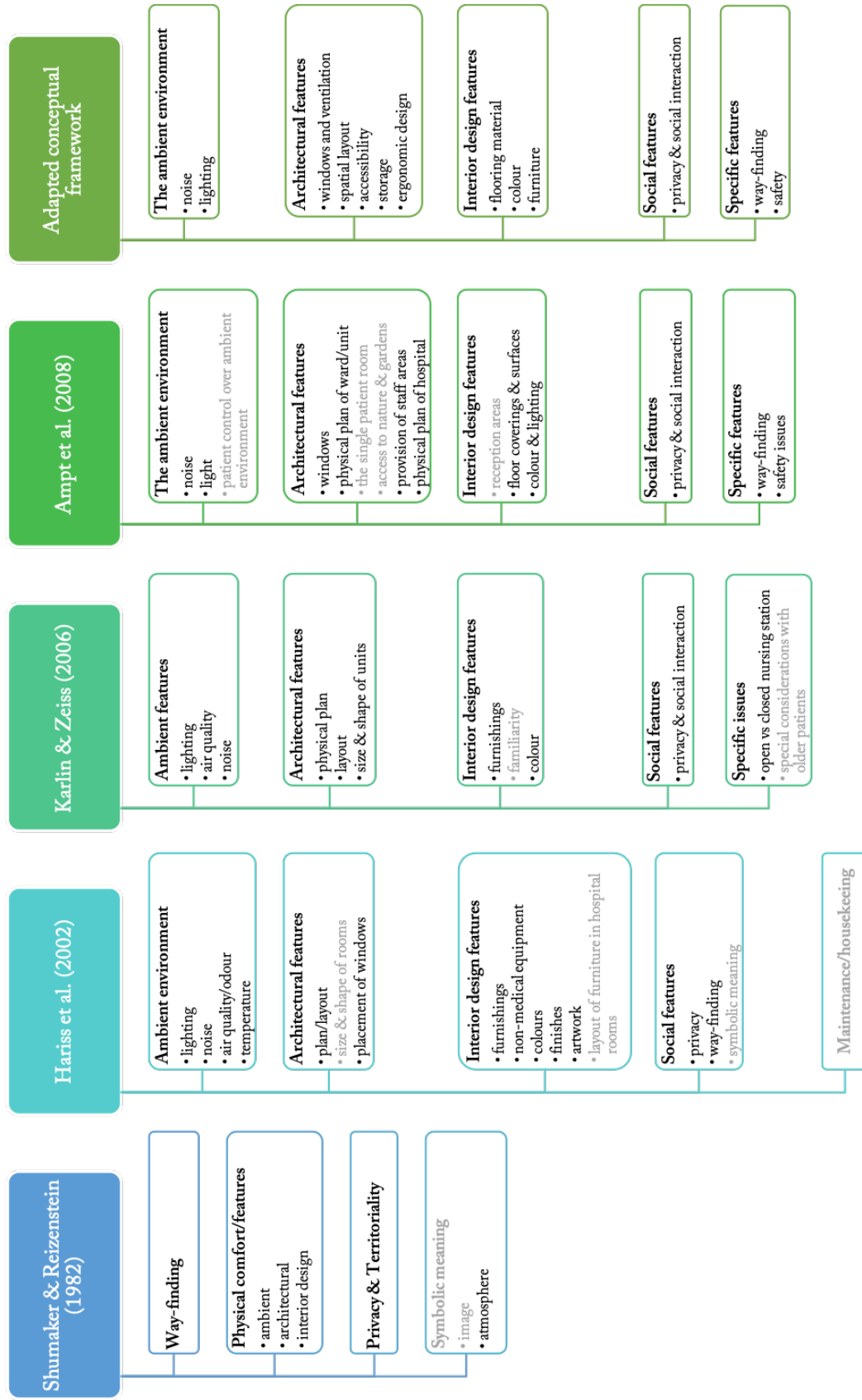


Figure 2.2: Existing frameworks from literature with adapted conceptual framework.

2.3 Emergent themes

The previous section illustrated five frameworks, listing various design elements obtained from the literature. These were mapped into an adapted conceptual framework consisting of five themes:

- the ambient environment
- architectural features
- interior design features
- social features
- specific features.

These five themes, together with their sub-themes, will be concretised in the following sections.

2.3.1 The ambient environment

The term ambient environment was mentioned by Harris et al. (2002) who refer to an article by Shumaker and Reizenstein (1982) in which four features that are considered necessary in the design of hospitals are identified. These features include way-finding, physical comfort, privacy, and symbolic meaning. Harris et al. (2002) explore the physical comfort category, which includes the ambient environment. These authors further identify lighting, noise levels, air quality and temperature as factors, which compose the ambient environment. Karlin and Zeiss (2006:1376) conducted a literature review in which they identified specific “best practise” forethoughts and recommendations for designing an inpatient psychiatric facility. This was done with the hope of potential improvement in patient care and the functioning of staff. The findings from their study were grouped according to five categories adapted from Shumaker and Reizenstein (1982) and Harris et al. (2002). One of the five categories consisted of the ambient environment, which included lighting, noise and air quality but excluded temperature. These factors are said to play a significant role in the functioning of both patients and staff. Karlin and Zeiss (2006:1378) recommend consultation and ongoing communication “...with internal staff, patients, and external professionals, throughout the design process”. The third and most recent study by Ampt et al. (2008) also includes five categories. The ambient environment in their study consists of noise, light and patient control over the ambient environment and excludes air quality.

For this literature review, the sub-themes of noise and lighting will be discussed.

2.3.1.1 Noise

Noise, measured in decibels, is defined as “a sound, especially one that is loud or unpleasant or that causes disturbance” (*Oxford English Dictionary*, 2019). In an article by Ulrich et al. (2006), most of the studies cited indicate that noise levels in hospitals exceed the World Health Organisation guidelines. An acceptable decibel level within a hospital environment ranges between 35-40 decibels but often reaches a decibel level of 70-75 (Ulrich et al., 2006:39). These noise levels are caused by various factors, ranging from staff voices to equipment, alarms and portable equipment.

Naccarella et al. (2016:5) identify three elements of a workplace that most significantly affect nurses. Firstly, adequate space for storage, secondly staff, patient and family areas and thirdly, proximity within the ward and the indoor environment quality including natural light and noise. These elements are grouped into attraction and retention factors. Noise was considered a retention factor, amongst access to natural light and maintenance, which were the main environmental factors that affected staff work experience (Naccarella et al., 2016:13). This can be associated with a study done by Ampt et al. (2008:19) who state that noise has been associated with error generation in addition to staff burnout. Ampt et al. (2008:16) state that “...noise consumes the largest amount of research enquiry into the hospital’s ambient environment”. They refer to a literature search that identifies more than 130 articles (Ulrich et al., 2004). Joseph (2006:5) comments on this by mentioning that studies regarding the effects of noise on patients are more common and adds that few studies have investigated the effects that noise has on the medical staff. This demonstrates the need for further research.

Ferri, Zygun, Harrison & Stelfox (2015), investigate end-user perceptions and experiences with evidence-based design features, which were implemented in a newly built hospital. The study took on a qualitative approach and included interviews with 39 end-users, 13 of whom were nurses. The analyses of the findings produced four topics, namely atmosphere, physical spaces, family participation and equipment. Findings associated with the healthcare providers included noise as a sub-topic, amongst others. The study indicated that lower noise levels resulted in higher levels of concentration among the nursing staff, as well as fewer interruptions, which increased the ability to complete tasks. However, this was not the case during handover periods, as noise levels increased during this time and were said to be as a result of nurses having to share a workplace. This can further be associated with open versus closed nursing stations, as open-plan nursing stations permit more disturbances (Chaudhury & Mahmood, 2007:18). These disturbances refer to the various noise sources previously identified.

Chaudhury and Mahmood (2007) conducted a study in which to explore the effect of environmental design on reducing nursing and medication errors. From the literature reviewed, it was evident that “crowded, acoustically ineffective and poorly designed nursing stations...” resulted in stressed staff, increasing the risk of medical errors (Chaudhury & Mahmood, 2007). Nursing errors were grouped according to active failures and latent conditions (Reason, 1990), with the latent conditions defined as decisions made by the designers and management, relating to environmental factors such as noise, lighting, temperature, layout and design (Chaudhury & Mahmood, 2007:7).

The literature further identifies noise sources, including telephones, conversations from staff and trolleys. Costa, de Lacerda and Marques (2013:647) found that the highest percentage of noise originates from various equipment with alarms, followed by loud conversations and laughter. Sundstrom & Sundstrom (1986) found that when staff are distracted by these noise sources, other sounds such as emergency alarms are blocked out.

Additional noise sources relating to specific design aspects include the nursing unit layout and surfaces such as the walls, floors and ceilings. Ulrich et al. (2004:15) concur by saying that these surfaces are often sound-reflecting, resulting in increased noise levels. Chaudhury and Mahmood (2007:8) found that from all the environmental factors, noise levels in patient care was considered a problematic aspect. In relation to noise, the study suggests the use of sound-absorbing materials, which may include acoustic panelling and sound-absorbing ceiling tiles.

2.3.1.2 Lighting

Artificial light, which is light produced from electrical lamps, has been associated with adverse health ailments, including visual fatigue and headaches (Altimier, 2004:90). Although natural light is the preferred light source (Joseph, 2006), artificial illumination is just as important as poor lighting levels can result in error generation. Buchanan, Barker, Gibson, Jiang & Pearson (1991) studied the relationship between direct illumination and the error rate in dispensing and found that different levels of illumination contributed to different levels of error generation. The error rate was, however, lower when exposed to a higher illumination level, and a higher error rate was noticed during low levels of illumination (Buchanan et al., 1991). These findings were mentioned by Mehrotra, Basukala and Devarakonda (2015) who carried out a systematic literature review, studying the effect of lighting design on human health and performance. From the literature reviewed, the conclusion is drawn that more research is needed to understand the effect that artificial light has on staff, in terms of performance and mood.

Iwata, Ichii and Egashira (2008) further examine the effects of lighting, studying nurses who work day, evening and night shifts. Through statistical analysis, the findings indicated a correlation between eagerness and exposure to bright artificial light during the night shifts. The findings indicated that 'subjective symptoms' such as depression, sleepiness and mood, deteriorated during the evening shifts but not during the night shifts. The findings remained the same for both normal light and bright light conditions; "the explanation that their internal rhythms were contradictory to the subsequent evening work is plausible" (Iwata et al., 2008:46).

2.3.2 Architectural features

The four themes identified by Shumaker and Reizenstein (1982) include way-finding, physical comfort, privacy and symbolic meaning. Harris et al. (2002) further explore the physical comfort feature. Although the study was most considerate of patients and how architectural features influence their experience, Harris et al. (2002:1277) comment that "the physical environment can play an important role in the health care experience". The architectural features are described as the more permanent aspects of the building, including the physical plan, size and shape of units and the placement of windows (Harris et al., 2002:1278). In an adapted version by Karlin and Zeiss (2006), the architectural features consist of the physical plan, the layout and the size and shape of units. Ampt et al. (2008:28) further adapt these features to include single-patient rooms, access to nature and gardens and the provision of staff areas.

From the above design criteria, windows and ventilation, spatial layout, accessibility and ergonomic design are discussed in the next section.

2.3.2.1 Windows and ventilation

The study conducted by Ferri et al. (2015:6) identifies natural light and noise levels as the most influential factors within a hospital ward. Aries, Aarts and van Hoof (2015:7) define daylight or natural light as the "solar radiation, visible to the human eye, emitted by the sun and perceived during daytime". The term 'natural light' is frequently used as the light cannot be artificially replicated and is therefore referred to as natural (Aries et al., 2012:7). The nursing staff participants from Ferri et al.'s (2015) study comment that it is important to have a bright and colourful environment, and this can be associated with circadian rhythms, which Joseph (2006:5) explains as biological occurrences that are automatically repeated at regular intervals. These occurrences are responsible "...for synchronising the body's internal clock to 24 hours" (Joseph, 2006:5) and if not synchronised with the workday rhythms, may result in tired and distracted

staff. This is often the case with nursing staff who work evening shifts as their internal and workday rhythms do not match, resulting in decreased alertness and performance further resulting in job errors (Smith-Coggins, Rosekind, Buccino, Dinges & Moser, 1997:960). Mehrotra et al. (2015:59) reiterate the importance of natural light and suggest that natural light should be incorporated into healthcare environments as it benefits both staff and patients “and is delivered at no cost and in a form that is preferable to most people”.

Zadeh, Shepley, Williams & Chung (2014), examine the psychological and physiological effects of windows and daylight through the use of four hypotheses. As part of the research design, the sample group consisted solely of registered nurses as existing evidence relating to this user group and topic is limited. Mehrotra et al. (2015:59) suggest that further research is required to understand the importance of natural light on staff. The findings from Zadeh et al. (2014) are similar to those of Ferri et al. (2015), with natural light being responsible for the most positive responses amongst the healthcare staff (Zadeh et al., 2014:36). The positive responses can be associated with findings from Pati, Harvey and Barach (2008) obtained through the use of questionnaires, which indicate a relationship between the external view and the alertness of the staff. The findings found that the nurses who were exposed to exterior views had higher percentages of alertness, in comparison to those who were exposed to a non-external view with deteriorating levels of alertness. Not only did the external views positively affect the alertness of the nursing staff, but also their stress levels, as pointed out by Pati et al. (2008:34). This indicates that the provision of windows not only positively affects the patients (Ulrich, 1984) but also influences the nursing staff.

Zadeh et al. (2014:36) point out that several quantitative studies have investigated the benefits of the presence of windows and daylight, mostly on patients, while other studies have “addressed overall benefits on healthcare staff”. Findings from a qualitative study may, however, explain the effects of windows and daylight on nursing staff, and the experiences associated with it.

The provision of windows as a means of natural ventilation is not only considered economical as stated by Qian, Li and Seto (2010) but also potentially ‘dilutes’ airborne diseases. Karlin and Zeiss (2006:1376) point out another advantage of natural ventilation by stating that sufficient air quality, as well as fresh air, is recommended as it assists with recovery. The disadvantage of natural ventilation is that it is affected by the outdoor climate, making it unsuitable in certain climates (Atkinson, Chartier, Pessoa-Silva, Jensen, Li & Seto, 2009:12). Artificial ventilation from air conditioning systems is, however seen as more suitable as it protects the healthcare staff, patients

and visitors in terms of airborne diseases (Abbott, n.d). Air conditioning systems are also easier to manage as the temperature can be better regulated.

2.3.2.2 Spatial layout

Halford and Leonard (2003) aim to understand the physical environment and how the spaces within a hospital are inhabited and used. Their study indicates that of all the hospital staff, nurses had the least access to space within the ward, explained as a space to which they are confined (Halford & Leonard, 2003:201). Access to space can both constrain and enable the performance of nursing staff and their identities within the workplace. While architects and designers have specific intentions for a particular space, the space should ideally be informed by the users who utilise the spaces (Halford & Leonard, 2003:202) as the spatial layout is determined by the purpose of the building and how it will be used (Bittencourt et al., 2015:6433). Naccarella et al. (2016) agree with this but also state that "...each ward design is unique to its location, infrastructure, models of care and other variables" (Naccarella et al., 2016:5) therefore, there is not one solution for all.

Lines of sight are also associated with the spatial layout and configuration of a hospital ward. With the older, existing hospitals having a centralised configuration, nurses often find that the lines of sight to patient rooms are interrupted (Naccarella et al., 2016:11). With an increase in single patient rooms, lines of sight can be even more affected as the corridors tend to become extensive in length. This does not only affect the lines of sight but contributes to the noise levels as long corridors may produce echoing, increasing noise levels (Ampt et al., 2008:45).

2.3.2.3 Accessibility

One of the elements of a workplace that most significantly affect nurses includes proximity within the hospital (Naccarella et al., 2016:3). This comprises walking distances, storage located near patient rooms, lines of sight to patient rooms and related wards within the hospital (Naccarella et al., 2016:3). The spatial layout of the ward has an impact on the accessibility of various spaces, affecting walking distances, as nurses spend a lot of their time walking between patient rooms and nursing stations, "hunting and gathering" (Joseph, 2006:6).

Naccarella et al. (2016) and Joseph (2006) explain that walking distances are associated with how a hospital ward is designed and configured. In the case where a ward has a centralised nursing station, Naccarella et al. (2016:11) identify both advantages and disadvantages. Although the

disadvantages outweigh the advantages, positive aspects include the fact that the nursing station becomes a clear staff point for visitors, is supportive of information sharing and allows for “easier managerial oversight to staff” (Naccarella et al., 2016:11). Disadvantages include higher noise levels and more walking as nurses are required to report to the nursing station every time information is needed. Joseph (2006:7) agrees with this by stating that in older hospitals, units tend to have a centralised configuration, which increases the number of trips between the nursing station and patient rooms. Karlin and Zeiss (2006:1377) remark that “greater distance may reduce environmental disruption but decrease staff responsiveness and available staffing resources”. Subsequently, Joseph (2006:8) states that new, modern designs are incorporating a more decentralised configuration in the design of hospital wards. This arrangement consists of incorporating numerous ‘alcoves’, allowing staff to be distributed across the ward, in closer proximity to patient rooms. This may promote safety (Karlin & Zeiss, 2006:1377) and reduce walking distances and noise levels (Naccarella et al., 2016:11).

Although both the staff and patients prefer the decentralised nursing station, the nurses generally favour a closed nursing station, whereas the patients prefer an open nursing station. This may be the reason why open versus closed nursing stations remains a controversial subject as it becomes a matter of prioritising user needs versus wants.

2.3.2.4 Storage

A literature review done by Naccarella et al. (2016:6) indicate that storage is considered a “key element of successful design”, with factors including readily accessible stores for medication and equipment being recurrently cited. Chaudhury and Mahmood (2007:19) found that centrally located medication storerooms near the nursing stations were preferred by the nurses but further comment that decentralised medication stores may reduce the amount of walking. Agreeing with Naccarella et al. (2016), Hamilton and Shepley (2010) also note the importance of having adequate storage for non-emergency equipment, which comprises stretchers, beds and wheelchairs. These facilities need to be easily accessible and spacious enough for future additional stock (Hamilton & Shepley, 2010). Naccarella et al. (2016) note that the provided storage facilities are often insufficient in terms of size resulting in other spaces being improvised for storerooms. As a result of this, storage space is considered a retention factor as it affects the efficiency and effectiveness of the workplace (Naccarella et al., 2016:13).

2.3.2.5 Ergonomic design

Ergonomic principles are essential when designing nursing station units as tasks performed may require standing and seated working environments. Franco and Fusetti (2004:67) note that a “prolonged stationery posture” may result in health ailments such as fatigue and muscular tension and ergonomic design principles, therefore, need to be considered. The configuration of nursing stations is essential in determining the efficiency and effectiveness of nursing staff performance, as poor ergonomic design “leads to back stress, fatigue and other injuries among nursing staff (Ulrich et al., 2004:5).

The design of nursing stations can be approached in two ways, either centralised or decentralised, each with advantages and disadvantages (Joseph, 2006; Naccarella et al., 2016). Decentralised nursing stations, adopted more recently (Joseph, 2006), include less walking as it consists of numerous working stations spread across the ward, in which nurses can do administrative work, closer to patient rooms. This, in effect, increases the amount of time in which nurses can provide care (Hendrick, 2003 as cited in Hendrich & Chow, 2008). Zborowsky et al. (2010:21) support this by stating that nursing stations are no longer required to be as spacious, as the paperwork has decreased as information technology has increased. Nurses are, therefore, able to be situated in a decentralised manner in closer proximity to patient rooms (Zborowsky et al., 2010:21). With a large amount of research supporting patient-centred design (Annemans, Stam, Coene & Heylighen, 2017; Bate & Robert, 2006; Braithwaite, Wears & Hollnagel, 2015; Greene et al., 2012; Moore, 2013), decentralised nursing stations may be preferred in future healthcare designs.

Open versus closed nursing stations are an additional aspect that affects the effectiveness of the nurses’ work. Open nursing stations are beneficial to patients as they feel less secluded but is a concern for nurses as the confidentiality of their working environment is lost (Shattell, Bartlett, Beres, Southard, Bell, Judge & Duke, 2015). Open nursing stations are also associated with increased noise levels both within the nursing station and in the ward, with staff conversations identified as a source of noise (Chaudhury & Mahmood, 2007:8). Noise from within the ward may be a distraction to the nurses if an open design is implemented.

2.3.3 Interior design features

Interior design features are defined as the less permanent aspects of a building (Karlin & Zeiss, 2006:1377). Less research has been done regarding these features in healthcare design (Harris et al., 2002; Ampt et al., 2008).

The term interior design feature was first identified by Shumaker and Reizenstein (1982) who listed the term as a sub-theme under the main theme of physical comfort and physical features. Their study, however, focused on the experiences of patients rather than that of the medical staff. Harris et al. (2002) identify interior design features as a main theme and lists furnishings, non-medical equipment, colours and finishes, artwork and layout of furnishings as sub-themes. Karlin and Zeiss (2006) adapted this framework by adding familiarity and carpeting and removing some of the other sub-themes (refer to Figure 2.3). The framework is further adapted by Ampt et al. (2008), who identifies reception areas, floor coverings and surfaces, and colour and lighting as interior design features.

For this literature review, the sub-themes of flooring material, colour, storage and furniture are discussed.

2.3.3.1 Flooring material

Flooring has been identified as an interior design element by most of the authors and can be defined as a complex system consisting of a sub-floor which acts as a support system. This support system is followed by the floor covering and finish (Nanda et al., 2012:1) on which various activities take place. As “flooring occupies every square inch of measured healthcare facility space...” (Nanda et al., 2012:1), it is crucial to consider the importance thereof as not merely an aesthetic aspect but rather as a functional one.

Various floor finishes have been identified and include hard flooring, resilient flooring, soft and flexible flooring, and hybrid flooring systems. Softer floor finishes which may include carpet and rubber have been said to minimise staff fatigue (Nanda et al., 2012:3) as the surface is softer to stand on and makes walking more comfortable. Harris (2000) further indicates the advantage of using a carpet finish with findings indicating that visitors spend more time in the patient rooms with a carpeting in comparison to the rooms which have a vinyl finish. Although advantageous from the visitors’ and patients’ perspective, a large percentage of the staff preferred the vinyl floor finish since it is easy to clean. Although the patients and visitors may see the carpet flooring as an aesthetic feature, the nurses consider the vinyl flooring as the more functional flooring type.

2.3.3.2 Colour

Bosch, Cama, Edelstein and Malkin (2012) note the importance of colour and the psychological and physiological affect that colour has on individuals, “when thoughtfully designing and shaping

the interior environment”. This is supported by Tofle, Schwartz, Yoon and Max-Royale (2004) stating that colour is an essential feature in environmental design, and that the selection depends on several features. Some of these features may include geographical location, the size and shape of specific spaces, “the characteristics of the potential users”, and the type of activities that are intended for the space and environment (Tofle et al., 2004).

The literature relating to the incorporation of colour in healthcare settings and the psychological response has, however, been identified as “oddly inconclusive and nonspecific” (Tofle et al., 2004:66), resulting in inconsistent findings (Bosch et al., 2012:53). Studies which are cited as means of evidence, often have no relevance to the selection of colour within healthcare design and architecture (Bosch et al., 2012:53). As a result of this, often healthcare designers “...make decisions concerning colour with unsubstantiated knowledge” (Tofle et al., 2004:6). It is therefore vital to take into consideration that the selection of a colour palette should not solely be based on the decisions of the healthcare users but “rather the specification of colours should centre first on the role of the colour in the environment and the intended activities in the space” (Tofle et al., 2004:61).

2.3.3.3 Furniture

It is important to note that “objects, such as furniture, also require careful EBD research to fully understand the role those objects play in realising desired patient and staff outcomes” (Malone & Dellinger, 2011). The selection of furniture is vital as it contributes to (1) interruptions and distractions, (2) sound and noise and (3) work space design and organization (Malone & Dellinger, 2011).

To avoid interruptions and distractions, Malone and Dellinger (2011) recommend appropriate layout and placement of the furniture and equipment. Additionally, it is important to consider the materials as some may be sound-reflecting, instead of sound-absorbing, contributing to noise levels. In terms of work space design, it is recommended that the furniture and equipment “accommodate workers of varying sizes”, which is also important when considering ergonomics.

Malone and Dellinger (2011) note an important aspect to consider when selecting furniture and equipment: “furniture with hard protuberances may damage walls; a lack of casters or gliders could tear softer flooring materials more frequently used now to mitigate patient falls and staff fatigue.

Although research shows that furniture plays a role in improving the healthcare experience for patients, visitors and staff, Malone and Dellinger (2011) found that no research addressed the specific furniture used by staff and whether it effectively reduced staff fatigue or not. They suggest that more research is needed to “to further understand the impact of furniture design as a tool to help mitigate staff fatigue”.

2.3.4 Social features

Harris et al. (2002) introduce the theme of social features, which includes the secondary themes of privacy, way-finding and symbolic meaning. These sub-themes were identified as “environmental sources of satisfaction” (Harris et al., 2002:1285) by discharged patients. In a literature review done by Karlin and Zeiss (2006:1377), social features are explained as the ability for patients to have control over their level of social contact. Added to this is the idea of privacy, which “may increase environmental satisfaction and place attachment”. Ampt et al. (2008) also conducted a literature review in which the five themes identified by Karlin and Zeiss (2006) were used with slightly adapted sub-themes. The social features are associated with Karlin and Zeiss (2006:1378), who indicate the importance of both privacy and social interaction.

For this study, the focus will be placed on the sub-theme of privacy and social interaction.

2.3.4.1 Privacy and social interaction

Privacy is defined as “a boundary control process whereby people sometimes make themselves open and accessible and sometimes close themselves off from others” (Altman, 1977:67). Within a healthcare environment, there is often a lack of privacy due to an absence of waiting areas and a “space for patients, between patients” (Naccarella et al., 2016:6). This does not only affect the patients in terms of privacy but also the staff as visitors are either in the patient rooms or standing in the corridors. A healthcare environment designed to accommodate both user groups is vital therefore vital (Shumaker and Reizenstein, 1982).

In terms of accommodating one of the user groups; patients and their visitors, the design should include areas where interaction can take place between family and patients. This is especially beneficial in healthcare environments where patient rooms are shared. As for the primary user group; the healthcare staff, an absence of sufficient waiting areas for visitors, means congested corridors, crowded nursing stations and noisy wards. This may “impede efficient work”

(Naccarella et al., 2016:6) and as work efficiency of staff affects patient care, it is crucial to consider the needs of the nursing staff (Ulrich, 2000).

2.3.5 Specific features

Karlin and Zeiss (2006:1378) introduce the theme specific features which include open and closed nursing stations and special consideration with elderly patients. A later study by Ampt et al. (2008:51-52) includes the use of specific features as a theme and incorporates way-finding and safety issues. These two sub-themes were previously identified by Harris et al. (2002) as part of the social feature theme, stating that “although these problems might affect patients, they might be more troublesome for visitors who must navigate...” (Harris et al., 2002:1281). Neither of the authors mentions the effect that way-finding may have on the staff. In terms of safety, Joseph (2006:1) states that the physical environment may improve the “health and safety for staff...increasing job satisfaction”.

Way-finding and safety are discussed in the following section, as the sub-themes of specific features.

2.3.5.1 Way-finding

Way-finding is defined as “the process of solving spatial problems while navigating from one point to another” (Sadek, 2015). In healthcare settings, however, way-finding and signage systems are mostly unsuccessful as a result of facility expansion and “a lack of awareness of existing guidelines by the developers and a lack of agreement between the existing recommendations” (Rodrigues, Coelho & Tavares, 2018:3).

Way-finding and signage are noted as one of the first sources of stress relating to the environment, experienced by patients and visitors (Shumaker & Reizenstein, 1982:192). Ulrich et al. (2010) state that although patients and visitors may feel stressed, way-finding also affects staff as staff time is diverted as a result of giving directions. Zimring (1990) supports this, commenting that nurses spent much of their time giving directions to patients and visitors. Although complicated buildings and poor way-finding systems are associated with most hospitals, Ulrich et al. (2004:17) state: “it is usually difficult to tackle this problem with a piecemeal approach”.

Way-finding problems have been associated with several characteristics, of which the designed environment is mostly addressed (Shumaker & Reizenstein, 1982). Way-finding may be

improved by colour coding floors and the use of directional lines on walls and floors. Although colour coding has been employed to ease way-finding, it may not be the most effective way as patients and visitors may not notice the varying colours and patterns (Shumaker & Reizenstein, 1982). Other healthcare environments have made use of large and repetitive graphics as a means of orientating visitors and patients, and contributing to a sound way-finding system (Huelat, 2007:12).

2.3.5.2 Safety

The literature relating to safety includes the control of infections, airborne diseases and patient falls (Joseph, 2006; Reiling, 2006; Saleh, 2017). In terms of the physical environment however, Joseph (2006) identifies high noise levels, inadequate lighting levels and poor ergonomically designed workplaces as factors that affect the safety of staff. These factors are classified as latent conditions (Reason, 2000:394) which “arise from decisions made by designers, builders, procedure writers and top-level management”.

Reiling (2006) conducted a study by which a community hospital was used as a case study where the need to develop a set of ‘safety-driven design principles’ emerged. Some of the design factors which emerged are like those mentioned by Joseph (2006), consisting of noise reduction, scalability, adaptability, flexibility, visibility of patients to staff and minimising fatigue (Reiling, 2006). Saleh (2017) identifies similar internal factors, one of which is the general building safety, and states that: “the physical structure of the hospital may pose hazards to the patients and workers alike”. Recommendations to lessen the risk include the incorporation of a traffic flow pattern, slip-resistant surfaces and the maintenance of certain services such as the staircases (Saleh, 2017).

2.4 Conclusion

The literature was presented under the main themes of design approaches, design criteria, and emergent themes. The design approaches indicated that using empathy, encouraged by human-centred design, designers can understand the needs of the intended users. It is apparent that the focus tends to largely be on the end user, in this instance, the patient, with less focus on the nurses and doctors as the primary users.

With the focus on the primary users, the emergent themes consist of the ambient environment, architectural, interior design, social and specific features. From the ambient environment, noise is considered one of the leading environmental factors that affect staff. This could explain why it

consumes the largest amount of research. Lighting has been associated with error generation and most significantly affects shift workers as a result of circadian rhythms. The effect of lighting on staff performance and mood is less known.

In terms of the architectural features, windows allow for natural light, which has positive effects on staff, increasing alertness and reducing stress. Accessibility is related to the configuration of the ward and should ideally be informed by those who colonise the space, as walking distances and lines of sight are affected by the design.

When selecting a floor finish, it is essential to consider the functionality factor as both soft and hard flooring systems have advantages and disadvantages. The selection of colours is informed by the users of the space together with the activities envisioned for the space. Both storage and ergonomic designs affect the efficiency and effectiveness of the workplace and nursing staff performance. Nursing stations may be designed as open or closed, and centralised or decentralised, with both advantages and disadvantages in terms of work performance.

Privacy, associated with social features, may impede efficient work of nursing staff, as a lack of family and patient areas may result in crowded corridors, contributing to the noise levels and affecting the perceived corridor width. These specific features include way-finding, which affect not only the patients but also staff, as nurses spend a large amount of their time giving directions to visitors. From the emergent themes, high noise levels, poor ergonomically designed units and lines of sight contribute to the safety of the wards

The literature reviewed for this study has been captured in Table 2.3 on the following page.

Table 2.3: Key findings from the literature reviewed.

Design criteria	Authors	Key findings	Section
Accessibility	Bittencourt et al. (2015), Chaudhury and Mahmood (2007), Joseph (2006) Karlin and Zeiss (2006), Naccarella et al. (2016)	Accessibility influences workflow as it relates to walking distances and proximity.	2.3.2.2
Noise	Ampt et al. (2008), Chaudhury and Mahmood (2007), Ferri et al. (2015), Joseph (2006), Kerr (2014), Kopec (2012), Moses (2012), Naccarella et al. (2016), Sundstrom (1987), Ulrich et al. (2004), Ulrich et al. (2006)	Low noise levels: better concentration and increased ability to complete tasks.	2.3.1.1
Ergonomic design	Chaudhury and Mahmood (2007), Franco and Fusetti (2004), Hendrich and Chow (2008), Joseph (2006), Kerr (2014), Moses (2012), Naccarella et al. (2016), Shattell et al. (2015), Ulrich et al. (2004), Zborowsky et al. (2010)	Poor ergonomic design of nursing stations may result in staff fatigue.	2.3.2.5
Flooring material	Harris (2000), Nanda et al. (2012)	Softer floor finishes can minimise staff fatigue.	2.3.3.1
Furniture	Heuberger & Specials (1997), Ulrich (2004), Malone & Dellinger (2011).	Impacts on work space design. Contributes to noise levels.	2.3.3.3
Natural light/Sunny rooms/Windows	Aries et al. (2015), Ferri et al. (2015), Joseph (2006), Pati et al. (2008), Smith-Coggins et al. (1997), Naccarella et al. (2016), Ulrich (1984), Zadeh et al. (2014)	Relationship between external view and alertness of nurses.	2.3.2.1
Lighting	Altimier (2004), Buchanan et al. (1991), Heuberger & Specials (1997), Iwata et al. (2008), Kerr (2014), Kopec (2012), (Mehrotra et al. (2015), Moses (2012)	May causes headaches and fatigue but reduces the rate of error and tension. It also improves eagerness.	2.3.1.2
Safety	Bittencourt et al. (2015), Joseph (2006), Reiling (2006), Saleh (2017)	Latent conditions such as high noise levels may affect the safety of staff.	2.3.5.2
Spatial layout	Ampt et al. (2008), Bittencourt et al. (2015), Halford and Leonard (2003) Heuberger & Specials (1997), Moses (2012)	The users who colonise the space should inform the spatial layout of wards.	2.3.2.2
Storage	Chaudhury and Mahmood (2007), Hamilton and Shepley (2010), Naccarella et al. (2016)	Storage rooms need to be easily accessible and large enough for future stock.	2.3.2.4
Ventilation	Abbott (n.d), Karlin and Zeiss (2006), Naccarella et al. (2016), Qian et al. (2010)	Natural ventilation is said to aid recovery. Artificial ventilation seen as more suitable as it protects healthcare staff.	2.3.2.1
Way-finding	Huelat (2007), Moses (2012), Sadek (2015), Rodrigues et al. (2018), Shumaker and Reizenstein (1982), Ulrich et al. (2010) Ulrich et al. (2004)	Way-finding affects staff as time is diverted when giving directions.	2.3.5.1

CHAPTER 3: RESEARCH DESIGN AND METHOD

3.1 Introduction

This chapter elaborates on the research design, which was used to answer the research question: *To what extent do the intentions of the healthcare designer respond to the primary users' experience?*

In response to the research question, the objectives of the research were to:

- Identify the design intentions of the hospital designer.
- Explore the experiences of nurses as primary users.
- Analyse the primary users' experiences in response to the designer's intentions.

In response to the objectives, the research methods included observations and interviews, that were informed by the design approaches in the literature. Observations and interviews were used for both sample groups, consisting of the designer and the nurses as the primary users. The findings collected from the observations and interviews were analysed through First and Second Cycle coding methods. The chapter concludes with ethical considerations and the limitations that emerged from the research design and method.

3.2 Research design

This section gives a brief description of the research design and method shown in Figure 3.1. Each division is discussed in more detail in sections 3.3 to 3.7.

A literature review was conducted in which five design approaches emerged. The design approaches included evidence-based, human-centred, spatial, usability and experience-based design. These approaches described how users could be incorporated into the design by considering their needs. Observations and interviews were based on the five design approaches which emerged from the literature reviewed.

A qualitative research approach was adopted for this study, together with inductive reasoning, explained further under section 3.3. The data was collected within a hospital, which acted as an intrinsic case study, discussed in more detail under section 3.4. The semi-structured interviews

and observations were guided using themes that emerged from Provisional Coding of the literature. From the literature reviewed, five facets of a healthcare environment emerged, namely the ambient environment, architectural, interior design, social and specific features.

The sample groups consisted of the designer and the nurses as the primary users of the case study. The nurses were interviewed and observed, allowing for a comparison between the opinions and the experiences of the various nurses.

The data was analysed using First and Second Cycle Coding methods, explained in greater detail under section 3.7. In-Vivo Coding was used as an initial coding method, and the research material was further analysed using Pattern Coding. The data was synthesised through Morville's (2004) User Experience Honeycomb model as a means to understand the relationship between user experience and interior design.

The research design and method are shown in Figure 3.1.

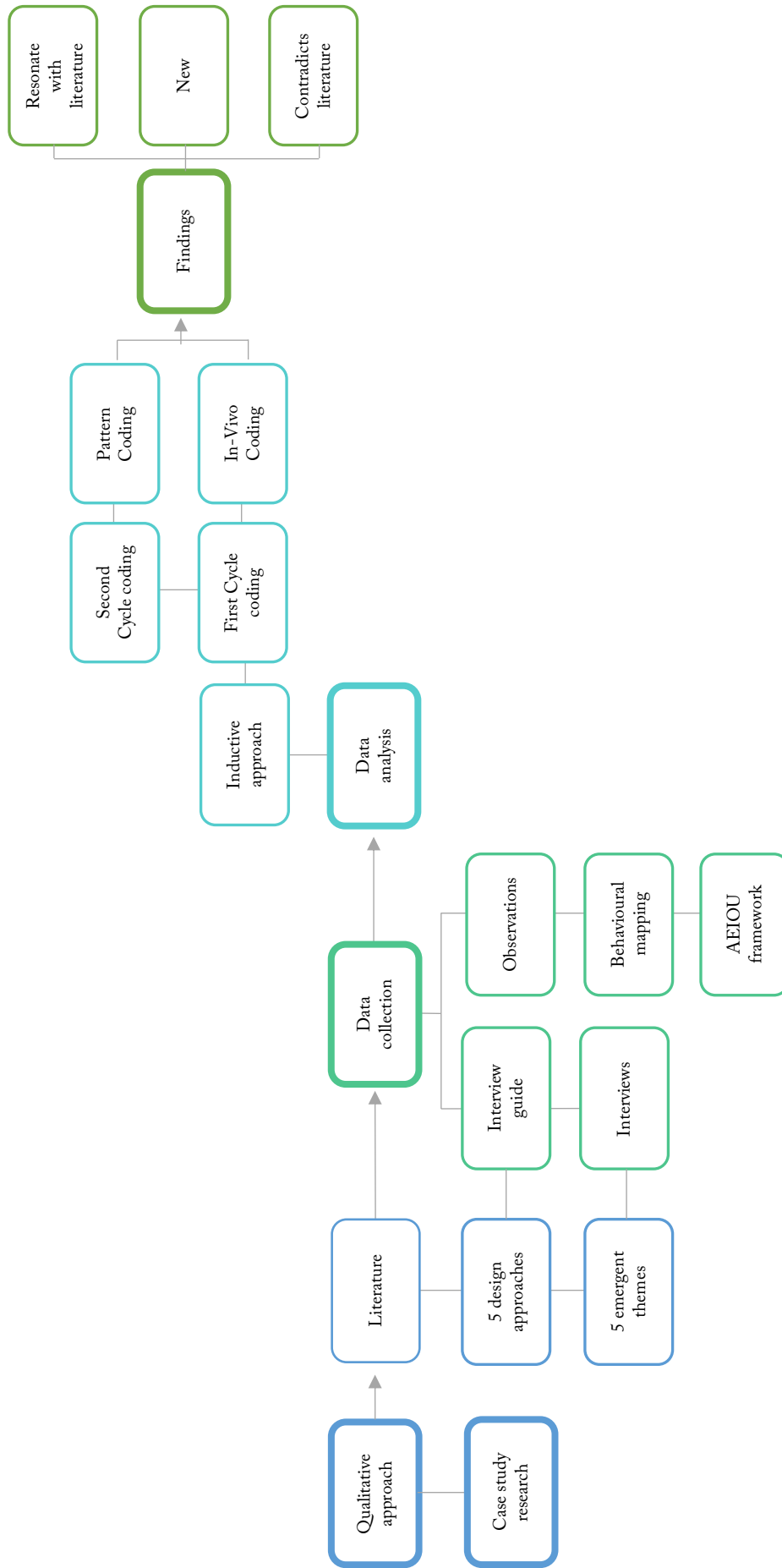


Figure 3.1: Research design and method.

3.3 Qualitative research approach

Qualitative researchers “want to make sense of feelings, experiences, social situations, or phenomena as they occur in the real world” (Blanche et al., 2006). The data is obtained in the form of written or spoken language or by observations that are recorded, in which themes are then identified as part of the analysis (Blanche et al., 2006:47). An interpretive paradigm is adopted when the researcher “believes that the reality to be studied consists of people’s subjective experiences” (Blanche et al., 2006: 7) and includes methodologies such as interviewing and observations.

3.3.1 Coding

For qualitative researchers intending to build on or validate previous research and investigations, Miles and Huberman (1994) explain Provisional Coding as a method that establishes a predetermined “start list set of codes” which is done before the fieldwork. Saldana (2009:144) adds that the list of codes is generated by formulated hypotheses by the researcher, literature reviews, conceptual frameworks and research questions, all relevant to the study.

At the beginning of the research process, certain codes may be more relevant than others, in which case the researcher may determine the relevance of each code (Saldana, 2009:146). Although recognised as a First Cycle coding method, Provisional Coding does not fall short of criticism as researchers may merely find what they are looking for. This may be prevented by the “willingness to tolerate ambiguity, flexibility, and the ability to remain honest with oneself” throughout the data collection process (Saldana, 2015). It is also important to note that “provisional codes can be revised, modified, deleted or expanded to include new codes” which may prevent the researcher from trying to fit the data into the set list of codes.

3.4 Case study research and inductive reasoning

A case study has been defined by several authors and varies across disciplines. For this study, the following definition is used: “case study is the study of the particularity and complexity of a single case, coming to understand its activities within important circumstances” (Stake, 1995:xi). He/she points out that although his reference to case study research is mainly associated with qualitative studies, it is not defined by it, but rather by the phenomenon that is being studied. Merriam (1998) further explains that case study research depends largely on inductive reasoning in handling multiple data sources (Merriam, 1998). These multiple data sources are obtained through various

research methods in which the research is seen as the fundamental instrument when collecting and interpreting the research material (Merriam, 1998).

Case study research does not fall short of criticism; however, with Yin (2009) stating that by using a singular case, the case may result in being different from what the researcher had initially anticipated. It has also been noted that a single case study may not deliver “rich theoretical insights” (Gustafsson, 2017:4). This may be as a result of less data being collected and the comparison of findings between various cases not being applicable when using a single case study. However, Dyer & Wilkins (1991) point out that rich theoretical data is not guaranteed using multiple case studies, and by using a single case study, ‘one single thing’ (Gustafsson, 2017:3) is studied, allowing the researcher to gain an in-depth understanding of a particular phenomenon. The participants were purposively chosen in order to collect as much relevant data as possible, using various data collection methods.

3.4.1 The hospital case study

The hospital which is located in Namibia, was used as an intrinsic case study as it was studied for the “intrinsic interest in the case itself” (Simons, 2009:21). In addition to the intrinsic case study, Stake (1995:4) points out that a typical case may work well, but further points out that an unusual case may help “illustrate matters we overlook in typical cases” and adds that the criteria should be to “maximise what we can learn” (Stake, 1995:4).

The chosen hospital presented characteristics of an ‘unusual case’ as large extensions were done in 2010. The extensions consisted of two new private wings of private wards. These were built above the new parking lot, which determined the structural footprint for the new private wing. Data could be collected from sample groups who were present both before and after the renovations. Findings from both sample groups could be compared, which maximised what could be learnt from the case study.

3.5 Research process

The research process includes the sampling of specific wards within the case study and the selection of the sample groups, which consisted of the hospital designer and six nurses within the specific wards.

3.5.1 Method of sampling

The sample population was drawn from the case study, consisting of the hospital designer and a specific group of primary users who work in the hospital wards. Including the designer in the sample population was vital to this study as the intentions of the hospital design are set out by this skilled individual, with the designer having extensive experience in healthcare design

The hospital consisted of two parts, one of which was newly built in 2010. The older wing of the hospital consisted of four wards (K1, K2, K3 K4), one of which was a high-care ward (K2), one a day ward (K1) and the other two identical in terms of layout and design (K3, K4). The new wards (K5, K6) were both private wards and were also identical when it came to the design.

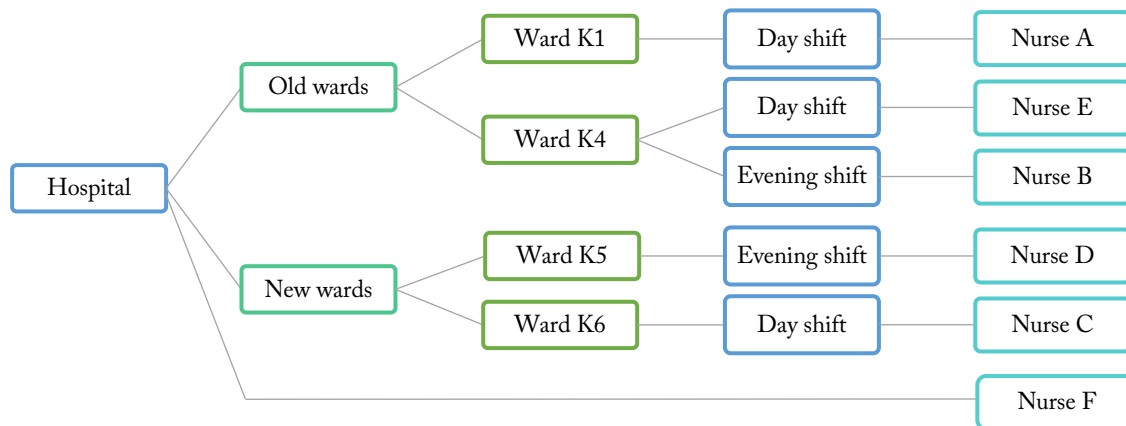


Figure 3.2: Sample population selected from the case study.

Figure 3.2 shows the nursing sample group in relation to the selected wards. For this study, Nurse F, who had experience having worked in all the wards, recommended the wards to be studied, which included wards K1, K4, K5 and K6. Ward K2 was excluded due to it being a high-care ward and K3 was excluded as a result of the design being the same as ward K4.

A purposive sample, from which one may “learn more, or more in-depth” (Simons, 2009:36) was chosen from the selected case study. A purposive sample was selected as the “purpose is to understand how the experience and actions of a single person or persons contribute to an understanding of the case” (Simons, 2009:70). The sample group was chosen in relation to the design of the hospital in order to consider opinions from nurses who had recently been employed, together with nurses who had years of experience. This was important as nurses with less

experience may have different opinions to those who have worked in the same environment for a long period of time.

Six nurses were selected in total, one of which was Nurse F, who had previously worked in the hospital wards. Three of the nurses worked in the older wards (K1, K4) and the remaining two worked in the newly designed wards (K5, K6), as indicated in Figure 3.2. As part of the purposive sample, the nurses were comprised of both day and evening shift nurses to collect multiple opinions. Two of the six nurses were involved in the design process. This enhanced the research as a comparison in findings could be made from the nurses who were involved and those that were not.

3.6 Data collection

3.6.1 Research instruments

As part of case study research, the three most commonly used methods include interviews, observations and document analysis (Simons, 2009:10). For this research, semi-structured interviews were selected in order to obtain more in-depth and detail on fewer topics (Rubin & Rubin, 2012:6).

Observations were also done in order to generate 'rich experience information' (Visser, 2009:11). Table 3.1 shows the research matrix, which indicates the instruments used to answer the secondary research questions.

Table 3.1: Research matrix.

Secondary question	Method	Instrument
What were the design intentions of the hospital designer?	Semi-structured interviews	- Adapted conceptual framework
How do the primary users experience these design intentions?	Observations	- Behavioural mapping - AEIOU framework
	Semi-structured interviews	- Adapted conceptual framework

The methods of investigation were informed by the design approaches identified in the literature reviewed, namely evidence-based, human-centred, empathic, spatial, usability and experience-based design. By using both interviews and observational studies, the differences in knowledge in

terms of “what a person thinks, feels and says” (Bate & Robert, 2006:309) about an experience could be understood.

3.6.1.1 Interviews

Martin and Hanington (2012:102) define an interview as a method of direct contact with individuals, “to collect first-hand personal accounts of experiences, opinions, attitudes, and perceptions”. A semi-structured interview is a data collection method in which the researcher has more control over the topics by asking a set of predetermined but open-ended questions (Ayres, 2008:2). Semi-structured interviews were used as opposed to surveys as “surveys get attitudes, but they do not get experiences” (Bate & Robert, 2006:309). Interviews were used as a means of collecting research material through one-on-one conversations with the designer and the nurses as the primary users.

Coelho (2015) comments that individual studies based on personal data rather than on spatial data may be useful in understanding the spatial experience based on its occupants, “assuming that each one has a particular way of experiencing architecture”. This became evident in the interviews with the nurses, as the spatial arrangements of the wards were the same, yet different experiences emerged. In experience-based design, the experience is understood as a “particular and very special kind of knowledge acquired from close and direct personal observation or contact” (Bate & Robert, 2006:309). The direct and personal contact was achieved through interviews, in which experiences were accessed through the words and language that the participants used in describing their experiences.

The literature, and the use of Provisional Coding, informed the semi-structured interview questions. Several codes that emerged from the literature were not relevant to the study, and as such an adapted conceptual framework was created (Figure 2.2). Five relevant themes, the ambient environment, architectural, interior design, social, and specific features, together with their sub-themes, were used as a conceptual guide to inform the interviews. “The empirical evidence which you collect needs to be considered with reference to the conceptual framework or theoretical constructs that have guided its collection in the first place.” (Farquhar, 2012:8).

The designer was interviewed first to gain a better understanding of his design intentions of the hospital. The designer was given a set of themes as a preparatory guide before the interview. It may be “useful for the participant to prepare for the interview” (Simons, 2009:10) for more precise studies. This further ensured that the data collected was relevant, as the design had been done a

few years before. The interview began with a few open-ended questions (Ayres, 2008), which allowed the designer to discuss the design intentions of the hospital. The open-ended questions were followed by several semi-structured questions, which were informed by the adapted conceptual framework. The interview was audio-recorded and transferred to a secure device once the interview was completed.

The semi-structured interviews with the nursing sample took place after the observations had been carried out. Each nurse was interviewed either on the same day or the day after their observation, whenever they had time available. The interviews consisted of the same questions used for the designer, in order to determine the extent to which the intentions respond to the nurses' experience. The primary users could discuss any additional information that may have been left out or not included in the interview questions. The interviews were audio-recorded and transferred to a security protected device.

3.6.1.2 Observations

Observations are used “to understand and capture the context within which people interact” (Patton, 2015). Observations were selected as part of the case study research, for exploring the research problem and question (Farquhar, 2012:8), within a specific context.

Blanche et al. (2006) identify four types of observational studies, namely descriptive, focused, selective and ethnographic observations. In understanding the chosen observation type, focused observations entail the use of particular questions in relation to general events and “looking out for particular kinds of interaction” (Blanche et al., 2006:310). Particular interactions were observed through ‘touch points’, which are points of contact with a service or space, and the affective and cognitive connection thereto.

As observations entail the capturing of behaviours, del Galdo et al. (2016:18) explain empathy as a practice that “requires deep research with real people in their natural environments”. Empathic design focuses on the experiences of everyday life (del Galdo et al., 2016) through which designers can understand and meet the needs of the users (Kouprie & Visser, 2009:438).

In order to achieve empathy in the design process, Stein (1964:11) suggests three steps:

- the emergence of the experience
- fulfilling explication of the experience
- the comprehensive objectification of the experience.

These steps can be termed 'entering', 'living' and 'communicating' (Rogers, 1975). Stein (1964) describes these stages as first perceiving an experience, then observing the experience; 'standing beside' and lastly withdrawing from the experience, having a better understanding of the experience. This is further emphasised by Blanche et al. (2006) who comment that interpretive researchers need to enter the research setting and engage with the research participants "in an open and empathic manner" (Blanche et al., 2006:286).

Kouprie and Visser (2009:445) developed a similar framework of empathy. The four phases identified are 'discovery', 'immersion', 'connection' and 'detachment', which were applied during the observational studies of the primary users. The discovery phase is explained as "entering the user's world" (Kouprie & Visser, 2009:445). This was done by approaching the nurses, before the observations and becoming familiar with the hospital environment. In the immersion stage, the researcher 'wanders around' in the user's world, identifying touch points and observing how design elements may influence the experience. The connection stage allowed the researcher to connect with the user through both 'affective' and 'cognitive' aspects, "the affective to understand feelings, the cognitive to understand meanings" (Kouprie & Visser, 2009:445). Once the observations had been completed, the researcher detached from the user's world, back to the role of the designer, with a clearer understanding of the user's world, and how certain design aspects influenced their experience.

Each nurse, as the primary user, was observed individually on separate days, allowing the researcher to observe each nurse in their natural work environment, observing behaviour as it happened. Each nurse was observed for approximately three hours from the start of their shift, with the first 20 to 30 minutes dedicated to the behavioural mapping process, as a means of describing "what behaviours actually occurred rather than what was planned for the space" (Nickerson, 1993).

Place-centred mapping was used as a behavioural mapping method as it involves the observations of individuals in a site-specific location (Sommer & Sommer, 2002:44). The architectural plans of the four general wards were obtained from the designer, prior to the observations, as

behavioural mapping “involves an actual chart or plan of an area on which people’s locations and activities are indicated” (Nickerson, 1993). The plans were used as the maps on which the interactions and activities of the primary users were documented. The behavioural mapping technique was stopped when ‘sampling to redundancy’ occurred as “further information becomes redundant to the extent where it becomes repetitive” (Blanche et al., 2006:289).

These maps were translated into spider diagrams, indicating the number of times the nurses would walk to the nursing station, kitchen, sluice room, store or linen room, patient room or elsewhere. These spider diagrams are presented in Chapter 4. The design plans on which the behavioural mapping method was done are included as Appendix D.

Once the behavioural mapping method was completed, the observations continued and were further recorded using an observational framework, AEIOU, developed by Prokopoff, Cain and Pokorny (1991). The AEIOU framework consists of a guiding taxonomy of activities, environments, interactions, objects and users (Martin & Hanington, 2012:10), which were all recorded during the observations in time intervals. The activities included observing a set of actions, and the environment included the entire space in which the activities took place. The interactions were observed between the nurses and the objects of the space, defined as the building elements of an environment.

The data that was extracted from the interviews and the observations is shown in Table 3.2.

Table 3.2: Research method, instrument and the extracted data.

Data corpus	Data set	Instrument	Data extracted	Refer to:
Interviews	Six interviews - One designer - Five nurses	Adapted conceptual framework	- Audio-recording - Note taking	Table 3.5 (excerpt from interview)
Observations	Five behavioural maps	Behavioural mapping	- Behaviour mapping on architectural plans - Field notes	Appendix D (transcribed into spider diagrams shown in Figures 4.4 and 4.5)
	Five observational frameworks	AEIOU framework	- Note taking in relation to framework	Appendix E (excerpts shown in table 3.3 and 3.4)

The audio-recorded interviews were transcribed as accurately as possible. The observations documented using behavioural mapping were typed up from the field notes in order to produce a digital copy, making sense of what had been observed. This was done in preparation for the data analysis and interpretation, discussed in the next section.

3.7 Data analysis and interpretation

The transcribed data from the interviews and observations were analysed using a First Cycle Coding method. Saldana (2013:4) defines a code as a short phrase or word that symbolises a summative portion of language-based data or visual data that is ‘researcher-generated’. The data can include interview transcripts, observational field notes, photographs and more, and can be analysed using First Cycle and Second Cycle coding methods. In-Vivo Coding was used as a means of analysing the research material.

3.7.1 Coding- observations

The observations were recorded using a framework by which activity, the environment, interaction, object and the user were observed, in a specific timeframe. An excerpt of the framework can be seen in Table 3.3, where the findings relating to activity, environment and interaction are shown, during the time interval of 8:00 and 9:00.

Table 3.3: An excerpt from an observational recording.

Nurse A (K1)	8:00	8:30	9:00
Activity	<ul style="list-style-type: none"> - nurse standing at nurse station - nurse to patient room - linen and theatre clothes taken to NS from linen room - patient and visitor leaving ward to go see doctor - nurse standing at nurse station 	<ul style="list-style-type: none"> - delivery from EXIT door (noisy) - BP machine to patient room - nurse writing at nurse station - patient wheeled to theatre (nurse goes along) - scale to patient room - cleaner to manager office - cleaning furniture in passage 	<ul style="list-style-type: none"> - nurse from K6 to fetch documents from manager office - nurse takes theatre clothes to patient room - patient wheeled back to room after surgery - 9:15 nurses all at station - dirty linen from beds to laundry room
Environment	<ul style="list-style-type: none"> - fluorescent lights back on, downlighter off - Aircon on (cold) - doors of patient room slam closed - noise from upstairs K4 ward (noise travels as there are stairs) - visitor on phone in passage 	<ul style="list-style-type: none"> - some natural light from window at staircase - noise from BP machine - noise from cutlery - phone from manager officer 	<ul style="list-style-type: none"> - one half of passage clean (no trolleys) - ward a bit quieter as less admissions are happening - tiles on stairs accentuate noise - weird smell - noise from phone - passage lights off by entrance
Interaction	<ul style="list-style-type: none"> - Food tray back to food trolley - nurse fetch BP machine - tea trolley wheeled next to food trolley - rubbish trolley wheeled away from entrance - food trolley out of ward - cleaner mopping floor 	<ul style="list-style-type: none"> - scale machine wheeled from patient room to nurse station (by porter) - patient wheeled out of room - empty drip to sluice room - squeeze patient bed past all things in passage 	<ul style="list-style-type: none"> - cleaner cleaning ward door - obstruction (no space to wheel patient to room) - linen form linen room to patient room - bed out of room to clean - 3 cleaning staff - nurse closes patient room after leaving - 2 beds wheeled in (no space as other bed is in passage) - tea trolley wheeled in

The data from the observational frameworks was further grouped into emergent themes similar to the ones from the literature. The main themes included noise, windows and ventilation, nursing stations, lighting, functionality, way-finding and spatial accessibility. The findings from Table 3.3 were grouped according to these themes and an example is shown in Table 3.4.

Table 3.4: Observational findings grouped according to emergent themes.

Theme	Findings
Noise	<ul style="list-style-type: none"> - noise from upstairs K4 ward (noise travels as there are stairs) (8:00) - visitor on phone in passage (8:00) - noise from BP machine (8:30) - noise from cutlery (8:30) - phone from manager office (8:30) - ward a bit quieter as less admissions are happening (9:00) - tiles on stairs accentuate noise (9:00)
Windows and ventilation	<ul style="list-style-type: none"> - some natural light from window at staircase (8:30)
Nursing stations	<ul style="list-style-type: none"> - nurse standing at nurse station (8:00) - nurse writing at nurse station (8:30) - Nurses all at nurse station (9:15)
Lighting	<ul style="list-style-type: none"> - fluorescent lights back on, downlighter off (8:00) - passage lights off by entrance (9:00)
Spatial accessibility	<ul style="list-style-type: none"> - cleaning furniture in passage (8:30) - squeeze patient bed past all things in passage (8:30) - one half of passage clean (no trolleys) (9:00) - obstruction (no space to wheel patient to room) (9:00) - bed out of room to clean (9:00) - 2 beds wheeled in (no space as other bed is in passage) (9:00)

Grouping the findings according to themes, allowed for a comparison to be done between the shifts and the different wards. These findings were further compared to the findings from the interviews to identify similarities and discrepancies.

3.7.2 Coding- interviews

To analyse the data from the interviews, In-Vivo Coding was used by which a word or short phrase, from the actual language of the participant, is used as a code (Saldana, 2013:91). In-Vivo Coding was used for this study, as it was important for the participants' voices to be prioritised (Saldana, 2013:91). The raw data from the transcribed interviews was put into a table; each interview answer in a separate row, shown in Table 3.5. The raw data was coded using the In-Vivo Coding method, which aided in condensing the meaning of the data (Charmaz, 2006:56).

Table 3.5: Example of coded interviews.

Raw Data	Preliminary Codes
<i>Well... with the situation of being in a hospital and nurse and being busy all the time, what is just important for us I think at this point is if we can have proper light for us to see what we are doing. For fresh air or for view, I think that can happen outside so I do not think that is much of a deal, its ok. But if it was an office where you are sitting, I mean that would have been nice, but we are always busy running up and down.</i>	<p>“what is just important for us” “proper light” “see what we are doing” “do not think that is much of a deal” “would have been nice” “always busy running up and down”</p>
<i>Yes, it does. Its way at the back and sometimes, like, it is just too far for you to, if you need something quickly you always have to run to the back and if it was a bit closer that would've been more convenient for us. But it's just way at the back and its far so, I wish they could have moved it.</i>	<p>“way at the back” “it is just too far” “if it was a bit closer...more convenient for us” “I wish they could have moved it”</p>
<i>Not quite. Sometimes you know, we have cleaners right, we have porters and then we have visitors. And it is the ground floor, it is very much close to the reception so there is a lot of people that are coming in and out and we have an exit for the ambulance as well, beds that are being pushed and also its quite a lot of noise. (Buys: and do you feel the stairs contribute as well?) Yes, that also.</i>	<p>“we have cleaners...porters...visitors” “people that are coming in and out” “exit for ambulance” “beds that are being pushed” “quite a lot of noise”</p>

The data from the interviews were plotted onto mind maps, with the central ideas emerging from the data. The central ideas were similar to those from the literature, and included the following:

- noise and acoustics
- flooring material
- storage
- nurse station
- functionality
- sufficient furniture (for staff)
- location of the nursing station
- sufficient staff areas
- single corridor
- natural lighting
- adequate lighting
- line of sight
- social interaction
- way-finding
- corridor width

The preliminary codes were used for the mind maps, which made it clear to see the difference in opinion between the nurses and the designer. This was done for each of the themes mentioned above. An example is shown in Figure 3.3.

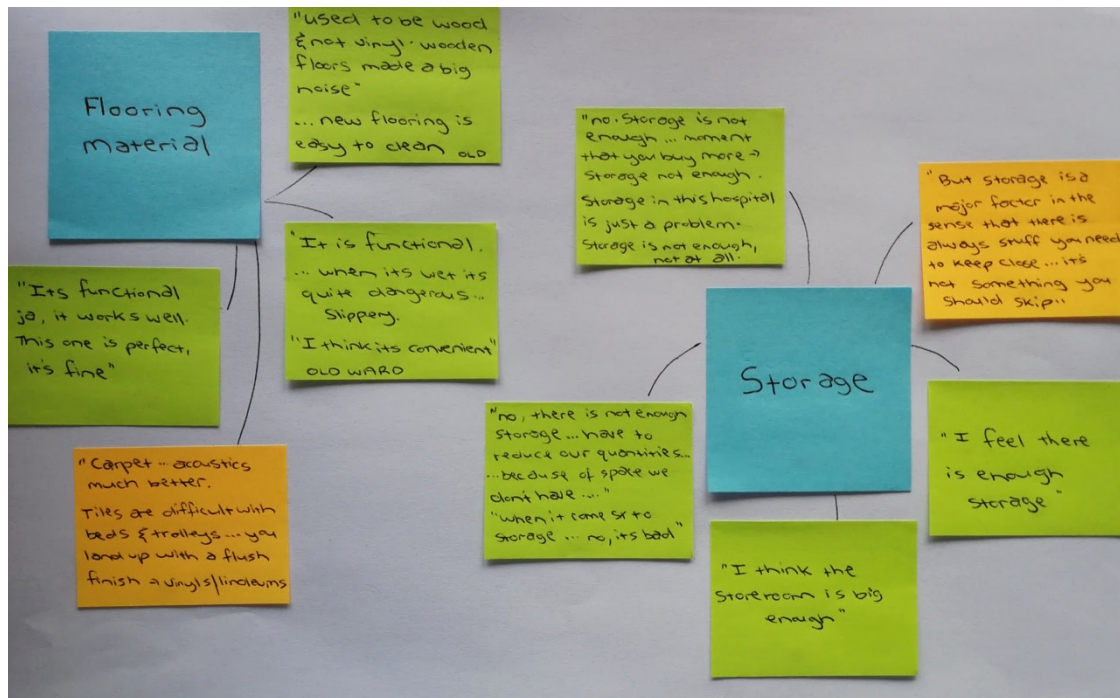


Figure 3.3: Example of mind map drawn from preliminary codes.

All of the findings were put into a table which allowed for a comparison to be done between the responses from the designer and the nurses, from the observations and interviews. By mapping the findings, the design intentions and the primary users' experience became clear. These findings were further plotted against Morville's (2004) User Experience Honeycomb model, indicating which design criteria were identified as being useful, desirable, accessible, credible, findable, useable and valuable.

3.8 Reliability and validity

Reliability is achieved when the same results are found by an instrument when measuring something more than once (Bernard, 2000) Validity is defined as "the accuracy and trustworthiness of instruments, data and findings in research" (Bernard, 2000).

Reliability and validity are enhanced by using multiple data collection methods and comparing the findings from these methods (Guest, MacQueen & Namey, 2012:8). This was achieved by interviewing the designer, observing the nursing sample and after that interviewing the nurses.

The nursing sample group was both observed and interviewed, which allowed for 'convergence or divergence' during data analysis (Guest et al., 2012). The findings from the observations and interviews gave an "accurate understanding of the context" (Ulin, Tolley & Robinson, 2005).

The interviews with the nurses were done after the observations, which was important as during interviews, participants often disclose on more than what is assumed from observational studies (Simons, 2009:4). The interviews were recorded and transcribed, which further enhances validity as it produces a verbatim account of the data (Guest et al., 2012:18). The themes that emerged from the data were similar to those in the literature, and by supporting the themes by using verbatim quotes throughout data analysis and discussion, the validity increased.

3.9 Ethical considerations

Before the research could commence, a proposal submission was submitted to the Faculty Research Ethics Committee (FREC) of the university, explaining the aim and objectives of the research and how the data was to be collected. The FREC approved the research proposal and advised that a research permit should be obtained from The National Commission on Research Science and Technology (NCRST).

A private hospital was selected for this study, and consent in principle was given by the hospital managers (Appendix A). The name of the hospital was to remain confidential and has therefore been referred to as 'a private hospital'. A research permit application was needed prior to data collection, as the case study was in Namibia. The National Commission on Research Science and Technology (NCRST) was contacted, and a research permit was issued (Appendix B).

Once consent was given, and the research permit was obtained, individual consent forms needed to be distributed to participating individuals. The designer and the nurses were asked to participate voluntarily, to which all agreed after they were informed about the aims and objectives of the research. Individual consent forms, provided by the university, were signed by each of the participants before the data collection process (Appendix C). The individual consent forms indicated that the nurses did not give permission for their names or photographs to be used in any documents. Nurses were therefore referred to as Nurse A, B, C, D, E and F. In the case where photographs were used, faces have been blurred.

The ethical concerns regarding anonymity of both the hospital and the participants was prioritised and participants were always approached respectfully. Interruptions during the interviews were also accommodated.

The data collected from the observations and audio-recorded interviews were transferred from the recording device to a password-controlled device. The data was transcribed as accurately as possible in order to represent the data as it was heard and observed.

A potential risk included the fact that the interviews may have made the nurses more aware of certain design factors that may have been problematic. Care was taken not to point out design flaws or strengths to the nurses, and the interview questions merely consisted of general design factors. It was made clear to the nurses that the observations and interviews were purely for research and that no design interventions would take place to improve any possible design flaws.

3.10 Limitations

Focused questions were used “to connect with the interviewee” which is recommended for a “busy person with limited time” (Simons, 2009). Although this could be a limitation, the data which was collected gave a clear and straightforward indication of what worked and what did not.

Another limitation was related to one of the nurses who did not give permission for the interview to be recorded. The interview continued as usual, and field notes were taken to ensure that as much data as possible was documented. The findings may have been more descriptive had the interview been recorded and transcribed.

The fact that only two of the six nurses who were interviewed were involved in the design process may have been a limitation. Had more nurses who were involved in the design process been interviewed, the designer’s intentions may have corresponded more with the experiences of the nurses.

3.11 Conclusion

In this chapter, the research design and method were discussed. A qualitative approach was adopted, and observations and interviews were used as a means of data collection. The interviews were guided by the Provisional Coding, and the observations were recorded using the AEOUT

framework. A First Cycle Coding method was used, which allowed the meaning of the data to be condensed, after which the data was further grouped according to emergent themes.

CHAPTER 4: PRESENTATION OF FINDINGS

4.1 Introduction

The preceding chapter presented the research design and methods which were used in obtaining the data for this research. The findings obtained using a combination of research methods, respond to the aim of the study: *to explore the intentions of the hospital designer in relation to the primary users' experience in a private hospital's wards*. In responding to the aim, the following secondary questions were asked:

1. What were the design intentions of the hospital designer?
2. How do the primary users experience these design intentions?

The findings are presented according to the five themes from the adapted conceptual framework (Figure 2.2, page 19): the ambient environment, architectural, interior design, social and specific features. The findings from both the interviews and observations, from both sample groups are discussed under the various themes. The layout of Chapter 4 is shown in Table 4.1.

Table 4.1: Layout of the findings under the main five themes.

Themes	Layout of findings	Secondary question
The ambient environment; Architectural features; Interior design features; Social features and Specific features	Findings from the interview with the designer	What were the intentions of the hospital designer?
	Findings from interviews with the primary users	How do the primary users experience these design intentions?
	Findings from observational studies	How do the primary users experience these design intentions?

In responding to the second secondary research question and as part of the secondary data analyses, the findings are synthesised through Morville's (2004) User Experience Honeycomb model.

4.2 Introductory questions

Prior to the interview, the researcher provided the designer with a few themes that were to be discussed throughout the interview. This was done in order to obtain all possible and relevant information on the design intentions, as the project had been completed a few years ago. The interview protocol consisted of five categories, which were derived from the literature.

The design protocol consisted of a few introductory questions which set the context and allowed for the interview process to commence. Some of the introductory questions included what the design brief was and whether the designer had to work within a specific budget and timeframe. The designer mentioned that the design brief consisted mainly of the number of beds that the client had wanted, rather than the design of the wards and rooms, which was dictated by the designer. The client consisted of the hospital manager and the supervisors of each of the hospital departments. It was interesting to note the relationship between the designer and the client throughout the design process:

“...a nice sort of interaction between the designer and the client, it was not much of a dictatorship” (Designer, 2018).

The new private ward was designed as a space on its own, taking into consideration all the rooms, services and nursing stations that constitute a hospital. The designer commented that he/she had made regular contact with the client throughout the design phase, as part of the design process, in which “they were happy with certain aspects or not and the design developed from there” (Designer, 2018).

The hospital was in the city centre, with minor room for expansion. This meant that the new wing of private wards was limited to a specific size and shape and the structural footprint determined that: “...we had to work within that space... they specifically wanted private wards for that wing” (Designer, 2018). The designer had to work within a specific budget but commented that he/she was able to advise the client on the budget where necessary. The designer continued by stating that the design brief of the two new private wards was meant to be a phase two, but through research done by the client, it was found that “patients were demanding private wards” (Designer, 2018). As the existing hospital had no private wards, it was proposed that they proceed with phase two. The designer explained that for phase two, they were allowed to veer away from the historical context of the older wards, “it was a clean slate in that sense”, and thus

he/she was able to bring in some modern regulations, which meant that “the spaces were bigger, the passages were nicer” (Designer, 2018).

The designer mentioned a few important design aspects that were taken into account with the design of the hospital. The main feature was the fact that the hospital was not a “greenfield site” and that the style of architecture was already there, “compared to a brand-new greenfield hospital, this was more of an adapting into...” (Designer, 2018). He/she mentioned that the existing hospital depicted a great deal of the design as the new wards had to tie in with the current hospital. Another notable design aspect, “and this was with the sisters”, was the need for the connection to the outside, “so the balconies and the link to nature” (Designer, 2018). With an open North and an open South facade, he/she was able to implement a ‘North garden’ and could simultaneously achieve proper cross ventilation within the wards.

4.3 The ambient environment

The findings from the ambient environment are presented under the sub-themes of noise and lighting, both artificial and natural, and ventilation.

4.3.1 Noise

The acoustic treatment within the wards, although minor, was incorporated by the designer, who mentioned that:

“We did not have the sort of specific experts involved... there was not really any specific need for acoustic panelling...” (Designer, 2018).

The designer mentioned several elements that were in fact used in reducing the noise levels within the wards. He/she mentioned that “you have got your joinery fittings which absorb” as a result of the material selection and continued by adding that the vinyl flooring is acoustically better than tiles. Acoustic ceiling tiles were also used, which assisted with the dampening of noise. The designer did, however, state that the space “needs to be acoustically sound dampening and quiet and nice but not dead” (Designer, 2018). He/she concluded by stating that although the specific experts were not involved, “...we, I think, successfully managed to make it happen right” (Designer, 2018). Although successfully managing, he/she admits that it would be ideal to measure the noise levels in the final stages of the design and stated that if the correct experts were involved, “you could do really well” (Designer, 2018).

Most of the nurses felt that the noise levels within the wards were not well maintained, with Nurse F stating that: “noise is just a problem in this hospital” (Nurse F, 2018). The noise seemed to be a problem in both the old and the new wards, with Nurse F stating that: “none of the wards have got a noise level that is maintained” (Nurse F, 2018). The noise was associated with a few factors within the wards, including the cleaners, staff, visitors and equipment. The two main factors which largely contributed to the noise, as identified by Nurse F, were the staff and the visitors. The staff because “instead of walking up to there, she will rather scream or shout for the other one...”, and the inconsiderate attitude of visitors during visiting hours as “they do not think this is a hospital...” (Nurse F, 2018).

Notwithstanding that most of the nurses had a different opinion to that of the designer, one of the nurses felt the noise levels were well maintained. Noise levels can be associated with the various shifts, as the nurse who agreed with the designer, had been working evening shifts since her first day of employment. Noise levels are better maintained during the evening shifts because visiting hours end at 19:00, which is when the evening shift commences.

The observations indicated that with K1 being a day ward, patients were continuously taken to surgery and brought back, resulting in visitors being in the ward throughout the day, regardless of visiting hours. Visitors are often given refreshments when waiting for patients to return from surgery. With an absence of social spaces; spaces providing social interaction, visitors find themselves standing in the corridor while having refreshments. As visitors would have conversations and would often walk in the corridors, the noise levels increased.

The noise from the visitors can further be associated with the two different shifts. The noise levels were higher during the day shifts as a result of the two visiting hour shifts, between 10:00 and 11:00, and 15:00 and 19:00. The noise levels were slightly lower in the new wards as a result of private rooms, which accommodate visitors. This resulted in quieter corridors and maintained noise levels within the wards.

The older wards were designed as open wards, divided by a passage or staircase, instead of a ward door. As a result of this, higher noise levels were observed in these wards. With ward K1 and K4 being open wards, noise generated in one of the wards would travel to the other ward, increasing the noise levels of both wards.

Although most of the noise was associated with the absence of social spaces, other contributing factors included the noise from trolleys, kitchens, and the staff. Three of the nurses identified

themselves as a noise source, as a result of the distances between specific spaces within the ward. This can be associated with the use of a single corridor configuration where corridors tend to be longer, resulting in further walking distances and nurses being spread across further distances.

The kitchens in the old wards were generally located in the middle of the corridor, making it easily accessible for staff. However, this also contributed to the noise levels. When the kitchen door was left open, the noise from the cutlery could be heard throughout the passage. This was observed in both an old and a new ward. It was interesting to note that in the new wards where the kitchen was located at the front end of the ward, the noise still travelled into the rest of the corridor, contributing to the noise levels within the wards.

4.3.2 Lighting

4.3.2.1 Artificial lighting

The designer noted that lighting specialists were not consulted for this specific project and continued by saying that:

“we actually just worked with [Nurse F] and the sisters with their experience...”
(Designer, 2018).

There are a few sets of lighting, which include the main room lighting, reading light, the lighting required for writing on the ledge and the night time dim lighting. The designer commented that the lighting used in the patient rooms must be accessible and operated from the bed of the patient as “you do not want to have to call the nurse to come and turn off the light, again, it is a waste of the nurses time” (Designer, 2018). The lighting used for the passage consisted of the main lighting used throughout the day, which was dimmable for the evening shift. The main lighting was found in the passage, required during the daytime, and the dim lighting which was used during the evening. The most essential lights were the nurse call lights “which you have to see over and above all that lighting” (Designer, 2018) as this indicated when a patient is calling the nursing staff.

The nurses’ responses to whether the lighting was adequate within the wards were mostly positive. The only negative comment raised by one of the nurses was the placement of the light switches, as there was confusion as to where lights were switched on and off: “it is just sometimes you do not know where to switch on and off” (Nurse C, 2018). This can be associated with the various

types of lighting required within a ward, as light switches would have been placed at the most accessible and practical locations, resulting in light switches being positioned at various points within the ward. With only one of the nurses having raised this comment, the concern can be associated with the fact that the nurse was only employed once the wards were already operational.

The remaining interviews indicated that the nurses felt that the lighting was sufficient and strong enough in both the old and the new wards, for them to perform their tasks. This may explain why none of the nurses mentioned any health ailments caused by the lighting. This could further be as a result of the different types of lighting used throughout the ward, addressing specific tasks.

The observations indicated that during the morning shifts, the main fluorescent lighting had already been switched on upon arrival at 08:00 and the downlighters from the evening shift had been switched off. The lighting was still the same as the morning shift when arriving for an evening shift at 19:00 in ward K4. The main fluorescent lighting was kept on until 21:00 when the medication was no longer being distributed. The main fluorescent lighting was only switched off at 22:10, at which time the downlighters were switched on, making the ward slightly darker. The fluorescent lighting at the nursing station remained on during the remainder of the evening shift observation, which allowed the nurses to have enough lighting when doing administrative work during their shift. During another evening shift observation in ward K5, the main lighting was switched off slightly later, at 22:50, after the medication distribution had taken place. As with ward K4, the fluorescent lighting by the nursing station remained on throughout the evening shift observation.

The observations further pointed out another set of lights, which were the lights that are switched on by the nurses in the patient rooms, indicating occupancy to other staff. These lights were most evident in the observations as some of the nurses forgot to switch these lights off, confusing other staff when patient call lights went on. This was observed in three of the five observations, all in the old wards. It was noted from the observations that the nursing stations in the old wards were more confined, resulting in poorer lines of sight. This made it difficult for nurses to see the patient call lights from inside the nursing station. However, from the interviews, this was not considered a problem by the nurses as there was a monitor in the nursing station, which showed occupancy of patient rooms.

4.3.2.2 Natural lighting

There was not a large amount of natural light in the wards. The designer explained that natural light only enters the ward through the patient rooms and “only if the door is open” (Designer, 2018). All the rooms were equipped with large sliding doors, allowing natural light and ventilation to infiltrate the room. The designer considered the amount of natural light adequate, which can be associated with the nurses frequently performing tasks in the patient rooms, where they are exposed to natural light.

The amount of natural light was not considered a problem by the nurses, with one nurse stating that all they require is sufficient lighting for them to see what they are doing “for fresh air or for view, I think that can happen outside” (Nurse A, 2018). In addition to this, the nurses were regularly attending to patients in their rooms, which received adequate natural light, which may explain why the nurses felt that there was sufficient natural light within the wards. Nurse F, however, commented on the amount of natural lighting, stating that in some regions of the ward the amount of natural light was not enough. She elaborated that natural light is “very important, it is helping with healing” (Nurse F, 2018), in which case she was referring to patients rather than staff.

In some areas of the ward, the amount of natural light was insufficient. The observational study carried out in ward K4 indicated that from 08:00 to 10:00, all the patient room doors were closed, resulting in barely any natural light entering the ward. The ward did, however, have a glass door on either side of the passage through which a small amount of light entered the ward, shown in Figures 4.1 and 4.2. The non-tinted door was, however, always covered with a curtain and can be as a result of the vinyl flooring creating a reflection when light shined on it, shown in Figure 4.1.



Figure 4.1: Morning light through tinted door (K4).



Figure 4.2: Opposite door covered with curtain (K4).

The natural lighting aspect in the new wards, K5 and K6, was similar to the older wards. As with the old wards, light only entered the ward when the doors of the patient rooms were open. Observations showed that the amount of natural light within the ward would vary as a result of the patient room doors being either open or closed.

4.3.3 Ventilation

The designer referred to the new wing of private wards as ‘high-end’ wards, with an open North and an open South, which allowed for proper cross ventilation to be achieved. The designer mentioned that there was a need for a connection to the outside, as requested by the nursing staff. The patient rooms were therefore equipped with large sliding doors that could be opened for natural ventilation. The patients’ needs were considered regarding ventilation as large sliding doors were implemented to avoid ‘stuffy rooms’, which becomes a health risk in terms of bacteria and diseases.

Although the nurses did not mention natural ventilation, two of the nurses did, however, mention the artificial ventilation. Nurse A complained that the air-conditioner was not circulating well within the nurse station, saying that “the only time you will feel the heater or cooler is only when you are stationed right across the air-conditioner” (Nurse A, 2018). Nurse B mentioned that one of the air-conditioning vents was not working in ward K4 earlier that week, which resulted in a cold through-flow throughout the ward.

The observations indicated that the air-conditioning was seldom kept on throughout the day. In ward K6, the aircon-conditioner at the nursing station was switched on at around 10:00, with the ward being experienced as cold. During another observation in ward K1, the air-conditioner was on upon arrival. The ward was experienced as cold towards 10:00 and remained that way until the observational study was completed. No visible air-conditioning was seen in ward K5, which may explain why the temperature felt regulated. Air-conditioning may have been present in only the nursing station and the patient rooms.

Table 4.2: Findings related to the ambient environment.

Sub-theme	Designer	Nurses	Implication
Lighting	Only natural light that infiltrates the ward is through the patient rooms when the doors are open.	Only important for them to see what they are doing. The amount of natural light considered enough. It is considered important with regard to healing.	Nurses were exposed to sufficient natural light within the ward and the patient rooms.
Noise	No need for specific acoustic panelling as acoustic ceiling tiles were used and there were joinery fittings that absorb sound.	The noise was considered a big problem in all of the wards, with noise sources ranging from equipment to staff and visitors. The noise levels were, however maintained during the evenings.	The majority of the nurses did not agree with the designer in terms of acoustics but did not mention how it affects their work.
Ventilation	Patients' needs were seen to in terms of natural ventilation. As the wards are premium wards, artificial ventilation systems were implemented throughout the wards.	Air-conditioning was not circulating well within the nursing station.	The air-conditioning systems caused discomfort during some of the observations, as it was not properly regulated and the wards being cold.

4.4 Architectural features

For this study, the architectural features consist of the spatial layout of the ward, spatial accessibility, and ergonomic design and supportive workplaces presented below.

4.4.1 Spatial layout

4.4.1.1 Corridor layout

A single corridor layout was used for the design of the wards, which was described by the designer as “banking rooms along the passage” (Designer, 2018). He/she continued by saying that “your passage is your non-functional, non-money earning space, so you try and keep that to a minimum” (Designer, 2018) so that the functional spaces can be maximised, increasing the functionality of the wards. By using a single corridor configuration, a functional space could be incorporated on either side of the corridor. One of these spaces included the nursing station of which the requirements were given by the client and some of the nursing staff. One of these requirements included that the nursing station is positioned centrally within the wards.

Regarding the functionality of the corridor, the designer mentioned that the corridors of the new wards were about 2.7 meters wide, almost 3 metres. He/she continued by saying that the central

passage needs to be spacious to allow for all the functions to occur at the same time as “...one must also remember it is a functional building...yes, it must be nice but it has actually got a reason” (Designer, 2018). The functions included the staff walking back and forth in the corridor, food trolleys being moved along the passage and cleaning staff with their trolleys.

Three of the nurses felt that the corridors were not large enough, with one of the nurses stating that “the space is quite narrow” (Nurse A, 2018). The space became congested as the cleaning staff needed to remove the furniture from the patient rooms when cleaning, resulting in the furniture being placed alongside the passage. Nurse E stated that in a scenario like this “... only one bed at a time can move” (Nurse E, 2018) and thus someone needs to give way first. This may, however, be due to trolleys and equipment being left in the corridor by the staff, instead of being stored away. As a result of this, the corridor space becomes narrow.

Another nurse did, however, not see the need for the corridors to be wider by explaining that more than one function can occur at the same time. The nurse may also have felt that the corridor width was adequate as the nurse was newly employed with no other wards to compare the new wards to.

Nurse F described the situation of both the old and the new wards by explaining that “... thinking about the corridor of the old building...we said it is too narrow” and therefore with the design of the new wards, “... we wanted the corridors to be even wider” (Nurse F, 2018). Nurse C from the new ward had a slightly different opinion, stating that the corridor was wide enough “...because you can pass a bed while there was a food trolley (Nurse C, 2018). Another nurse from the older wards explained that everyone needs to be considerate with regards to the movement within the corridors. Nurse F concluded by saying that “if I can give advice: bigger rooms and bigger corridors. Wide, they must be wide, wide enough” (Nurse F, 2018).

Although most of the nurses felt that the corridors were too narrow, findings indicated that all the functions could still take place in both the old and the new wards. Certain functions may, however, have been performed with more ease had the corridors been wider. This may explain why the nurses felt that the corridors were too narrow.

4.4.1.2 Lines of sight

The lines of sight were associated with the location of the nursing station, which did not seem to affect the view that the nursing staff had on the patient rooms. The nursing stations within the older wards were more confined (Figure 4.3) than in the newer wards, which meant that the nursing staff had less of a view to other areas within the ward.



Figure 4.3: Confined nursing station in older ward (K4).

Although the observations indicated that the nurses struggled to see all the patient rooms from the nursing stations, the interviews with the nurses indicated that it was not a problem. This was explained by one of the nurses who stated that all they have to do is “...go out of the post, stand in the centre, then you can just see” (Nurse E, 2018). She further explained that in the new wards, the nursing stations were equipped with monitors, which indicated which patient was calling. Although it was clear from the observations that there was some confusion, the respondents mentioned that the location and design of the nursing stations did not affect the lines of sight.

4.4.2 Spatial accessibility

For this research and as identified from the literature reviewed, the accessibility section includes walking distances and proximity within the ward, and not the requirements for disabled and less-abled persons.

4.4.2.1 Walking distances and proximity

The various functions that took place within the ward included the transport of the beds, staff walking back and forth in the passages and kitchen staff distributing food from trolleys. With all these functions, the designer considered the services for the staff as being important. He/she mentioned that “they have to access the services and the medicines and everything, fast and accessible and not sort of away” (Designer, 2018). He/she concluded by stating that “there is a lot of systems in place that reduces physical walking around the hospital” (Designer, 2018), making it a more comfortable environment for the staff to work in as they are not always running up and down.

Figures 4.4 and 4.5 indicate the number of times the nurses walked to specific areas within the ward, in an older ward (K4) and a newer ward (K6).

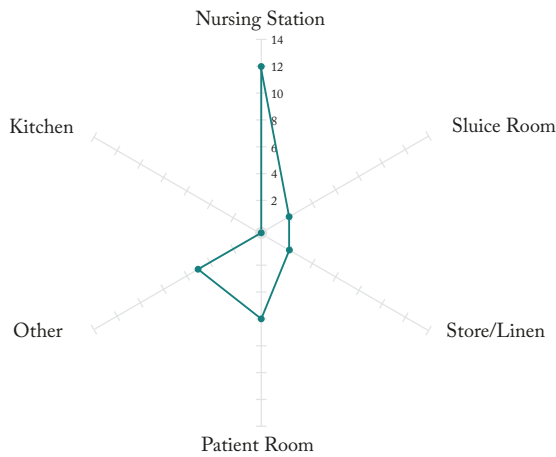


Figure 4.4: Observation from old ward (K4).

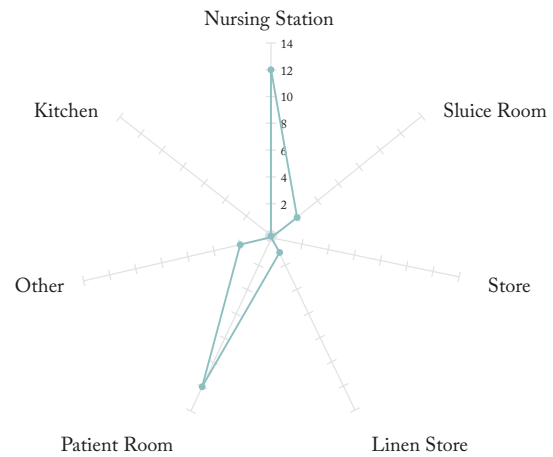


Figure 4.5: Observation from new ward (K6).

In both the old and new ward, most of the walking took place to-and-from the nursing stations. Nurses would return to the nursing stations after they had been to the patient rooms, which was the second most walked distance. In the older wards, the storeroom was also the linen room, with Figure 4.4 indicating that a few trips were made here. In the new wards, however, there were two separate rooms for storage and linen, with Figure 4.5 indicating that no trips were made to the storeroom, during that specific observation.

In terms of the ‘systems’ which reduced the walking distances, two of the nurses felt that the storage rooms were too far from the nursing station: “if it was a bit closer that would have been more convenient for us” (Nurse A, 2018). Nurse B, who works evening shifts in the same ward as Nurse E, disagreed and felt that it was at a convenient place within the ward (Nurse B, 2018).

The storage rooms of the new wards were also located to the one end of the ward, next to the kitchen, and when asking the nurses whether spatial accessibility was a problem, one replied 'no', and the other replied: "I think it is fine" (Nurse C, 2018).

The reason for the difference in opinion could be as a result of the one nurse working only evening shifts, which the observations indicated are generally quieter. In addition to this, this nurse also mentioned that as a result of working in the hospital for more than 20 years, one compares it with how it used to be and appreciate the improvement.

During an observation in ward K4, one of the many trolleys that had been standing in the corridor was taken to the storeroom. Due to the storerooms being located at the back end of the ward, the nurses had to walk to the storeroom to fetch and return equipment when needed. This resulted in plenty of back and forth movement to and from the storeroom, throughout the day.

Two of the nurses commented on the overall accessibility of the ward. Nurse F referred to the old wards and stated that it would have been functional if "...everything could be together", such as the nursing station and the linen storeroom (Nurse F, 2018). The findings from the new wards were slightly different from that of the older wards, as the linen store was located behind the nursing station and the sluice room towards the outside of the ward. Although an interview with one of the nurses confirmed that the sluice rooms were situated in a more functional location, the walking distances increased.

It was evident from the observations that more dirty linen trolleys were being used. This can be associated with the location of the sluice rooms. More trolleys implied fewer trips to the sluice rooms, decreasing the amount of time spent walking. Although this may have been the case, the observations showed that cleaning occurred throughout the day, resulting in staff regularly taking dirty linen to the sluice rooms. This may explain one of the findings which indicated that although the nurse was satisfied with the location of the sluice rooms, she mentioned that "it needs courage to walk from here to there" (Nurse C, 2018). Nurse F concluded by saying that it would have been much better "... if the nurse station and the linen rooms and everything that the sisters need" (Nurse F, 2018) was situated in close proximity. This ties in with the accessibility of the wards, as the wards were considered functional if the spatial accessibility was adequate.

In the older wards, however, the observations indicated that the nurses had shorter distances to walk as the sluice rooms were located towards the centre of the ward. Although convenient and functional in terms of walking distances, with the sluice room being in the centre of the ward, it

became an inconvenience as the staff needed to make sure the door was closed as patients and visitors were always walking past. With the sluice room located directly opposite the nursing station, next to the staircase and near the entrance of the ward, this specific point became congested as there was a constant movement of patients, visitors and staff. The observations indicated that this was predominantly the case during the day shifts.

Conclusively, the walking distances within the wards were affected by the location of specific spaces which included the storerooms, linen and sluice rooms. It was clear from the observations that in some instances, the nursing staff needed to fetch stock from other storerooms within the hospital, which increased the walking distances.

4.4.2.2 Storage

“...storage is a major factor in the sense that there is always stuff you need to keep close at hand, it is not something you should skip...” (Designer, 2018).

The designer mentioned that in terms of the allocation of square metres for storage, the client “looked at what we had drawn and what we designed and then obviously needed it bigger or smaller” (Designer, 2018). Three main types of storerooms were identified, which included the medicine store, linen store and general store. The medicine store, which was a “secure locked thing” (Designer, 2018) was located near the nurse station. The linen store for clean linen, and then the sluice room, which should be accessible to an exit or entrance as “you do not want to be dragging dirty linen through the ward” (Designer, 2018). The general storeroom, “which is often left out” was used to store the stands, spare beds or a bedside table which the designer explains is usually stored somewhere in the hospital where it is not easily accessible. The designer also stated that storage is essential in the staffrooms for the nurses to store their belongings.

The designer cautioned that “sometimes stuff does not need so much space”. He/she added that sometimes a cupboard in the passage is sufficient for storing smaller items, and when it comes to bulkier things, then a larger space may be required.

“...a big thing is to physically measure the actual size of everything that goes into a ward, and to get this from the client and to physically measure it and not presume” (Designer, 2018).

This is an important consideration as storage is essential, but space is also an expensive commodity. The designer can, therefore, not make any assumptions in this regard.



Figure 4.6: Floor plan of Ward K1 indicating specific areas within the ward.



Figure 4.7: Floor plan of ward K5 indicating specific areas within the ward.

The floor plans shown in Figures 4.6 and 4.7 indicate the various storerooms within the older and newer wards and give a visual representation of the difference in sizes of each of the storerooms. The location of the storerooms is also shown in relation to various other spaces within the wards.

Although the storage of the ward was well thought through, four of the nurses complained about the storage being insufficient. Two of the six nurses who felt that the storage was indeed enough, were the nurses who worked in the older wards. One of the other nurses who also worked in the old wards disagreed with them by stating that "...there is not enough storage in this ward" (Nurse A, 2018). She continued by explaining the implications of not having enough storage and stated that "we have to reduce our quantities that we keep in the store" which leads to the ward having to borrow stock from other wards. She reiterated that storage is a problem: "When it comes to storage...no, it is bad. It is not enough" (Nurse A, 2018).

One of the nurses who worked in the new wards stated that "actually the ward is patient-friendly" (Nurse C, 2018), explaining that the rooms were big enough and that the storage within the patient rooms was adequate. When asking her whether the ward was nurse-friendly, she replied "...it is not really" and concluded by stating that the storage for the stock was not sufficient (Nurse C, 2018). Nurse F, who had worked in both old and new wards, agreed with Nurse C and stated that: "... storage in this hospital is just a problem. The whole hospital" (Nurse F, 2018). Like Nurse C, she continued by mentioning, that when new equipment is bought, the storage is not enough. She explained that "... at the beginning we did not accommodate" for any additional stock, and with an increase in patients, there is an increase in stock (Nurse F, 2018).

From the observations, it was evident that the storerooms within the older wards were not sufficient in terms of size. During an observation in ward K1, one of the busiest wards within the hospital, the ward had no pillows left in the storeroom. This resulted in one of the nurses having to walk to another storeroom located elsewhere in the hospital. A similar event was observed in ward K4 during the evening shift, with one of the cleaners needing a duvet cover. This suggested that not only was the storeroom possibly too small to accommodate all the necessary linen, but it also meant that in terms of accessibility, one of the nurses had to walk to another linen store in the hospital to fetch a duvet cover.

In summary of the storage, the designer explained the importance of measuring the size of all the equipment needed in the ward, as not all equipment requires ample storage space. This was interesting to note as additional storage was incorporated in the new wards but was still not

perceived to be sufficient. This may be due to the continuous increase in stock, which some of the nurses indicated may not have been considered with the design of the wards, as well as the storerooms not being utilised efficiently.

4.4.3 Ergonomic design and supportive workplace

The process of designing the nursing station, with the input from some of the nursing staff, was described as:

“...in-depth, very much in-depth. That is their cockpit... it has to work” (Designer, 2018).

The designer explained that guidelines were given for the nursing stations: “they needed one nursing station per ward...obviously centrally” (Designer, 2018). He/she mentioned that it was difficult to explain the design to individuals who lack three-dimensional visualisation skills, that the space will be a specific size because once it is built “there is still a ‘ja but we do not like this.’” (Designer, 2018). He/she explained that there were specific requirements, one of which included a working station with a counter high enough to accommodate for doctors and nurses who stand and work. Through this, better ergonomics were achieved, in which one’s “posture is nice” (Designer, 2018). In addition to this, the nursing stations also needed to be comfortable, “... because they actually sit there, I mean they often wait a lot of their life” (Designer, 2018).

The designer mentioned two electronic devices that needed to be considered; the nurse control panel and the public address system. Other electronic devices included computers, printers and x-ray machines. He/she mentioned that every component had to be carefully measured according to the specifications on the data sheets. He/she noted the importance of the installation of the technology components, stating that it needed to be easily accessible and easy for maintenance purposes.

The nurses’ opinions on the nursing stations were, however, slightly different from that of the designer. One of the nurses mentioned that the nursing station was “functional, but not big enough” in both the old and the new wards (Nurse F, 2018). Findings indicated that both nursing staff and doctors often utilised the counter space on the passage side. One of the nurses indicated that the emergency trolley should ideally be located in front of the counter, making it easily accessible in the case of an emergency: “...is supposed to be in front, here at the sisters’ station where you can grab it and run” (Nurse F, 2018). The emergency trolley was, however, stored in

the linen storeroom located behind the medicine store. In the case of an emergency, the emergency trolley would not be readily accessible as nurses and cleaning staff are often in the linen and medication store, minimising the circulation space within the nursing station.

The emergency trolley was not utilised during any of the observations, and although stored in the linen room, not easily accessible, the corridor width did in any case not allow for it to be placed where it ideally should be kept. The observations further indicated that circulation space within the nursing station was minimal, suggesting that there would be no space to store the emergency trolley in the nursing station. Regarding this, one of the nurses concluded by saying that it would have been ideal to have a nursing station the size of two patient rooms for there to be more storage. Nurse C agreed that the nursing station was too small and added that “I would have wanted a more spacious place” (Nurse C, 2018). She explained that “with the design, they never took into consideration of adding new things on”. She mentioned that they recently employed a secretary for which they needed to make space at the nursing station and “that is why the place is a bit too small” (Nurse C, 2018). Nurse A agreed that the nursing station was too small but did not mention it being a problem as “we do not have to spend much of our time there” (Nurse A, 2018). This was evident from one of the observations which took place during an evening shift in ward K4, with nurses seldom being at the nursing stations at the start of their shift. Nurse A explained that the nursing station was only used when doing record-keeping and when handing over or giving information to one another. Nurse B, who worked in one of the old wards, mentioned that the nursing stations had been made bigger, “...so now it is much better” (Nurse B, 2018). Although the nursing stations were made bigger, the observations indicated that two of the nurses were writing in files on the trolleys in the passage, as counter space by the nursing station was limited.



Figure 4.8: Location of computer within nursing station.

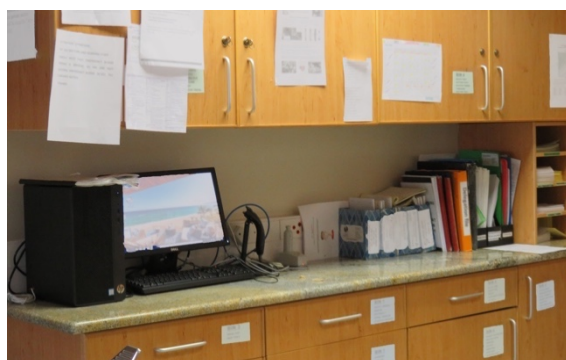


Figure 4.9: Location of computer in relation to counter and overhead cupboard height.

Figures 4.8 and 4.9 show the placement of the computer in the nursing station. A chair was provided for the nursing station but was used by nurses who sat at the desk space, rather than where the computer was. This may, however, have been as a result of the staff moving equipment around, once the design was completed, to suit their working dynamics better or to have more writing space by the desk area. As a result of the computer being positioned on the counter, there was no space for a chair and the observations indicated that nurses had to be cautious when working on the computer, as they would knock their heads on the above cupboards.

Only one chair was provided per nursing station, and this may have been done intentionally as an additional chair may have resulted in a less spacious nursing station which affects movement within the station. The nursing station did not allow for any additional furniture as it became crowded when one of the nurses was seated, and when another nurse was busy on the computer.

Table 4.3: Findings related to architectural features.

Sub-theme	Designer	Nurses	Implication
Spatial layout (corridor layout & lines of sight)	Single corridor layout was used to try and minimise the size of the corridor. Corridor width of nearly three meters, to make it a functional building.	Space is too small, so it becomes congested with furniture and people. Space is big enough; everyone needs to be considerate. Lines of sight not considered a problem.	A discrepancy between what the designer mentioned and what the nurses experienced. Although narrow and crowded, all functions could still take place.
Accessibility (walking distances & proximity, and storage)	A lot of systems present which minimises the walking distances within the hospital. The client had looked at the allocated areas for storage. Important to measure every component.	If everything was closer to one another, it would have been more accessible. Some nurses found that storerooms were too far away while others disagreed. Storage was considered a problem by the majority of the nurses as there was enough storage.	Storage was insufficient in the older wards and stock needed to be stored elsewhere in the hospital. This affected walking distances.
Ergonomic design and supportive workplace	The nursing station was as 'in-depth piece of joinery work'. Specific requirements: standing and seating spaces and needed to be comfortable as nurses sit a lot of the time. The technology was also considered.	Considered functional but not spacious enough, as space for additional stock and storage was not taken into consideration.	Although considered small, nurses do not spend much time in the nursing station and take turns in sitting.

4.5 Interior design features

The interior design features consist of the flooring material, colour, and furniture and equipment, and are presented below.

4.5.1 Flooring material

The designer referred to another private hospital who incorporated carpets in their design as they were “...trying to make it homely and soft and that the acoustics were much better” (Designer, 2018). Although the acoustics were better in that hospital, He/she reiterated the fact that a hospital is a function place. In terms of flooring material options, granolithic concrete is generally used in rural hospitals because “it is hard and you seal it” (Designer, 2018). With the constant movement of beds and trolleys, tile joints become problematic and therefore “you land up with a flush surface finish” (Designer, 2018), which he/she added are your linoleums and vinyl flooring. For a hospital, it is crucial to have a surface that is easy to clean and sanitise, and thus the designer reckoned that the vinyl was the best option as “...your whole bacteria risk comes right down” (Designer, 2018).

All of the nurses agreed with the fact that the vinyl was easy to clean with one nurse stating that “I think the flooring is 100% because you can actually spot the dirt with your eye” (Nurse C, 2018). Another nurse commented that the flooring used to be wooden which contributed to the noise levels and when comparing the two types of floor finishes, also agreed that the vinyl was easy to clean and acoustically better (Nurse B, 2018). Although all the nurses agreed that the vinyl flooring was a functional type of flooring, one of the nurses pointed out that “... when it is wet it is quite dangerous...” as it tends to be slippery. She concluded: “that is the main risk we have with this...besides that I think it is convenient...” (Nurse A, 2018).

4.5.2 Colour

The designer’s approach regarding the implementation of colour psychology was explained as: “you do not want to go for bright, vibrant colours” (Designer, 2018). He/she continued by saying that a pastel colour palette was selected with tones of blue and green and that “the sisters also liked the greenish tints” (Designer, 2018). Although mentioning that bright colours are often avoided, the designer mentioned that a bright orange was implemented which introduced a bit of vibrancy. The vibrant colours were, however, not seen in the ward, which meant that the colours were implemented in the patient rooms. One of the nurses added that the bright colours were

chosen as “it is helping with healing” (Nurse F, 2018), which explained why these colours were implemented in the patient rooms.

The pastel colour palette was incorporated in the vinyl flooring, extending up to the bump rails as wall cladding, together with the bump rails within the corridor. In both old and new wards, Figures 4.10 and 4.11, a white cream colour was used for the remainder of the walls together with the white acoustic ceiling panels.



Figure 4.10: Colour application in the older wards.



Figure 4.11: Colour application in the newer wards.

Figures 4.10 and 4.11 indicate the different colour applications within both wards. How the colour was applied in the older wards created the illusion of the corridor being even narrower, seen in Figure 4.10. The old wards had floor patterns which were achieved with the use of different coloured vinyl, which may have been implemented as a means of guiding patients and visitors and assisting with way-finding. Findings from the interviews, however, indicated that the stripe on the floor did not assist in way-finding.

The designer mentioned that with the new wards “we did not do many floor patterns”, adding that this was “to keep within a certain budget” (Designer, 2018). One of the nurses mentioned that “after the new ward opened, then we started renovating the old ward” (Nurse F, 2018) which meant that the flooring patterns were even less in the old ward as the designer had to work within a specific budget. Due to the hospital not having any specific requirements in terms of colour, there was no specific need for all the wards to look the same. The designer further explained the difference in wards by mentioning that another project architect was involved in the renovation of the older wards. He/she elaborated that as there were no set requirements, the colours were chosen by the designer together with whichever nurses worked in those wards at that specific

time. This may explain why the wards were slightly different in colour as the nurses' opinions may have differed.

4.5.3 Furniture and equipment

The furniture provided for the nursing staff, within the ward, consisted of one chair per nursing station, which was generally used by the nurse in charge of the specific ward during that specific shift.

“... one almost wants a little lounge there, not just an office chair because you spend a lot of time there” (Designer, 2018).

The designer mentioned that the nurses often wait a lot of their time and that a 'little lounge' would thus be beneficial. None of the nurses, however, agreed with the designer's statement, with one of the nurses stating that “there is no space for chairs. There is only space for one chair” (Nurse C, 2018). She continued by explaining that their routine does not allow for there to be more than one chair as “... we do not have time to sit down there” (Nurse C, 2018). One of the nurses from the old wards mentioned that if more furniture was provided, “...some people will sit too much” (Nurse E, 2018). Nurse B agreed with this statement, explaining that they can bring a chair from a patient room or wherever there is a chair available if needed. She added that there is not enough space to permanently have chairs at the nursing station but admitted that during the evening shifts, they have more time to sit. This was observed in an evening shift in ward K5, where at 22:00, one of the nurses had taken a chair from an empty room and placed it in the nurse station, while the other chair was used by a nurse who was busy filing. The nurses who were not sitting were leaning on the counters and standing around. As the evening progressed, more nurses were returning to the nurse station, and by 22:05, all nurses had returned to the nurse station. This indicated that for the evening shifts, it might have been ideal to have a lounge as suggested by the designer.

The discrepancy in findings can be explained by the observational studies, which indicated that in most instances, the nurses were either standing at the nurse station or attending to patients. Throughout most of the day shifts, nurses were seldom situated at the nursing stations. At 10:00 in one of the new wards, the chair at the nursing station was not being used as nurses were not present. At 10:50, however, all five nurses on duty had returned to the nurse station, with one seated and the rest standing. A similar scenario occurred in ward K1, with all nurses being present at the nursing station at 09:15 and 10:20, with only one being able to sit and write. The remaining

nurses made use of the trolleys to write on as the seating provided was not enough for everyone. It is thus difficult to justify whether a small lounge or additional seating would be beneficial to the nurses as the findings indicated both that nurses are seldom at the nurse station and that nurses often stand around.

With the day shifts being busier with plenty of movement; from visitors to staff, it was interesting to note that the cleaners would remove the furniture from the patient rooms, such as the beds and chairs, in order to clean the furniture. This occurred mainly in the old wards where most of the rooms were double rooms, and cleaners therefore not being able to clean the room while another patient was still in the room. The cleaning occurred throughout the day, which was interesting to note as one assumes that the cleaning only takes place during the day shifts. The cleaning staff had to take dirty linen to the sluice room and fetch clean linen from the linen room located behind the nursing station. In ward K4 at 09:30, the chairs had been taken out of the patient rooms in order for the cleaning staff to wash the floors. The furniture taken out of the room was placed alongside the passage walls. A patient had been wheeled in from theatre, and once in the room, the theatre bed was also taken into the passage. This made it difficult for staff and patients to move around in the corridor, as all the furniture was placed in the passage. The same occurred in the day ward, with patients continually being wheeled to and from the theatre. At 09:00 there was congestion in the corridor as furniture was being cleaned, and at the same time, two beds were being wheeled back from theatre. There was no space for the two beds in the corridor as another bed was being cleaned in the passage, which meant that the bed had to be wheeled back into the room.

Observations further indicated that another factor influencing the functionality of the wards were the trolleys. This included the food, linen, laundry and cleaning trolleys. The trolleys were present in both day and night shifts. In ward K4 during the evening shift, four trolleys were present at 20:00, minimising the circulation space in the corridor, with nurses having to move the trolleys against the bump rails in order to move past. At 20:30 a food trolley had arrived which the kitchen staff placed against the bump rail, approximately in the centre of the corridor. The kitchen staff left the trolley there while taking the dinner to the patients, instead of pushing the trolley up and down the corridor to each room. This was, however, not the case in the day shift of the same ward, as the food trolley was continually moved up and down the corridor. Not only was the food trolley present in the passage, but also the laundry basket and the trolley with the clean linen. During an evening shift in ward K5, five trolleys were present at 21:10, ranging from the medication trolley to the cleaning trolley. With five trolleys in the corridor, the space to function

became significantly less. The medication trolley, generally used in the morning and again in the evening, is stored at the nursing station and taken into the corridor during use. The nursing station became less spacious, with nurses having less space to function.

Table 4.4: Findings related to interior design features.

Sub-theme	Designer	Nurse	Implication
Flooring material	Hospital is a functional place; therefore, carpeting is not the best flooring choice. Tiles are also not appropriate. Flush surfaces are the best, and a vinyl floor finish was chosen.	Flooring considered functional as it is easy to clean. Vinyl is also acoustically better than the previous wooden flooring.	Although considered functional, it is slippery when wet, becoming a safety risk, as the floors are washed throughout the day.
Colour	Bright, vibrant colours were avoided, and a pastel colour palette was selected. Bright colour used for vibrancy in patient rooms.	Bright colours help with healing.	Colour was mainly incorporated in the flooring patterns and on the bump rails. The colour floor patterns did, however, not assist in way-finding.
Furniture and equipment	One chair provided for the nursing station, although a little lounge would be better as nurses spend much of their time there.	There is no space for more than one chair, and there is no time to sit down.	Observations indicated that there was no space for additional seating. Nurses seldom seated as they were moving between patient rooms, storerooms, sluice rooms and the nursing stations.

4.6 Social features

The findings relating to the social features are presented in terms of privacy and social interaction.

The designer noted that there was no space for “...a nice waiting room before the visiting times” and added that “one has to be considerate about spatially how that space works” (Designer, 2018). He/she raised the fact that there are no combined lounge areas within the wards and stated that visitors need to be attentive; this is where a room where they can wait becomes beneficial. In terms of waiting rooms and privacy, the designer referred to the nurses who are relatively well sorted with their tearooms, as are the patients with their rooms. A space for interaction between the visitors, staff, and patients is therefore required.

From the interviews, all the nurses mentioned that a space providing privacy and social interaction would be beneficial to both visitors and staff. One of the nurses from an older ward commented that “... having them in the corridor, that is not quite ok” and added that if there was a room where the parents and visitors could go, “... that would probably be a very good thing” (Nurse A,

2018). One of the nurses who worked in an old ward pointed out that "... some people come ten at a time for one person...they will be standing in the whole corridor" (Nurse E, 2018). Nurse C raised an interesting fact when explaining that one of the hospital policies included that "when you are doing a procedure, even just a checking of blood pressure of the patient, you ask the relatives to go out" (Nurse C, 2018). In a situation like that, the visitors would stand and wait outside the patient room, in the corridor. The nurse further explained the situation by giving an example:

"Imagine you go in a room; you are doing your vitals. There is a doctor in that room, those visitors are also out. There is another nurse changing something there; those visitors are also out. Then it is traffic in the corridor" (Nurse C, 2018).

Nurse C continued by explaining that in a situation where a patient may have passed away, many visitors come to the ward, and tend to stand around in the corridor. She concluded by saying that in a situation like that, the visitors may disturb other patients within the ward, resulting in the staff taking them to the staff tearoom as "... you are forced to bring them here" (Nurse C, 2018), due to the absence of waiting areas.

From the observations, it became evident that the visitors, especially in ward K1, would visit patients throughout the day, regardless of visiting hours. This was permitted as ward K1 was a day ward, with patients continuously going into theatre and returning. It was also observed that these visitors were occasionally provided with refreshments upon waiting for the patients to return from theatre. As there are no "...combined lounges and things like that..." (Designer, 2018), the visitors stood in the corridor while having their refreshments. Not only did this contribute to the noise level of the ward, but also decreased the corridor width making it difficult for the staff to pass as "... you have to excuse yourself every time" (Nurse E, 2018), when veering out of the way.

Additionally, visitors receiving phone calls would leave the patient room and stand outside in the corridor, often walking up and down in the passage. This was primarily observed in the old wards as more than half of the rooms were shared between two patients. As the observer, it became clear that visitors were often in the way of the staff, indicating that a space for social interaction would indeed be beneficial to both visitors and staff, particularly in the older wards.

The observations did, however, indicate that a few chairs were present towards the entrance of ward K1 and K4. This seating was perhaps provided for the visitors to use before and during visiting hours, as no waiting rooms were provided. It was evident from the observations that these

chairs were vacant throughout the day, with the occasional visitor or patient making use of them. This may be as a result of visitors going to the patient rooms upon arrival, remaining in the patient rooms until visiting hours were over.

This indicated that although seating was provided, due to its location, it was seldom utilised. As a result of this, it is difficult to justify whether a waiting area would be utilised, even though all the interviews indicated that a space for social interaction would be beneficial to both the staff and visitors.

Table 4.5: Findings related to social features.

Sub-theme	Designer	Nurse	Implication
Privacy and social interaction	There was no space for a waiting room, and there are no combined lounges within the wards. Patients are well stored with their rooms and the nurses with their pause rooms.	A space providing social interaction and privacy would benefit patients, visitors and staff. Large groups of visitors stand in the corridor, making it crowded.	As a result of the absence of waiting rooms, visitors are taken to the nurse pause area. This affects the privacy of the nursing staff.

4.7 Specific features

The findings associated with specific features are presented under the sub-themes of staff amenities, way-finding within the wards, and safety.

4.7.1 Staff amenities

In terms of the staff facilities incorporated into the design, the designer explained that:

“There is a tearoom... a central one, sort of a bigger one, but you obviously do not have staff running back and forth” (Designer, 2018).

These rooms were referred to as breakaway rooms, which were essential in the design of the wards with the designer stating that there needs to be a space for off-duty staff, before and after their shifts.

The nurses’ responses were mostly negative with one of the nurses from a new ward stating that although there is a tearoom, she “would have wanted a more spacious place” (Nurse C, 2018). Another nurse mentioned the lack of rest areas by saying that “there is not enough like resting places like a bed” (Nurse E, 2018). Nurse F, however, contradicted this by stating that “in the old

wards it is big” (Nurse F, 2018). The staff tearoom which Nurse F was referring to was in ward K3, it was shared by wards K1, K3 and K4. Although describing the room as being big, “you have to go all the way up with the stairs to the other wards”, with a nurse from another ward commenting that “it would have been really nice if we also had one on the ground” (Nurse A, 2018). Ward K1 had a small kitchen but it was not spacious enough to function as a staff tearoom. With the design of the new wards, each ward had a staff tearoom located by the entrance of the ward, “behind the storerooms...sort of hidden there” (Designer, 2018). With these tearooms being spacious enough, the nursing staff from the new wards did not have to walk to the large tearoom located in ward K3, reducing walking distances.

Observations indicated that although the tearooms in wards K1 and K4 were small, the nurses were too busy attending to patients, resulting in no time available for them to spend in the staffroom. In situations like these, the small kitchen was sufficient as the nurses did not have time to rest in the kitchen. It was, however, observed that all staff utilised the kitchen and not only the nursing staff.

4.7.2 Way-finding

“The first thing is you obviously sit with the client and you work out what they logically understand, and a clear logic of levels and names...” (Designer, 2018).

The designer explained that the current hospital had two receptions, making it confusing for people coming in. He/she added that one only becomes familiar with the two receptions if one has previously been to the hospital. He/she mentioned that one reception would, therefore, be preferable. He/she added that the hospital has two ground levels, one on the West side and one on the East, making it “... quite tricky to tie in the whole hospital” in terms of the design (Designer, 2018). He/she explained that “...the best way to do it” is to spend time walking through the hospital and in doing so, “you have got to be somebody who does not know the place...” (Designer, 2018). He/she added that once all the junctions had been mapped out and the signage had been indicated on the design plans, one had to walk through it again as in most cases something would have been left out. He/she stated that:

“...way-finding I think is another whole entire skill... that is how people read buildings” (Designer, 2018).

The way-finding was mainly achieved using signage, which needed to be clear with neat writing. The designer stated the importance of the signage being legible, as there are older, younger emotional people. He/she concluded that the signage should be well lit with clear arrows but cautioned not to overdo it "...so that there is six signs and the person just sees arrows" (Designer, 2018). This may create even more confusion.

Nurse F commented on the way-finding and the confusion thereof: "it is very difficult to find your way in this hospital..." (Nurse F, 2018). She explained that it is not only in this particular hospital, but that way-finding, in all hospitals and in general, is difficult. She added that "even if you are going to make footsteps for them..." (Nurse F, 2018), they will still ask for assistance. The new private wing of the hospital makes the situation even more 'terrible' because you have the new building joining the existing building. She explained that this caused confusion for both patients and visitors "... because there is the lab and there are the doctors' rooms" (Nurse F, 2018), making it difficult to direct people to where they need to be. When asking her whether the way-finding might have been better had there been more apparent signs, she replied saying that the signs are already clear, and that people tend to be ignorant. She concluded by giving the example of the red line on the floor which indicated that the ward door opens inwards and added that "...they will still go up to the door" (Nurse F, 2018), having to move away once the door opens.

Moreover, Nurse C agreed with the fact that people are ignorant towards signage and stated that: "I do not know whether it does not catch their eye...people ignore it" (Nurse C, 2018). She explained the frustration of when a visitor enters a ward and says: "I am looking for Mr. so and so" and the patient does not appear to be in that ward. She elaborated that one may not tell them that the patient is not in the ward so, "you leave what you are doing, you pick up the phone, then you ask reception..." (Nurse C, 2018). She continued by saying that she then needs to direct the visitor to a different ward. She added that one does not always have the time to do this and may come across as being impatient. Nurse A explained a similar scenario:

"It is quite annoying to be honest because people will still pass reception where they are supposed to get all the help they need, but then yet they will still come to the station and they will ask where is which patient..." (Nurse A, 2018).

From the observational studies, it was evident that signage and way-finding were, in fact, a problem within the hospital wards. Ward K1, located next to the reception, had the most trouble in terms of visitors and way-finding. Many visitors would pass through ward K1 in search of various other wards. The first problem occurred by the ward door as visitors did not know where

to open the door. Once inside, most of the visitors reported to the nursing station in search of a patient. The nursing staff would tell the visitor in which room the patient was, but visitors still struggled to locate the room.

During another observation in one of the old wards, a visitor had entered the ward in search of a patient. The visitor complained to the nursing staff about being lost. Visitors also struggled to locate the bathrooms within the ward, as observed in ward K1. It was interesting to note that although these visitors were unable to locate the bathroom, the bathroom door, which was slightly recessed, did have signage indicating that it was a bathroom. Another point of confusion occurred at the ambulance entrance door, which read 'EXIT' from inside the ward. Many visitors would try and exit through this door, only to realise that this door was no longer used as an exit.

A problem repeatedly observed in the new wards was the ward bell which visitors needed to ring in order to enter the ward. The bell was situated approximately one metre behind the ward door, which made it difficult for visitors to see as they would have already passed the bell once at the ward door. The ward door could only be opened from the nursing station, resulting in a delay when there were no nurses present at the nursing station. This was observed in ward K6, when the cleaning staff had opened the ward door for a visitor, as all of the nurses were attending to patients. During an evening shift in ward K5, the intercom at the nursing station was faulty, resulting in staff having to open the ward door using the exit button located by the ward door.

Not only did the visitors struggle to enter the ward, but many of them, especially in ward K1, did not know where to open the ward door in order to exit. Once the nurse had pushed the button for them, they would walk right up to the door even though there was a clear red line on the floor indicating that the door opens inwards. This resulted in them having to move back so that the door could open. This related to what Nurse F had mentioned in the interview, stating that even if there are clear indications and signage, the visitors would still need assistance.

The observations further indicated that the visitors were not the only individuals who were confused when it came to way-finding. Observed mostly in ward K1, a few of the patients who entered and left the ward were also not sure of where and how to open the ward door. Upon returning to the ward, one of the patients struggled to locate in which room she had been in and entered the wrong room where another patient was lying. As the rooms are numbered but do not have patient name labels, this occurred more than once. In ward K4 during an evening shift, a similar scenario occurred, as there was confusion between the nursing staff regarding room numbers and patient names.

4.7.3 Safety

The designer mentioned several safety measures which needed to be considered in the design of the hospital. Most of the safety measures he/she mentioned were implemented in the patient rooms. He/she did, however, mention, that the primary safety feature was the “non-slip surfaces, that is a big one” (Designer, 2018) which is why a vinyl floor finish was selected. Although seen as a non-slip surface, one of the nurses had mentioned that “when it is wet it is quite dangerous” (Nurse A, 2018) and therefore needs to be well managed by the cleaning staff.

Another vital safety measure that was implemented was the handrails. Handrails were necessary for the frail or sick who may need to grab or hold onto something, both in the rooms and in the corridors. The handrails were mostly implemented within the patient rooms. In addition to the handrails, lighting is a safety feature. The designer acknowledged that they had not used sensor lighting for this project, but added that “we have got the technology now to use sensors and things like that, and that makes a big difference” (Designer, 2018).

The designer mentioned that another safety aspect that had to be considered was the protection of the facility itself. He/she explained that the ward is not a static environment and that ‘things’ are constantly moving around: “You are moving these beds around, you are moving trolleys” (Designer, 2018). He/she indicated that they had used all sorts of corner and door protectors which “...was put on often afterwards” once they saw how damaged the doors and walls were (Designer, 2018). He/she mentioned that these are things one needs to think of right at the beginning of the design, but that one also hopes people use and protect the facility adequately. He/she reiterated that everything comes at a price and that as the designer, one tries to keep the cost down, “so you do not want to layer everything, you cannot sugar-coat everything...” (Designer, 2018). He/she concluded by saying that:

“...the human factor is something that one has to just deal with you know. That is a big factor” (Designer, 2018).

Table 4.6: Findings related to specific features.

Sub-theme	Designer	Nurse	Implication
Staff amenities	A central tearoom was provided, shared by the older wards. These rooms were essential for off-duty staff before and after their shifts.	Breakaway room considered too small and did not have enough resting places. One of the nurses mentioned that it would have been ideal if there was a tearoom on the bottom floor.	Walking distances increased as the tearoom was located in ward K3, with only small kitchenettes in the other older wards. The new wards each had a breakaway room for the staff.
Way-finding	Important to sit with the client and make sure they understand the levels and different areas. Way-finding was difficult as the hospital had two entrances. Way-finding is best achieved when walking around as someone who is not familiar with the space. Cautioned not to overdo the signage.	Way-finding was considered difficult, mainly because people are ignorant with regard to signage. The two sections of the hospital further contribute to the confusion. Way-finding, in general, is difficult.	Staff time is diverted when giving directions to visitors and patients.
Safety	Main safety feature was the non-slip surface. Handrails were also implemented for the frail or sick. Another safety feature was the protection of the facility itself, where the human factor needs to be considered.	The vinyl floor finish becomes a safety hazard when wet.	Safety features, specifically the protection of the facility, needs to be thought of at the start of the design, and not implemented once things are already damaged.

4.8 Synthesis of findings

It is apparent from the findings that there are discrepancies in a few of the design intentions and how the primary users experience these design intentions. Table 4.7 shows the findings under the main themes of the ambient environment, architectural, interior, social and specific features, which are synthesised through Morville's (2004) User Experience Honeycomb model. This indicates the relationship between the design criteria and user experience, in the field of interior design.

Table 4.7: Synthesis of the findings through Morville's (2004) User Experience Honeycomb model.

Sub-theme	Designer	Nurses	Implication	Synthesis
The ambient environment	<ul style="list-style-type: none"> -Natural light through patient rooms. -Acoustic ceiling tiles were used. Joinery fittings absorb sound. -Patients well sorted in terms of natural ventilation. Artificial ventilation systems implemented in wards. 	<ul style="list-style-type: none"> -Important to see what they are doing. Natural light considered enough. -Noise considered a problem in all wards. Noise sources ranging from equipment to staff and visitors. Noise levels better during the evenings. -Air-conditioning was not circulating well. 	<ul style="list-style-type: none"> -Nurses exposed to sufficient natural light. -The majority of the nurses did not agree with the designer in terms of the acoustics. -The air-conditioning systems caused discomfort. 	-Useful
Architectural features	<ul style="list-style-type: none"> -Single corridor layout (width of nearly 3 meters) Minimise the size of the corridor. -Systems present to minimise walking distances. -The client looked at allocated areas for storage. Important to measure everything. -The nursing station was an 'in-depth piece of joinery work'. Certain requirements. The technology was also considered. 	<ul style="list-style-type: none"> -Corridor congested with furniture and people. Space big enough; everyone needs to be considerate. Lines of sight not affected. -Everything was closer to one another: more accessible. Storage considered a problem by the majority of the nurses. -Functional but not spacious enough. Space for additional stock and storage not taken into consideration. 	<ul style="list-style-type: none"> -Although narrow and crowded, all functions could still take place. -Storage was insufficient in the older and stock needed to be stored elsewhere in the hospital. This affected the walking distances. -Although considered small, nurses do not spend much time in the nursing station and take turns in sitting. 	<ul style="list-style-type: none"> -Useable -Accessible
Interior design features	<ul style="list-style-type: none"> -Carpet and tiles are not functional. Flush surfaces are the best: vinyl floor finish was chosen. -Bright, vibrant colours were avoided, and a pastel colour palette was selected. Bright colour used patient rooms. -One chair provided for the nursing station. A small lounge would be better as nurses spend a lot of time sitting. 	<ul style="list-style-type: none"> -Flooring considered functional as it is easy to clean. Vinyl is acoustically better than wooden flooring. -Bright colours help with healing. -No space for more than one chair and there is no time to sit down. 	<ul style="list-style-type: none"> -Vinyl is slippery when wet: safety risk. -Colour incorporated in the flooring patterns and bump rails. The colour floor patterns did not assist in way-finding. -No space for additional seating. Nurses seldom-seated: moving between patient rooms, storerooms, sluice rooms and nursing stations. 	<ul style="list-style-type: none"> -Useful -Desirable -Usable
Privacy and social interaction	<ul style="list-style-type: none"> -No space for a waiting room. -Patients are well stored with their rooms and nurses with their pause rooms. 	<ul style="list-style-type: none"> -A space providing social interaction and privacy: benefit patients, visitors and staff, as visitors stand in the corridor, making it crowded. 	<ul style="list-style-type: none"> -As a result of the absence of waiting rooms, visitors are taken to the nurse pause area. This affects the privacy of the nursing staff. 	-Valuable

Sub-theme	Designer	Nurses	Implication	Synthesis
Specific features	<ul style="list-style-type: none"> -A central, shared tearoom was provided. Essential for off-duty staff. -Sit with the client, make sure they understand the levels and different areas. Way-finding was difficult: two entrances. Walking around as someone who is not familiar with the space and not to overdo the signage. -Main safety feature: non-slip surface. Handrails also implemented. Protection of facility: considering the human factor. 	<ul style="list-style-type: none"> -Breakaway room: too small and not enough resting places. One of the nurses mentioned that it would have been nice if there was a tearoom on the bottom floor. -Way-finding was considered difficult: people are ignorant towards signage. The two sections of the hospital further contribute to the confusion. -The vinyl floor finish becomes a safety hazard when wet. 	<ul style="list-style-type: none"> -Walking distances increased as the tearoom was located in ward K3. Only small kitchenettes in the other older wards. New wards each had a breakaway room. -Staff time is diverted to giving directions. -Safety features: protecting of the facility, needs to be thought of at the start of the design, and not implemented once things are already damaged. 	<ul style="list-style-type: none"> -Valuable -Findable -Credible

The findings above are synthesised through Morville's (2004) User Experience Honeycomb model, under the headings of useful, desirable, accessible, credible, findable, useable and valuable.

4.8.1 Useful

Findings suggest that in terms of artificial lighting, all the nurses were satisfied with the lighting, and agreed with the designer that the lighting within the ward was adequate. The majority of the nurses agreed that the amount of natural light was sufficient, with only Nurse F commenting that the natural light was not enough, specifically within the ICU. She considered natural light as vital as it assists with healing. In conclusion, the lighting was experienced as useful as the nurses were able to perform their tasks, and all patient rooms were equipped with windows for natural light.

Regarding the acoustic treatment within the ward, only one of the nurses regarded the noise levels as being well maintained. The remaining nurses did not agree with the designer, who felt that there was no need for acoustic treatment and that they had achieved successful acoustics within the wards.

The ventilation within the wards was also considered useful, consisting mainly of artificial air, with minimal natural ventilation entering through the windows. The designer mentioned that no fanlights were present within the 'high end' wards, as they were all equipped with air-conditioning systems. One of the nurses mentioned that the air-conditioner was not circulating well, causing discomfort within the nursing station. This was also experienced in the observations, where some

wards would be extremely cold, while others felt warm and gloomy. For health reasons, it is essential to keep the temperature regulated within the wards.

Another design aspect that was considered useful was the vinyl flooring system. The nurses explained that wooden floors are uneven and contribute to noise, and that carpet is not well suited for a hospital. All the nurses agreed with the designer with the fact that the vinyl was easy to clean, reducing the risk of bacteria build-up. The only negative comment was raised by one of the nurses who mentioned that the vinyl becomes slippery when wet. The observations did, however, not indicate any safety risks, despite the floors being cleaned throughout the day.

4.8.2 Desirable

The colour palette used within the wards was kept to a minimum and was mainly introduced in the flooring, walls and the bump rails. One of the nurses explained that grey colours were avoided as they are 'sad', and mentioned that the brighter colours, introduced in the patient rooms, assist with healing. The designer mentioned that bright colours were generally avoided, but that some vibrancy was brought in with an orange colour, but only within the patient rooms. The colour palette was also introduced in the flooring, and contributed to the visual aesthetics of the ward, especially when patterns were used. Due to budget constraints and another project architect being involved, the floor patterns were, however, kept minimal. Although the colour palette and use thereof was minimal, it still contributed to the visual aesthetics of the hospital.

4.8.3 Accessible

The proximity of specific spaces and the walking distances associated with that affected the spatial accessibility of the ward. Within the older wards, the nurses felt that certain service rooms could be located nearer to the nursing station, which would result in decreased walking distances. The sluice rooms within the older wards were located towards the centre of the room, which the nurses identified as being easily accessible, but observations indicating that it was not the most practical location in terms of passers-by. The spatial accessibility in the new wards was different from that of the older wards, as various service rooms; linen and sluice rooms, were located in different areas of the ward. Walking distances increased in the new wards, as sluice rooms were positioned towards the back end of the wards, where it had previously been situated towards the centre of the ward.

In response to the walking distances associated with the spatial accessibility, most of the findings contradict what the designer had said when mentioning that there are a few systems in place that reduce the physical walking of the nurses. Although most of the findings may not correspond, the designer may have referred to other systems which were introduced in the new wards which were not present in the older wards. These include the linen storeroom which was placed behind the nursing station and the larger sluice rooms located outside the ward.

Another factor that affected the spatial accessibility of the ward was the walking distances associated with the centralised nursing station. This directly affected the primary users of the space; nursing staff, who, although satisfied with the placement of the nursing station, commented on the walking distances. The spatial accessibility of storage in relation to the nursing station was also considered a problem by some of the nurses, with the interviews both confirming and contradicting this. Some of the nurses felt that it would have been more convenient had the storerooms been closer to the nursing stations, while others felt it was situated at a convenient place. Not only was the placement of the storage raised by the nurses, but also the size thereof. This was interesting to note as although the client was involved throughout the design process, findings from the interviews and observations indicated that the nurses, as the primary users, did not consider the storage sufficient.

4.8.4 Credible

The main safety features consisted of the handrails, flooring and the protection of the facility itself, of which flooring was considered the primary safety risk, by one of the nurses. The observations did not indicate any safety risks, which may have been as most of the safety features were present in the patient rooms, which was not the focus of this study.

4.8.5 Findable

With way-finding being a challenging task and extremely difficult in hospitals, the designer felt that the signage was clear and legible, which would assist in the way-finding. Although the signage was incorporated using colours and floor patterns, there was still a discrepancy in results as all the nurses complained about the way-finding, stating that it was 'distressing' and 'annoying'. When comparing what the designer had said with what the nurses had mentioned, together with what was observed, it is difficult to justify whether additional signage would improve the way-finding. More research is thus required to understand the importance of signage and way-finding within hospital wards and whether people respond to signage or merely ignore it.

4.8.6 Useable

The corridor configuration affected the usability of the ward, as certain functions were spread throughout the ward. With the single corridor configuration, functions were placed on either side of the passage as the passage is the non-functional part of the ward, and therefore kept to a minimum. There was a discrepancy in results in terms of the corridor width, as what the designer had mentioned, to what was mentioned by the nurses, and what the plans indicated, did not align. Three of the nurses felt that the corridors were too narrow, while others disagreed, with one of the nurses concluding that one adapts to the environment one works in and make use of what one has.

The design of the nursing station and the corridor layout affected the lines of sight of staff, to the patients. The nurses did, however, not find the lines of sight to be interrupted, although observations indicated that the design hindered the lines of sight. The disparity in results from the interviews and observations may be as a result of the different design of the nursing stations in both old and new wards, as the problem was only observed in the older, more confined wards. The design of the nursing stations, therefore, affect the lines of sight, although not considered a problem due to the implementation of technology and monitors.

The usability of the furniture and equipment was evident in the observations, with the nursing staff making constant use of the equipment required, which included the trolleys. The trolleys ranged from linen and food to the general trolleys, utilised throughout the ward by various staff. As a result of some of the smaller nursing stations, the trolleys were utilised when counter space was not available, acting as a writing platform for nurses who needed to do administrative work. Although the equipment was beneficial to the staff, it had an adverse effect on the usability of the ward, as circulation space in the corridor became less as the amount trolleys within the ward increased.

4.8.7 Valuable

The primary users considered a space for social interaction and privacy as valuable, indicating that staff, patients and visitors would benefit from a space providing this. The design did, however, not allow for social and private spaces such as waiting rooms, which affected numerous aspects of the ward; corridor width, noise levels and privacy. Observations indicated that a space providing social interaction and privacy would have been more valuable and beneficial in the older wards, where the rooms were shared between 2-3 patients. In the newer wards, the private rooms allowed

for some privacy and social interaction, when visitors were allowed in the rooms. As the findings indicated, due to hospital policies, visitors were not permitted to remain in the patient room when staff were doing any procedures, in which case waiting rooms in the wards would be valuable.

With the research focusing on the primary users, it was essential to review aspects which were considered valuable to these users. The interviews with the nursing staff indicated that the staff amenities provided for them were insufficient, therefore not considered valuable. This relates to social interaction and privacy, as indicated by one of the nurses, that as a result of the absence of waiting rooms within the new wards, visitors are taken to the staff tearoom, devaluing the few staff areas which were provided.

4.9 Conclusion

The findings were presented under the main themes of the ambient environment, architectural, interior design, social and specific features and the sub-themes associated with each of the themes. The findings were further synthesised through Morville's (2004) User Experience Honeycomb to understand the users experience in response to the design intentions. An adapted framework developed from the findings is shown in Figure 4.12.

Adapted conceptual framework from literature

Morville's (2004) User Experience Honeycomb model

Adapted framework for interior design in healthcare

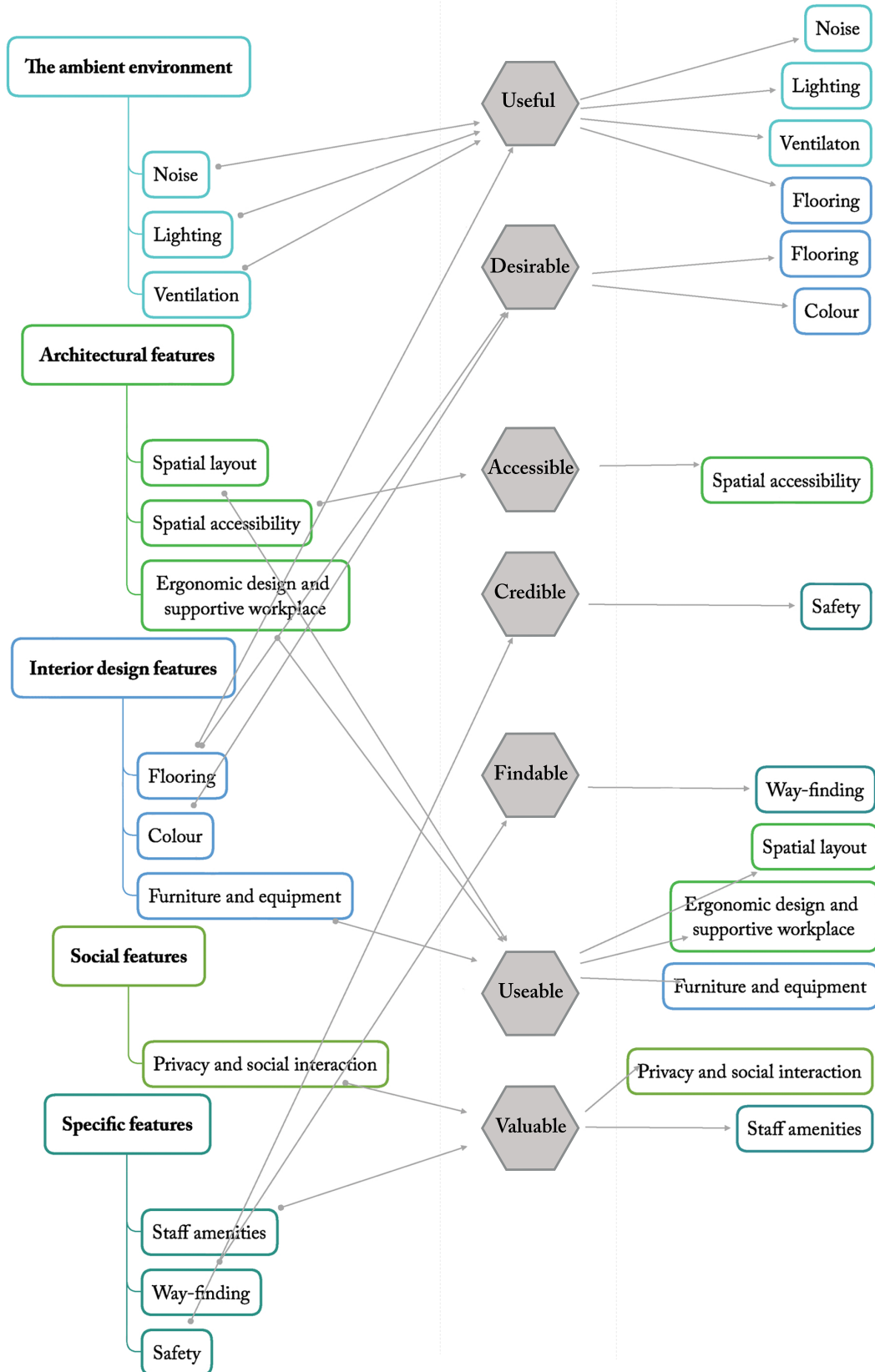


Figure 4.12: Adapted framework for interior design in hospital wards.

CHAPTER 5: DISCUSSION, CONCLUSION & RECOMMENDATIONS

5.1 Introduction

In response to the aim of the study: to explore the intentions of the hospital designer in relation to the primary users' experience, the findings presented in Chapter 4 were synthesised using Morville's (2004) User Experience Honeycomb model. In healthcare design, it is important to understand that "experiences sensed in healthcare settings can have either a detrimental or supportive effect on hospital users" (Lacanna, 2016:1). By considering the users' needs, their experiences can be understood and implemented in the design, which is essential as "people experience space and space, influences them in its turn" (Foque & Lammineur, 1995:47).

Chapter 5 will include a conclusion of the discussion of the findings and triangulation with the literature that was reviewed. The chapter is presented under the main themes of the ambient environment, architectural, interior design, social and specific features. The sub-themes are further structured by order of importance and structured in such a way to respond to the secondary research questions:

1. What were the design intentions of the hospital designer?
2. How do the primary users experience these design intentions?

The findings corresponding to the secondary research questions will answer the main research questions. Thereafter, recommendations for further development and research are proposed.

5.2 Discussion of results

Five emergent themes, each with various sub-themes, are used to discuss the findings in a structured manner. Some of these themes have been revised, modified and expanded as recommended by Saldana (2009:144). The sub-themes are discussed in order of their prevalence in the findings, shown in Table 5.1.

Table 5.1: Layout of the discussion of the findings.

Theme	Sub-theme in order of prevalence	Section
The ambient environment	Noise Lighting Ventilation	5.2.1.1 5.2.1.2 5.2.1.3
Architectural features	Spatial layout Spatial accessibility Ergonomic design and supportive workplace	5.2.2.1 5.2.2.2 5.2.2.3
Interior design features	Furniture and equipment Flooring material Colour	5.2.3.1 5.2.3.2 5.2.3.3
Social features	Privacy and social interaction	5.2.4
Specific features	Staff amenities Way-finding Safety	5.2.5.1 5.2.5.2 5.2.5.3

5.2.1 The ambient environment

5.2.1.1 Noise

Literature indicates that often, the floor, wall and ceiling surfaces are sound-reflecting, which increases the noise levels (Ulrich et al., 2004). In terms of sound-reflecting and sound-absorbing surfaces, the flooring in the older wards, before the renovations, were wooden, which the designer mentioned is usually a sound-absorbing material, reducing the noise levels. The findings from one of the nurses contradict this as the wooden flooring as a hard surface contributed to the noise. One of the other nurses mentioned that the noise levels had improved since the vinyl flooring had been installed during the renovations. This indicates that floor finish surfaces influence the noise levels and needs to be taken into consideration.

Factors that affect nurses are identified by Naccarella et al. (2016), and include patient and family areas and noise. The findings from this study show that these features go hand-in-hand. As a result of the absence of designated patient and family areas, noise levels increased. With the absence of family areas, visitors would position themselves within the corridors during visiting hours, walk around in the corridors and have conversations. As a result of the open wards, the noise generated would travel to the other wards, increasing the noise within the hospital.

Ferri et al. (2015), however, found that noise levels mainly increased during the handover period, as nurses had to share a workplace. This was not the case in this study as the noise levels seemed to be maintained during handover periods, and may be due to the hospital being smaller, with fewer

nurses. The observations indicated that the wards were generally quieter once dinner and tea time had ended. With visitors being absent during the evening shifts, the open ward design did not affect the noise levels and was thus considered well maintained.

Although the noise levels were maintained during the evening, the day shifts proved otherwise, indicating a discrepancy in results. It would have been beneficial to consult expert advice as mentioned by the designer and to measure the noise levels in the final stages. This would improve the acoustics further.

5.2.1.2 Lighting

The designer was able to obtain relevant information about the lighting by consulting with a few of the primary users, based on their experience on the required lighting. As lighting was essential to the nursing staff throughout their shifts, they were well informed about the specific lighting required. Their comments regarding lighting were all positive, indicating that what they had suggested was in-fact implemented and seen as sufficient.

Altimier (2004) found that artificial lighting was associated with visual fatigue and headaches, but this was not mentioned by any of the nursing staff. Although Joseph (2006) states that natural lighting is the preferred light source, findings from this study contradict this, as the nurses considered artificial lighting to be more important. Joseph (2006) does, however, state that although natural light is preferred, artificial lighting is also essential. This was supported by one the nurses who explained that all they need is appropriate lighting for them to see what they are doing.

Although one of the nurses had raised the concern on the placement of the light switches and the confusion this created, the observations indicated that the lighting within the wards was seldom adjusted. This may have been as a result of the nurses not knowing where to adjust the lighting. It was evident from the observations that the lighting within most of the wards was kept on through the day, even though a small amount of natural light infiltrated the ward through the patient rooms. The amount of natural light might have been insufficient for specific tasks, especially when the patient room doors were closed, and may explain why the artificial lighting was seldom adjusted.

With extensive research done on the effects of natural light on patient well-being, the designer considered the amount of natural light to be adequate. One of the nurses further commented on the healing effects of natural lighting which relates to Ulrich's (1984) first pioneering study in which patients with nature views had a faster recovery and required fewer analgesic doses. Although the

nurses agreed with the designer in terms of the natural light being enough, only one of the nurses noted the importance thereof. The other nurses did not seem concerned whether natural light infiltrates the ward or not. This was interesting to note, as Zadeh et al. (2014) found that most of the positive responses from the healthcare staff were related to natural light.

Natural light is associated with circadian rhythms and is responsible for the body's 24-hour internal clock (Joseph, 2006). Bright environments, during the day, are essential for circadian rhythms as the body's day and night time rhythms are synchronised. This is important for both patients and staff. Although the evening shift nurses were not exposed to natural light during their shift, no negative comments or complaints emerged. One of the nurses mentioned that she had been doing evening shifts for the past 20 years, to say that she was used to it. Smith-Coggins et al. (1997), however, point out that for evening shift workers, "their internal and workday rhythms do not match", which has been associated with decreased alertness, and tired and distracted staff, resulting in job errors. This may not be the case with the nurse who had worked evening shifts for several years, as her day and night time rhythm has adapted to her evening shift routine. It may be interesting to compare the alertness and performance between the day shift nurses and the evening shift nurses, within this specific hospital.

5.2.1.3 Ventilation

Findings related to the ventilation were less than the other design criteria and may be as a result of enough natural ventilation entering the ward through the large sliding doors in and windows in the patient rooms. The artificial ventilation, however, seemed to cause an unpleasant environment when not functioning correctly, and although this is not as a result of a design flaw, the nurses still considered this to be a problem. This supports Abbott (n.d) who states that the nursing staff feel 'protected' from airborne diseases when there is artificial ventilation, explaining why the nurses were dissatisfied when the ventilation was not functioning correctly.

5.2.1 Architectural features

5.2.1.1 Spatial layout

The literature identified both advantages and disadvantages of incorporating a centralised nursing station. The observations indicated that by introducing a centralised nursing station, it became a focal point for both visitors and patients, making it easier for effective oversight of the ward (Naccarella et al., 2016). The reason for this is ascribed to the single corridor configuration which

consists of long corridors and the need for the nursing station to be accessible. As Halford and Leonard (2003) suggest, the space and configuration should ideally be informed by the individuals who 'colonise' the space, and this may explain why all interview responses were positive regarding the placement of the nursing stations.

The functionality of the ward was associated with the corridor width in relation to the various activities carried out within the corridors. A discrepancy between the findings was noted, with the designer mentioning that the corridors were nearly three metres wide, and one of the nurses commenting that the corridors were too narrow. The designer may have envisioned and planned on having a wider corridor but was restricted due to the structural footprint.

With the lack of social spaces, the corridors were utilised by the visitors when they were not in the patient rooms. As a result of this, visitors would end up standing in the corridors when a staff member was attending to a patient or when receiving a phone-call, resulting in a crowded corridor. Although this may not have bothered the visitor or patient, the activities of the hospital staff were restricted due to the circulation space being affected, which may "impede efficient work" of the staff (Naccarella et al., 2016). The findings from all the interviews from the old wards indicated that the absence of social spaces was a problem. With the design of the newer wards, the designer did mention that it would have been ideal to have a waiting area to be utilised before visiting hours, but also commented that the visitors generally go directly to the patient rooms upon arrival. This may explain why no provision was made for waiting rooms within the newer wards.

Lines of sight were also associated with the spatial layout of the corridor, as the configuration of the ward affected the lines of sight that the nursing staff had over the patient rooms and the ward. Occupancy lights were used for the patient rooms, indicating occupancy to other staff. This set of lighting, however, confused the nursing staff as these lights were not always utilised correctly and were difficult to see when positioned within the nursing station. This relates to Naccarella et al. (2016), who state that centralised configurations often result in nurses commenting that the lines of sight to patient rooms are interrupted. The confusion created can be associated with the design of the nursing stations, most predominantly in the older wards, as the nursing stations were more confined, which resulted in poorer lines of sight. Naccarella et al. (2016) state that "nurses understand and largely support single bedrooms but worry about the safety of patients when lines of sight are interrupted". With less visibility, nurses were unable to view all the patient rooms within the ward and could, therefore, not see when a nurse enters or vacates a patient's room.

Although the observations indicated that this caused confusion, the interviews proved otherwise as the nursing staff mentioned that the nursing stations were equipped with a monitor which indicated occupancy. The observations further pointed out that when there was uncertainty, the nurse would walk up and down the corridor, either in search of a staff member and in the process, turning off any occupancy lights which had not been switched off. The lines of sight were therefore, not affected by the spatial layout of the corridor.

5.2.1.2 Spatial accessibility

Using a single corridor layout, one of the nurses mentioned that they did not spend much time at the nursing station as they were always walking back and forth between patient rooms and other service rooms, 'hunting and gathering' (Joseph, 2006).

Walking distances were associated with the centralised layout as although the nursing station becomes a clear staff point for visitors, walking distances increased as nurses are required to return to the nursing station each time information is needed (Naccarella et al., 2016). The findings indicated that the nursing staff were satisfied with centrally located nursing stations. Further findings, however, contradict this as although satisfied with the placement, the majority of the nurses complained about the walking distances.

The findings may have differed had a decentralised layout been implemented, which Naccarella et al. (2016) explain is the approach implemented in contemporary hospital designs. By incorporating a decentralised layout, the nursing stations are spread across the ward, allowing nursing staff to be closer to patients, resulting in decreased walking distances. Further research is needed to understand the relationship between nursing station configuration and walking distances; each case requires communication between the designer and user, as the spatial layout of each ward may be case-specific.

The designer mentioned that the passage needs to be large enough for certain functions to occur. These functions included the transport of equipment. The majority of the equipment was transported to and from the storerooms, which are located towards the back end of the old wards and the front end of the new wards. With the storerooms being located towards the ends of the wards in the single corridor configuration, observations indicated that the nurses were required to walk further distances each time when something was needed from the storeroom. This supports Naccarella et al. (2016), who found that storage was one of the main factors affecting the nurses due to the accessibility and location of the storerooms.

Storage is a critical factor to implement in the design as there is always 'stuff' that needs to be stored and within proximity. This supports the view of Naccarella et al. (2016), who state that storage is a vital element for achieving a successful design. With no specific requirements given in terms of storage and as the designer dictated most of the design, the storage was designed by the designer who would communicate the design to the client.

The three types of storerooms included the medicine, general and linen storage. The observations indicated that the medicine stores in the old wards were located within the nursing station for security reasons and ease of access. General storage was incorporated in the design but was, however, not located centrally within the wards. Chaudhury and Mahmood (2007) note that the nurses prefer centrally located storerooms, which are near the nursing stations. This explains why the nursing staff in this study were not satisfied with the decentralised storage rooms, as storage was less readily accessible, increasing walking distances.

The general storerooms consisted of spaces that allowed for the storage of various equipment used in the wards. Hamilton and Shepley (2010) note the importance of having enough storage facilities for the non-emergency equipment. The designer explained that this equipment is usually stored elsewhere in the hospital, making it less accessible to staff. This required the nursing staff to walk further distances in search of equipment from other wards and storerooms. This may explain why the findings from Naccarella et al. (2016) identified storage as a retention factor, as it affects the efficiency and effectiveness of a workplace. Although four of the nurses felt that the storage was insufficient, two nurses from the older wards disagreed.

The linen store in the old wards was found at the back of the ward, and in the new wards, behind the nursing stations. In the older wards, the observations indicated that the storerooms were not only utilised for storing linen but any equipment that the wards needed to store. One of the nurses pointed out that no provision was made at the time, and that an increase in patients would mean a need for an increase in stock and therefore, storage space. This is noted by Hamilton and Shepley (2010) who state that the storage facilities need to be large enough for future additional stock, and needs to be readily accessible. In keeping with the literature, the designer took future additional stock into account in the design of the new wards by allocating two separate spaces, one for linen and the other for general use.

5.2.1.3 Ergonomic design and supportive workplace

With the focus placed on the nursing staff as the primary users, the ergonomics of the nursing station were crucial throughout the design of the wards. The designer reinforced this view stating that the ergonomics of the nursing stations were essential in order to facilitate the work of the primary users. He/she explained the different components that comprise a nursing station, ranging from storage and counter space to the technology. Although incorporating the nurses' opinions into the design, the designer did, however, mention that it became difficult when trying to explain to them how the design would look in terms of size and shape. This may explain why the findings indicate a discrepancy between what was planned for the nursing stations and how the nurses experienced the design.

The designer remarked that the nursing staff are often seated and therefore mentioned the idea of having additional seating in the nursing station. The observations indicated that no provision was made for a chair for those working on the computer in the new wards, which resulted in nurses standing while working on the computer. This may not have been mentioned in the interviews as being a problem as the nurses may have shifted the computer from the desk to another counter. Although this specific counter was not ergonomically designed to stand while being on the computer, it was not considered problematic and may be as a result of the nurses seldom using the computer.

In summary of the nursing stations, it was interesting to note that although the designer mentioned the nursing station was an 'in-depth' joinery item, the nurses raised numerous complaints regarding the size and placement of certain items. This was important to note as a few of the nurses were consulted during the design of the nursing station. This indicates that further research is needed to understand to what extent design approaches addressed in the literature are, in fact, implemented and in which instances they are applicable. The designer may have envisioned larger nursing stations with increased circulation space but may have been restricted in terms of size due to the structural footprint. This supports Naccarella et al. (2016) who state that the design of each ward is defined by its location, infrastructure and other variables, making it unique and therefore there is no standardised solution.

5.2.2 Interior design features

5.2.2.1 Furniture and equipment

The furniture and equipment were the main factors which affected the functionality of the corridors and wards. Findings indicated that in most cases, the corridors were perceived as being too narrow as trolleys or furniture removed from the patient rooms were left in the corridor. As the majority of the observations indicated, the food trolleys were left at a certain point in the corridor while the kitchen staff would serve dinner to the patients. This was done to avoid the constant movement of trolleys within the corridor, specifically during the evening shifts. This was beneficial in terms of the functionality on the one hand, as the trolley was parked at a specific location for a while, but on the other hand, meant that staff had to constantly veer out of the way of the trolley. This also meant that the kitchen staff had to continuously walk up and down between the food trolley and the patient rooms, contributing to increased walking distances.

Although minimal furniture was provided for the staff, most of the nurses felt that the furniture provided was sufficient as they had reiterated that there was no space for additional seating within the nursing station. It was evident from the findings that the nurses were regularly attending to patients, with limited time available to sit at the nursing station. Although the designer may have envisioned a 'little lounge' within the nursing station, space was restricted. This was due to the medication trolley placed within the nursing station, and the counter space being limited. With this, the trolleys within the wards increased, affecting the circulation and overall functionality.

In addition to the designer mentioning that the protection of the facility was mainly a safety feature, He/she admitted that the furniture and equipment, such as trolleys, caused damage to the facility. This was noted by Malone and Dellinger (2011) who state that "furniture with hard protuberances may damage walls". This could have been prevented by using corner and door protectors throughout the wards as part of the initial design.

5.2.2.2 Flooring material

Nanda et al. (2012) point out that in terms of the flooring material, softer floor finishes have been associated with reduced staff fatigue. This may include carpeting, which the designer identified as not suitable for a healthcare environment. Findings related to staff fatigue as a result of the type of flooring did not emerge from the interviews. This could be as a result of the vinyl flooring considered functional by the nurses as it was relatively soft and also easy to clean.

In hospitals, tiles are seldom used, as according to the designer tiles are generally uneven and not ideal for trolleys and other equipment that needs to be wheeled around the hospital. This was evident in the observations, as trolleys and beds were regularly being wheeled in and out of the wards. One of the nurses mentioned that the flooring used to be wooden and explained that this contributed to the noise levels. With the noise levels already being a problem in the wards, it made sense to introduce a floor finish that had better acoustic properties. The designer selected a vinyl floor finish as it was acoustically better than tiles and easy to clean, lowering the risk of bacteria and health matters. Similar findings were reported by Harris (2000), who found that nurses preferred a vinyl floor finish as it is easier to clean in comparison to carpeting.

In terms of the vinyl flooring being functional, all the interviews corresponded with that of the designer. These findings are consistent with Nanda et al. (2012), who mention that as flooring occupies every square metre of a healthcare facility, it is vital to consider the functionality thereof.

5.2.2.3 Colour

The designer mentioned that bright colours are often avoided, and therefore, with the help of the nurses, incorporated shades of green and blue. As a result of colour psychology and the effect that colour has on individuals, bright colours may be overstimulating to both patients and staff. Although bright colours are seldom used, the designer mentioned that an orange shade was incorporated on the bump rails within the patient rooms, which he/she explained brought some vibrancy. From one of the interviews, the nurse showed appreciation to the application of the vibrant colours and felt that colour assists with healing.

5.2.3 Social features

With the new wards consisting of only private rooms, the patient rooms were considerably larger than those of the older wards, which meant that the rooms were able to accommodate more visitors. As a result of this, social spaces may not have been considered essential as observations carried out in the new wards indicated that visitors were mostly in the patient rooms during visiting hours. When the visitors were, however, required to leave the rooms, they would wait outside the patient room, contributing to the noise levels and affecting the circulation space within the corridors. One of the nurses explained that there had been instances where they, the nurses, had to accommodate visitors in their staff resting rooms, as there were no other spaces within the wards where the visitors could wait. Although this may be better for the staff in terms of noise levels and congested corridors, it affected the privacy of the nursing staff, as their assigned pause area became a multi-purpose space

for everyone to use. This relates to Ulrich et al. (2004) who state that there is a need for additional studies that “examine privacy and confidentiality breaches associated with the physical environment...in spaces such as waiting rooms and nurses’ stations”.

In the older wards, where rooms were shared between two to three patients, a different scenario occurred. As the design of the room did not accommodate all the visitors for each patient, visitors would stand outside in the corridor. These findings are important to consider in relation to Karlin and Zeiss (2006) who state the importance of including spaces in the design, where patients and families can interact, especially when patients share a room. In this ward, the nursing staff provided the visitors with refreshments, making the situation even worse due to the absence of social spaces in which the visitors could have the refreshments. This resulted in visitors standing in the corridor, which in both old and new wards, contributed to the noise levels and minimised circulation space within the ward. This became problematic as patients were frequently being wheeled in and out of their rooms, and as the trolleys were standing in the ward, nursing staff and porters had to make way for the beds to pass. Work performance and efficiency of the nursing staff is therefore affected (Naccarella et al., 2016).

5.2.4 Specific features

5.2.4.1 Staff amenities

The findings from the interviews indicated a discrepancy between the design of the staff amenities and how the primary users felt regarding the provision made for these amenities. Two of the nurses felt that the allocated spaces were firstly not spacious enough and secondly not located within all the wards, resulting in increased walking distances between the various wards. This may explain why Chaudhury and Mahmood (2007) suggest that staff break rooms need to be located near the nursing station. This also addresses the ‘little lounge’ recommended by the designer, as when the staff areas are located near the nursing stations, no additional seating will be required within the stations.

Commenting on the suggestion made by Chaudhury and Mahmood (2007), the designer took into consideration the need for a tearoom, per ward, within the newer wards. The new wards each had a staff room with a kitchenette, to compensate for only the one large staffroom located in the centre of the older wards. Although this was still not considered sufficient by the nursing staff, the observations indicated that the nurses seldom utilised this space during their shifts.

5.2.4.2 Way-finding

From the interview with the designer, it became clear that way-finding was a challenging task and required a unique set of skills. He/she further mentioned the importance of way-finding and explained that it is how people read buildings, and is often the first source of stress experienced by visitors and patients (Shumaker & Reizenstein, 1982). In order to avoid stress and confusion, the signage was kept as legible and straightforward as possible. Findings, however, indicated that there was still confusion amongst visitors and occasionally patients. This may be as a result of the designer having thought the way-finding was clear from his point of view, as someone with an understanding of the hospital and the design. The way-finding may have been clearer to understand had the designer asked the opinion of an individual who was not familiar with the design of the space.

The nurses explained the way-finding as 'distressing' and 'annoying' as a result of individuals being ignorant when it came to signage, and how it was incorporated in the design, through the use of colour and floor patterns. These findings support Shumaker and Reizenstein (1982), who note that colour and floor patterns may not be the most effective way by which to incorporate signage, as it often not noticed by visitors and patients. From the observations, it was clear that not only did way-finding displease the visitors, but also the nursing staff, who were always asked to give directions. This affected their workflow and job performance as staff time was diverted (Ulrich et al., 2010).

Although four of the nurses complained about the way-finding, Nurse F pointed out that way-finding, in general, is difficult, and may, therefore, explain why the nurses complained. The difficulty with way-finding may not have been only design related.

5.2.4.3 Safety

In terms of safety within the wards, it appeared that most of the safety measures were incorporated into the design of the patient rooms. The safety features outside of the patient rooms consisted mainly of the hand and bump rails, lighting and floor finish. Noise levels were also considered a safety feature, as identified by Joseph (2006). The features all form part of the latent conditions classified by Reason (1990), which are related to decisions made by architects and designers.

One of the main safety features incorporated in the wards, which related more to the primary users, were the non-slip surfaces such as the vinyl flooring, with which the nurses were satisfied, as it was hygienic and more functional in comparison to other floor finishes. This supports Saleh (2017), who notes that slip-resistant surfaces decrease the safety risk. Although functional, it was noted

during the observations that the vinyl floors which were cleaned throughout the day became slippery when wet, posing a safety threat to staff, patients and visitors.

5.3 Reflection

This chapter concludes with a methodological, substantive and scientific reflection. Included in the conclusion are the advantages of the research methods, the contribution to the body of knowledge and recommendations for further development and research.

5.3.1 Methodological reflection

The research for this study was conducted using observations and interviews which were informed by the design approaches identified in the literature, namely evidence-based, human-centred, spatial, usability and experience-based design. The interviews were used for both sample groups consisting of the designer and the primary users of the case study. The observations were carried out with nurses as the primary users. By doing the observations before the interviews, a detailed understanding of the nurses working environment was obtained in terms of the design layout and how the nurses utilised the space. The observational findings were compared with the individual interviews, allowing for a more informative and in-depth analysis.

A potential limitation of using interviews for the primary users was that the nurses had very little time, which possibly limited the amount of in-depth data that could be obtained. This was however, mitigated using semi-structured interviews with more focused questions.

In addition to this, most of the nurses were interviewed once their shift had ended, possibly impacting the findings, as fatigue may have affected their alertness and response during the interviews. Other nurses preferred to be interviewed during their shifts, which meant they were restricted in terms of time and that interruptions had to be allowed. This was, however, also beneficial as the data collected gave a clear and straightforward indication of what worked and what did not, with no irrelevant information given.

In terms of validity, similar findings emerged from all the interviews with the nurses, either supporting or contradicting what the designer had mentioned during his interview. The validity increased by using both observations and interviews, as some of the findings from the observations also emerged during the interviews. The themes emerging from the data resonated with the

literature, and the inclusion of quotations throughout data analysis and discussion contributed to the validity.

5.3.2 Substantive reflection

Despite the inclusion of some of the primary users in the design process which took place in meetings held with the designer, certain discrepancies emerged, particularly with regards to the nursing stations. This may have been as a result of the primary users' lack of three-dimensional visualisation skills, which created difficulties in communication in terms of the design throughout the design process.

Although discrepancies emerged, it is essential to incorporate the opinions of the users of the space in the design process. This resonates with Norman's (2013) definition of human-centred design: an approach that aims to ensure that the designs align with the needs and competencies of the users for whom they are intended. Further research is needed in the field of participatory design methods which could be incorporated in the form of virtual reality, health and design literacies and mock-ups, by which to communicate the intent of the design.

Findings which contradicted the literature were related to natural light in the ward, and the effects thereof on staff. Authors mention the importance of natural light, affecting staff in terms of their alertness and performance (Ferri et al., 2015; Joseph, 2006; Smith-Coggins et al., 1997; Zadeh et al., 2014; Pati et al., 2008). Findings, however, suggested that in the nurses' work areas, the natural light did not impact their overall experience and performance. This could be attributed to the geographical location as the literature is from California (Smith-Coggins et al., 1997), Canada (Ferri et al., 2015) and Atlanta (Pati et al., 2008), where climates are colder and where there is less natural light than in the Southern Hemisphere.

5.3.3 Scientific reflection

From the findings presented in Chapter 4 and the discussion that followed, the contribution of the research to the body of knowledge is twofold:

Firstly, the five main themes of the ambient environment, architectural, interior design, social and specific features, together with the various sub-themes, were adjusted and an adapted conceptual framework for interior design was developed (refer to page 92). The framework responds to the first secondary research question: *what were the design intentions of the hospital designer?* The list of design

features influenced the experiences of the primary users within the healthcare environment. This responds to the second secondary question: *how do the primary users experience these design intentions?* The framework can be used for further development, which will be discussed in section 5.4.2.

Secondly, a reflection and synthesis of the findings were done using Morville's (2004) User Experience Honeycomb Model, indicating the relationship between the design criteria and the user experience. From the findings, it became evident that certain design features were experienced differently by the designer and the primary users, in terms of Morville's (2004) User Experience Honeycomb, and the seven aspects, which make up an experience. By understanding which design features were considered useful, desirable, accessible, credible, findable, useable and valuable by the primary users, interior designer and architects can be informed on how to approach interior spaces, specifically healthcare environments.

5.4 Recommendations

The findings of this research demonstrate the need for further studies under the categories of policy and practice, further development and further research as recommended by (Plomp, Van den Akker, Bannan, Kelly & Nieveen, 2010).

5.4.1 Policy and practice

This study presented a set of five themes: ambient environment, architectural, interior design, social and specific features, together with their sub-themes, related to interior design and design features. The study explored how the primary users experienced these design features in relation to the designer's intentions, by which some discrepancies emerged.

The framework generated could inform hospital policy in terms of creating better working environments for the everyday users of healthcare facilities, specifically hospital wards. A number of the retention factors identified in the literature were design related, affecting job satisfaction. The design of the working environment may negatively affect the staff, which in turn will affect the patients.

The framework may further inform the interior design and architectural practice by how the users of the space are incorporated into the design process, focusing on evidence-based, human-centred, spatial, usability and experience-based design.

Participatory design methods could also be incorporated through health and design literacies and the use of mock-ups. The framework can be used as a set of criteria with which to focus on specific design elements that affect the primary user experience in interior design. Although the discrepancies from this study may be case-specific, the framework can be used as a guideline indicating which design factors to focus on when it comes to the primary users of healthcare design, especially hospital wards.

5.4.2 Further development

Although the findings from this study may be case-specific, the adapted framework for interior design in hospital wards can be used for replication studies to examine the same design features in multiple cases, where different or similar discrepancies may or may not emerge.

In addition to this, the recommendations for further development include the development of similar adapted frameworks that may be applied for the other users' groups within a hospital environment.

The final recommendation would be to develop a context-specific toolkit that will enable conversation and engagement between all stakeholders (developers, architects, interior designers, primary-users and end-users) of the space.

5.4.3 Further research

Further research in this field includes the replication of this study for the various other user groups within healthcare environments.

From the discrepancies that emerged from the findings, further research is needed:

- In the field of participatory design, where participatory design methods could be incorporated in the form of virtual reality, health and design literacies and mock-ups, through which to communicate the intent of the design, specifically in specialist areas such as the nursing stations;
- To understand participatory design in terms of the time needed for such a design method and the effect thereof on financial viability and turnover rate and

- To understand the effects that geographical location has on the design of healthcare facilities, and how climate needs to be taken into consideration when designing environments where the climate may affect healing.

5.5 Concluding remarks

This study aimed to explore the nurses as the primary users of the wards and fore fronted their daily experiences. It is apparent that hospital environments cater for several groups of individuals, all with different needs. The findings of this research resonate with literature regarding the direct and indirect impact that interior design can have on user experience in hospital wards. Through the process of conducting a literature review, certain design criteria were identified. The use of a combination of research and design research methods, such as the importance of observations in obtaining first-hand experience, will inform my own practice going forwards.

In doing this research, I learnt the importance of communication in the design process, and that various visual and verbal skills are needed in order to include end/primary users in participatory design methods. The role of the interior designer as researcher and facilitator is crucial and the spaces we design should not only delight the user but must be functional in all aspects.

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APPENDICES

APPENDIX A: CONSENT IN PRINCIPLE

ROMAN CATHOLIC HOSPITAL WINHOUER
NURSING SERVICE MANAGER
 P.O. BOX 157, TEL: 276215, FAX: 2762134
 E-MAIL: bs@rcna.org

I Bernadette Shwaga in my capacity as Nursing Service Manager at Roman Catholic Hospital give consent in principle to allow Anienke Buys, a student at the Cape Peninsula University of Technology, to collect data in this company as part of her M Tech research. The student has explained to me the nature of her research and the nature of the data to be collected.

This consent in no way commits any individual staff member to participate in the research, and it is expected that the student will get explicit consent from any participants. I reserve the right to withdraw this permission at some future time.

In addition, the company's name may or may not be used as indicated below. (Tick as appropriate.)

	Thesis	Conference paper	Journal article	Research poster
Yes				
No				

B Shwaga
 Bernadette Shwaga
 Nursing Service Manager

09.05.2018
 09.05.2018

Roman Catholic Hospital
 Nursing Service Manager
 Tel: 021 276215 Fax: 021 2762134
 Box 157 Winhouver, 7800

APPENDIX B: RESEARCH PERMIT

FORM RST/4



NATIONAL COMMISSION ON RESEARCH, SCIENCE AND TECHNOLOGY

RESEARCH, SCIENCE AND TECHNOLOGY ACT, 2004


RESEARCH PERMIT
FOR
NON-NAMIBIAN-BASED RESEARCH
INSTITUTE/PERSON

(Section 21 and Regulation 22)

Permit Number

RPIV00352018

Name of Non-Namibian-based Research Institute/Person: Anienke Buys		Physical Address: P.O.BOX 80241, Olympia, Windhoek, Namibia	
Issue Date: 19 October 2018		Commence Date: 19 October 2018	
Termination Date: 30 September 2019		Sample Taking Authorised:	
		YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>
Type of Research Authorised The intentions of the hospital designer versus the primary users experience in a private hospital. Non Commercial research and the use of the resources be limited to what is specified in the research proposal.			
Type and Size of Sample Taking Authorised N/A			
Locations Authorised for Research and/or Sample Taking Khomas Region			
Intended Use of Samples N/A			
Responsible Person: Anienke Buys		Contact No: +27 76 180 5039	


Signed on behalf of the National
Commission on Research, Science &
Technology



APPENDIX C: INDIVIDUAL CONSENT

	In thesis	In research publications	Both	Neither
My image may be used:				✓
My name may be used:				✓
My exact words may be used:			✓	
Any other (stipulate):				✓

Acceptance: I, (print name) _____

agree to participate in the above research study conducted by Anienke Buys of the Faculty of Informatics and Design, Interior Design at the Cape Peninsula University of Technology, which research is under the supervision of Monica Di Ruvo.

If I have any questions about the study, I may contact the researcher or the supervisor. If I have any questions regarding the ethical conduct of this study, I may contact the secretary of the Faculty Research Ethics Committee at 021 469 1012, or email naidoo@cput.ac.za.

Participant's signature: _____

Date: 23.07.2018

Researcher's signature: _____

Date: 23.07.18

	In thesis	In research publications	Both	Neither
My image may be used:			yes	
My name may be used:			yes	
My exact words may be used:			yes	
Any other (stipulate):			yes - all good	

Acceptance: I, (print name) _____

agree to participate in the above research study conducted by Anienke Buys of the Faculty of Informatics and Design, Interior Design at the Cape Peninsula University of Technology, which research is under the supervision of Monica Di Ruvo.

If I have any questions about the study, I may contact the researcher or the supervisor. If I have any questions regarding the ethical conduct of this study, I may contact the secretary of the Faculty Research Ethics Committee at 021 469 1012, or email naidoove@cput.ac.za.

Participant's signature: _____ Date: 25/7/2018

Researcher's signature: _____ Date: 25.07.18

	In thesis	In research publications	Both	Neither
My image may be used:				
My name may be used:				
My exact words may be used:				
Any other (stipulate):				

Acceptance: I, (print name) _____

agree to participate in the above research study conducted by Anienke Buys of the Faculty of Informatics and Design, Interior Design at the Cape Peninsula University of Technology, which research is under the supervision of Monica Di Ruvo.

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Participant's signature: _____ Date: 23/7/18

Researcher's signature: Buys Date: 23-7-18

	In thesis	In research publications	Both	Neither
My image may be used:				✓
My name may be used:				✓
My exact words may be used:	✓			
Any other (stipulate):				

Acceptance: I, (print name) _____

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Participant's signature: _____

Date: _____

30/7/18

Researcher's signature: _____

Date: _____

30.7.18

	In thesis	In research publications	Both	Neither
My image may be used:				X
My name may be used:				X
My exact words may be used:			X.	
Any other (stipulate):				X.

Acceptance: I, (print name) _____^{ph.}

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Participant's signature: _____

Date: _____

Researcher's signature: _____

Date: _____

	In thesis	In research publications	Both	Neither
My image may be used:				X
My name may be used:				X
My exact words may be used:	X			
Any other (stipulate):				

Acceptance: I, (print name) _____

agree to participate in the above research study conducted by Anienke Buys of the Faculty of Informatics and Design, Interior Design at the Cape Peninsula University of Technology, which research is under the supervision of Monica Di Ruvo.

If I have any questions about the study, I may contact the researcher or the supervisor. If I have any questions regarding the ethical conduct of this study, I may contact the secretary of the Faculty Research Ethics Committee at 021 469 1012, or email naidoo@cput.ac.za.

Participant's signature: _____

Date: 30/7/2018

Researcher's signature: _____

Date: 30.7.18

	In thesis	In research publications	Both	Neither
My image may be used:				X
My name may be used:				X
My exact words may be used:	X	X		
Any other (stipulate):	<hr/>			

Acceptance: I, (print name) _____

agree to participate in the above research study conducted by Anienke Buys of the Faculty of Informatics and Design, Interior Design at the Cape Peninsula University of Technology, which research is under the supervision of Monica Di Ruvo.

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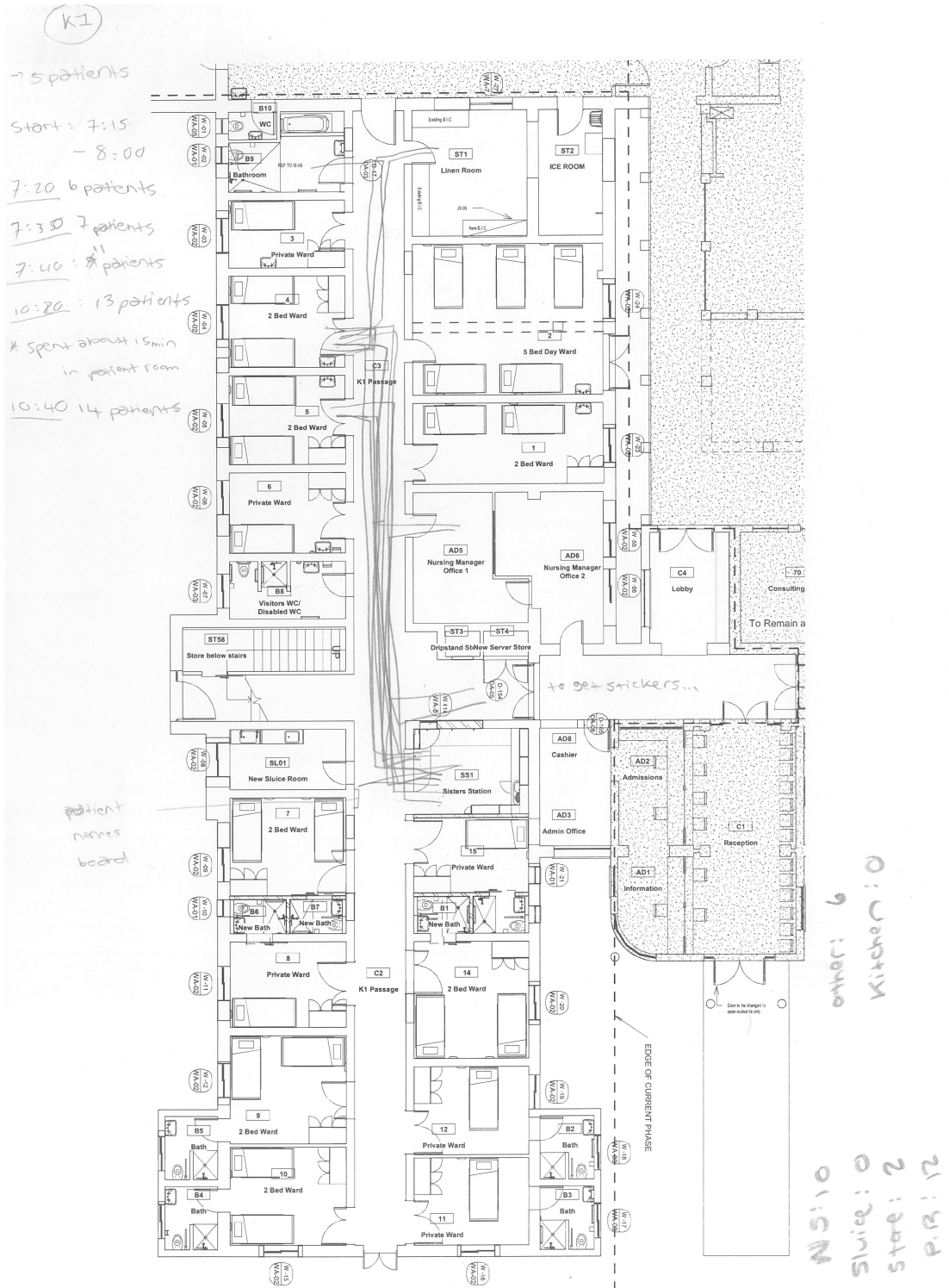
Participant's signature: _____

Date: _____

Researcher's signature: _____

Date: 31.07.2018

APPENDIX D: BEHAVIOURAL MAPPING



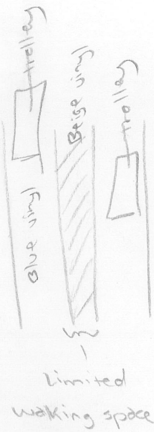
K4 - 5 nurses on duty

START 7:30 - 8:00

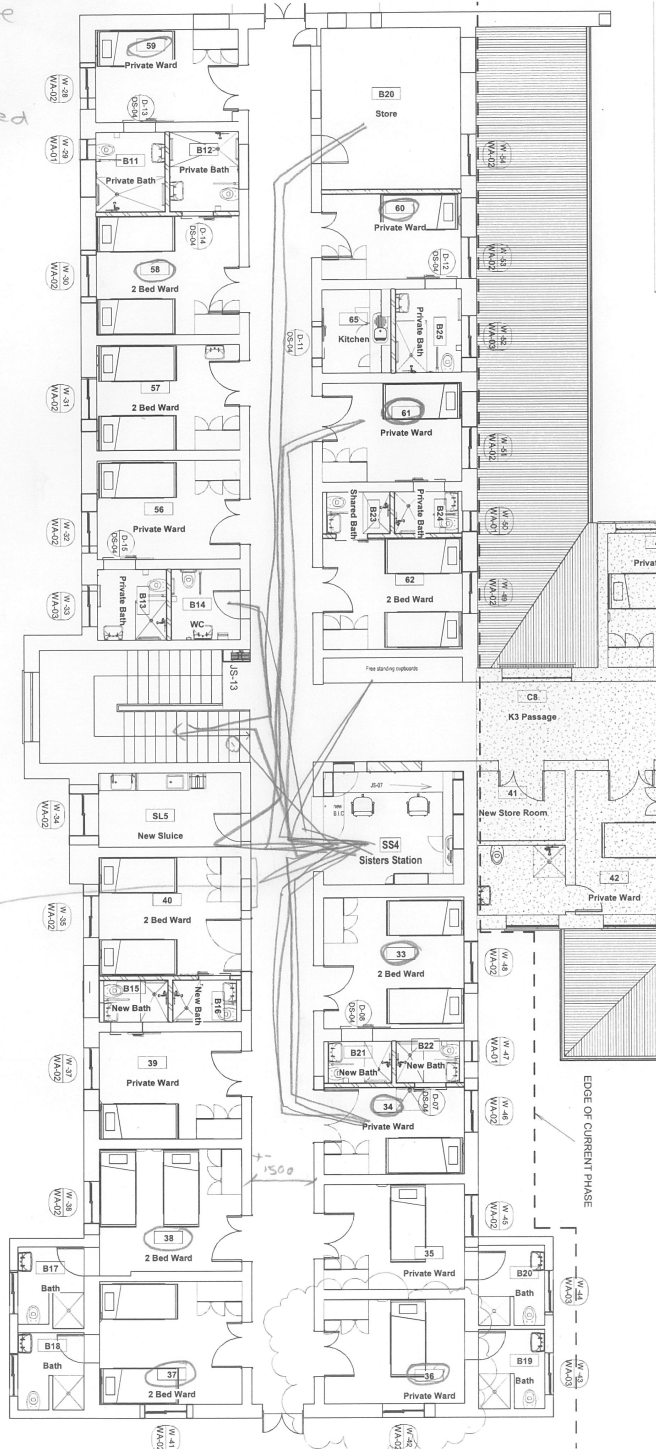
"Monday mornings are always slow"

22 beds, 10 occupied

Journey mapping took long



Board with patient names



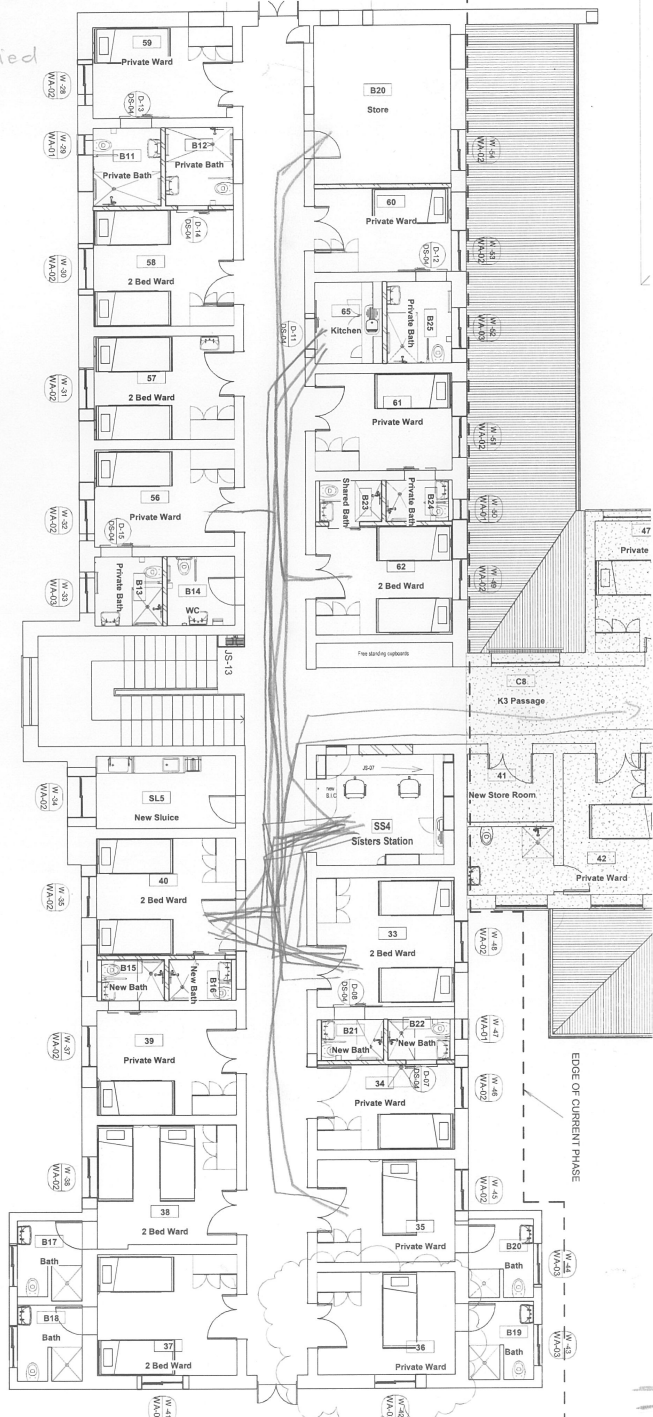
other: 5
kitchen: 0

NS: 12
sluice: 2
stor: 2
P.A.: 6

K4 = 3 ⁴ nurses on duty

Start 19h30 - 20:10

22 beds, 14 occupied



to theatre
back with patient from theatre

NS: 11
Sluice: 0
Store: 2
P.R.: 20
Other: 1
Kitchen: 3

NS: 12
 Sluice: 2
 Store: 0
 P.R.: 12

Others: 2
 Kitchen: 0 + Linen: 1

Label room
 to according
 numbers X
 (on
 floor)

Start: 8:00
 00:11 - 00:19
 00:19 - 00:19
 00:19 - 00:19



Handwritten notes on the left side of the plan:

- ① Store by the end
- ② Sluice
- ③ Room 10
- ④ NS
- ⑤ Kitchen
- ⑥ Room 10
- ⑦ Sluice
- ⑧ Room 10
- ⑨ Room 10
- ⑩ Room 10
- ⑪ Room 10
- ⑫ Room 10
- ⑬ Room 10
- ⑭ Room 10
- ⑮ Room 10
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- ㊹ Room 10
- ㊺ Room 10

1 W1 & W2 Floor Finish Layout
 Scale: 1:75

Handwritten notes at the bottom left:

- ① NS
- ② Sluice
- ③ Room 10
- ④ Room 10
- ⑤ Room 10
- ⑥ Room 10
- ⑦ Room 10
- ⑧ Room 10
- ⑨ Room 10
- ⑩ Room 10
- ⑪ Room 10
- ⑫ Room 10
- ⑬ Room 10
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- ㊹ Room 10
- ㊺ Room 10

APPENDIX D: JOURNEY MAPS - AEIOU

3 nurses on duty

JOURNEY MAPPING - AEIOU

PARTICIPANT LOCATION: K1

all furniture out of room when cleaning rooms

OBSERVATION NO. 4

SHIFT: 7:00-19:00 (7:00-11:30)

	8:00	8:30	9:00	10:00	10:30	11:00	
ACTIVITY	<p># Patients may not fetch patient by themselves, have to report to nurse first</p> <p># main phone came in: no hot water on L side of ward</p> <ul style="list-style-type: none"> - nurse standing at nurse station - nurse to patient room - linen & theatre clothes taken back to NS (from linen room) - patient & visitor leaving ward to go see doctor (asked to look room) - nurse standing at nurse station 	<ul style="list-style-type: none"> - delivery from EXIT door (Noisy) - BP machine to patient room - nurse writing @ NS - patient wheeled to theatre (nurse goes along) - cleaning - scale to patient room furniture - cleaner to manager office in passage - patient wheeled to theatre (nurse goes along) 	<ul style="list-style-type: none"> - A - nurse from K1 to fetch documents from manager office - nurse takes theatre clothes to patient - patient wheeled back to room after surgery - patient wheeled to surgery (porter going) - 9:15 nurses all at NS (L standing) - Dirty linen to bundles @ central room - patient back from theatre 	<ul style="list-style-type: none"> - # People come & use the bathroom here - nurses standing at nurse station - nurse from K1 to manager office - Dirty linen being fetched - patient back from theatre - nurse to patient room (BP) (1) - other nurse writing @ NS counter (1) - nurse to linen room & then to (2) patient room - 10:20 nurses all @ NS 	<ul style="list-style-type: none"> - patient from casualty - patient wheeled out to theatre admit patient - nurse @ checking emergency trolley - nurses @ NS standing - porter to manager office 		
ENVIRONMENT	<ul style="list-style-type: none"> - fluorescent lights back on - downlights off - aircon on (cold) - doors slam closed - noise from K1 ward upstairs (stairs occulate this) 	<ul style="list-style-type: none"> - some natural sunlight from window @ staircase - noise from BP machine - noise from cutlery - phone from manager office 	<ul style="list-style-type: none"> - E - decrease of passage clean (no waiting) - ward abit quieter now that less admissions are happening - talks on stairs occulate noise - weird smell - noise from phone - hear people talking clearly 	<ul style="list-style-type: none"> - temperature regulated - chatter from visitors in passage - ward quiet again - ward getting slightly colder 	<ul style="list-style-type: none"> - quieter - Lighting still the same - phone ringing 		
INTERACTION	<ul style="list-style-type: none"> - visitor on phone in passage - food done when back to trolley - nurse checking BP machine - tea trolley wheeled next to food trolley - visitor leaving manager office - rubbish trolley wheeled away from entrance - food trolley out of ward - clean trolley in passage - rubbish trolley standing @ entrance - wheelchair rolled out 	<ul style="list-style-type: none"> - scale machine wheeled from A to NS (by porter) - cleaning staff knock on manager's door - patient wheeled out of room - drip empty to sluice room - has to squeeze patient bed past all the things in passage (clean) 	<ul style="list-style-type: none"> - J - cleaner cleaning ward door - construction work start to start - What patient to room - linen from linen room to patient - 2 cleaning staff - nurse close patient door after leaving - 2 beds wheeled in - NO SPACE - 2 beds in passage - visitor brought flowers - BP machine to P room (2) - BP machine to NS & nurse writes in file (1) - dirty tray placed on table by entrance - visitors getting tea - all furniture back in rooms 	<ul style="list-style-type: none"> - cleaner bed wheeled into room - rubbish bags to sluice room - medicine brought from pharmacy 	<ul style="list-style-type: none"> - reception gets water from WI (for kettle) - food taken from K1 to K4 		
OBJECT	<ul style="list-style-type: none"> - nurse light in P.R. left on - food tray from K4 brought to K1 - chairs & bedside table into passage (for cleaning room) 	<ul style="list-style-type: none"> - nurse light in P.R. left on - food tray from K4 brought to K1 - chairs & bedside table into passage (for cleaning room) 	<ul style="list-style-type: none"> - nurse light in P.R. left on - food tray from K4 brought to K1 - chairs & bedside table into passage (for cleaning room) 	<ul style="list-style-type: none"> - passage clean only dirty - pillow brought in from other side 	<ul style="list-style-type: none"> - theatre bed - bed scraping against vinyl wall - trolley with no objects still standing in passage - trolley only moved now 		
USER	<ul style="list-style-type: none"> - patients being admitted - patients don't know when to open door (new admission) - worker to nurse manager office - patient visitor waking in corridor looking for bathroom - cleaner to patient room 	<ul style="list-style-type: none"> - doctor used stairs & walked through WI - porter enter ward - staff up stairs to K4 to deliver stickers - patient went into ward room 	<ul style="list-style-type: none"> - U - patient doesn't know which room she is in - visitor walking past & up stairs - visitor patient back from doctor - K1 staff coming past K1 - cleaning company's boss is talking in passage - # Room was locked but cleaners unlocked it to clean - cleaners need medicine trolley to passage 	<ul style="list-style-type: none"> - visitors standing in passage & being called back talking - paramedics - visitors arriving - # users don't know what door is for - # visitors don't even know where the bathroom are - # staff to have a large Social interaction especially with visitor 	<ul style="list-style-type: none"> - porter arrived - visitor of patient arrived - visitor entering (in wrong ward) - doctor to manager office 		

nurse also enquires as to where patient is lying

visitors waiting outside room

porter enter ward

social interaction

visiting hours 10:00 - 11:00

JOURNEY MAPPING - AEIOU

OBSERVATION NO. 2

(A lot quieter than ward 16)

reasoning?
prefer new word?

*no sensor lights in K4

just just fit past each other

	PARTICIPANT LOCATION: K4 (old ward)		SHIFT: 7:00 - 19:00 (7:30 - 11:30)		
	8:30	9:00 (9:30)	10:00	10:30	11:00
ACTIVITY	<ul style="list-style-type: none"> food trolley being wheeled in following doctor - nurse to check patients show to room patient wheeled out of room nurse to patient room to sluice food lady walks from one side of corridor to other side nurse to sluice room & down corridor writing patient names on whiteboard 	<ul style="list-style-type: none"> nurse measures patient BP make BP machine up & down cleaning lady to food sluice room breakfast raised from room to trolley nurse from store to sluice 8:40 4 nurses @ NS nurse downstairs nurse marks linen trolley to sluice 	<ul style="list-style-type: none"> nurse cleaning medication board cleaner sweeping corridor staff to kitchen to get tea 7:20 cleaner mopping floor back & forth from store room 7:25 wheelchair & bed wheeled in corridor food to be fetched from ground floor 	<ul style="list-style-type: none"> 9:50 cleans fetching dirty linen from sluice room 9:50 tea time begins cleaner took bed out framed into passage to clean - nurse back from other nurse sitting @ work station nurse going down to ground floor again cleaner mopping away linen from bed 	<ul style="list-style-type: none"> visitors @ nurse station asking for other classes nurse to tea room / kitchen worker (cleans) standing in passage on phone nurses stand around by NS nurse back from tea time (20min) nurses sitting @ nurse station (only 2)
ENVIRONMENT	<ul style="list-style-type: none"> moderate temperature no natural light (curtain @ 10:00) - noise from trolleys closed in corridor visitors on phone overday lighting - gets noisy when there are patients & nurses bad ventilation (little air) 	<ul style="list-style-type: none"> noise from downstairs baby crying open ward so noise travels sweaty smell down corridor NS noisy but "closed" so noise doesn't travel noise from 2 admin staff sitting between K2 & K4 aircon off @ NS aircon in ward's colder (on) 	<ul style="list-style-type: none"> ward getting uncomfortable chilly ward less cramped with trolleys noise from kitchen noise from cleaning trolley trash bag dumped on floor ward slightly darker due to staircase light off 	<ul style="list-style-type: none"> ward still quite chilly all room doors still closed so no natural light noisy (people/workers screen across passage) noise from food trolley phone ringing fall from gutter above doorway 	<ul style="list-style-type: none"> lightning some since arrival ward still chilly - clear gap in passage: light not phone ringing visitors standing on staircase shouting (noise travels) slamming doors (not as soundproof as other wards) - noise from
INTERACTION	<ul style="list-style-type: none"> nurse follow doctor to p. room nurses @ NS pharmacy trolley out of ward with sanitizer which was empty had to squeeze past other nurse @ nurse station dealing staff to sluice room 	<ul style="list-style-type: none"> coats close very loudly (not like K6) phone ringing patient & nurse wheel patient out of room where to dodge all other trolleys within the ward linen trolley bumps against door (kickplate) - nurse with admin staff phone ringing 	<ul style="list-style-type: none"> nurse sitting @ nurse station, others are standing phone ringing head sister turned off light by stairs patient wheeled out 	<ul style="list-style-type: none"> phones ringing empty bed wheeled back into passage to be cleaned physio @ NS make beds in passage furniture in passage moved back into room patient on crutches squeeze past bed 	<ul style="list-style-type: none"> patient back from surgery wheelchair to patients room patient in wheelchair brought in nurses close patient rooms after loading patient in wheelchair wheeled back to room
OBJECT	<ul style="list-style-type: none"> cleaning staff - drip trolley to sluice all room doors closed does not always use sanitizer linen baskets in corridor trolleys with clean linen food trolley on one side & linen on other side linen trolley to storage 	<ul style="list-style-type: none"> patient room nurse light not always switched off 1 linen trolley on either side Food trolley stays in one place trolleys still standing in corridor by staff scale & height machine in kitchen 	<ul style="list-style-type: none"> Food trolley is out of ward wheelchair from store room nurse light in patient room left on chairs taken out from room when washing floors ECG machine from store room EE machines don't touch bumpers 	<ul style="list-style-type: none"> Trolley for tea time in passage steaming trolley still in passage clean linen on trolley for bed in passage All room patient lights switched off 	<ul style="list-style-type: none"> wheelchair - calling nurse empty trolley standing in passage trolley moved to store room bed moved back into room & bumped door (pushed in @ an angle) cleaning trolley still in passage made to the back
USER	<ul style="list-style-type: none"> doctor & nurse - patient kept squinting patient being admitted visitors early morning nurse discussing food of patient with food person patient lady another patient admitted 	<ul style="list-style-type: none"> patient admin staff 	<ul style="list-style-type: none"> visitors already here intern from overseas (german) following nurse around of hospital medical Aid person 	<ul style="list-style-type: none"> visitor visiting patient patient patient making sound out of room & in corridor physiotherapist X2 visitors one in passage complaining about 	<ul style="list-style-type: none"> visitor arrived patient who wheeled in patient pharmacist visitors arrived visitor on phone outside room cleaning staff done

*LED lights used in ward K3 (light restriction compared to K4)

*not enough space for doctor & 2 nurses @ NS counter
+ can't see room lights from NS

order to get breakfast for new patient

being lost
visitors asked me where the rooms were (bad signage)

*very little movement in comparison to K6

JOURNEY MAPPING - AEIOU

OBSERVATION NO. 3

	PARTICIPANT LOCATION: K4			SHIFT: 19:00 - 7:00 (19:30 - 11:00)		
	20:00	20:30	21:00	22:00	22:30	23:00
ACTIVITY	<ul style="list-style-type: none"> - 3 nurses @ nurse station - nurse wiping trolley (1) - main nurse sitting @ nurse station - worker bring food to p. room - other nurse standing & doing medicine distr. (2) - nurse to patient room (measure BP) 	<ul style="list-style-type: none"> - nurse to patient room (1) - main nurse @ NS - main nurse walk down to theatre - nurse detangling wires from BP machine - medicine trolley to patient room - nurse to NS to get file - food staff takes; nurse food to kitchen 	<ul style="list-style-type: none"> - nurse measure BP & write on trolley in passage - medicine distr. takes long slow - dirty linen to sluice room - lost room for BP - nurse got cloth sheet from trolley & took to patient room - 9:45 still distributing pills 	<ul style="list-style-type: none"> - nurse to patient room - nurses writing notes on trolleys & @ NS - cleaning staff mopping floor (passage) - nurse to p room as patient is bleeding 	<ul style="list-style-type: none"> - nurses taking @ nurse station - nurse to patient room - nurse has to walk to other kitchen to go get bottled water - nurse standing @ NS & writing - other nurse squeezed past 	
ENVIRONMENT	<ul style="list-style-type: none"> - Lighting same as morning shift - Aircon seems to be off, moderate temperature - Lights left on in room - noise from patient room 	<ul style="list-style-type: none"> - lights still on same as previous 	<ul style="list-style-type: none"> - loud music from p. room - lighting still bright as they are still distributing medicine - patient bell noise - sweeter, except for noise from patient room 	<ul style="list-style-type: none"> - patient room bell - lights still on (same as previous) - 10:10 dim lights on, main lights off (only on one side) (fluorescents off & downlights on) - lights @ NS stay on 	<ul style="list-style-type: none"> - adjacent ward lights switched off (downlights on & one big LED in centre) - other half of passage also turned off, only downlights left on - noise from phone ringing - ward quiet as patients go to sleep 	
INTERACTION	<ul style="list-style-type: none"> - nurse to sluice room - one nurse pushed bed & BP machine was in the way - trolleys pushed against bump rails - linen trolley to sluice room 	<ul style="list-style-type: none"> - phone ringing - nurse to sluice room - nurse switch on patient (nurse) light in patient room - anti septic/disinfectant before entering room - patient crutches walking around corridor abit 	<ul style="list-style-type: none"> - nurse entered which way from patient room & take to sluice room - Food to patient room - nurse writes on trolley front @ desk - nurse moves trolleys to get past - Bell from p room - 9:50 All nurses @ nurse station 	<ul style="list-style-type: none"> - nurse reporting to nurse on ward duty - Switched on dim lights 	<ul style="list-style-type: none"> - phone ringing @ NS - disinfect before entering room - medicine trolley back into nurse station 	
OBJECT	<ul style="list-style-type: none"> - linen trolley in passage - All patient doors closed - trolleys parked in front of nurse station (1) - 4 trolleys in passage 	<ul style="list-style-type: none"> - linen trolley still in passage - medicine trolley - stickers trolleyed - food trolley (bed time) 	<ul style="list-style-type: none"> - staff has to dodge all trolleys - trolley full so food to kitchen - "speed" bump in passage - washed dishes from kitchen into food trolley - trolley w/ tray still left in passage 	<ul style="list-style-type: none"> - medicine trolley left @ NS 	<ul style="list-style-type: none"> - dirty linen (from patient who bleed to sluice room - on trolley) - Bell from patient room - 2 trolleys still in passage - pharmacy baskets delivered 	
USER	<ul style="list-style-type: none"> - nurses - visitors arriving 	<ul style="list-style-type: none"> - visitor looking for p. room - 8:45 no nurses @ NS - doctor to patient room with nurse - 8:50 visitor to p. room - visitors leaving - nurse arrived (late for shift) 	<ul style="list-style-type: none"> - u - nurses - cleaning / food staff member - Nurse from another ward (friendly staff) 	<ul style="list-style-type: none"> - 4 nurses @ nurse station - 10:05 all nurses @ nurse station 	<ul style="list-style-type: none"> - nurses interact with nurses - nurse from other ward to this ward's kitchen 	

* Nurses can't hear bell from patient room

just came to help

* quiet cover needed & there are not any in the store room...
 * not enough space on NS carts so they write on trolleys
 (nurses walking to room somewhere in hospital)

JOURNEY MAPPING - AEIOU

OBSERVATION NO. 5

		PARTICIPANT LOCATION: KS			SHIFT: 19:00 - 7:00 (19:30 - 11:30)	
		20:00	20:30	21:00	10:00	10:30 11:00
ACTIVITY	*nurses struggle to see patient room lights	<ul style="list-style-type: none"> - nurse (1) to patient room to get BP - nurse (1) handing out (administering) medicine - cleaner from kitchen to sluice - nurse (2) collecting blood from outside of ward - nurse (1) out of p. room & writing on trolley - phone to p. room 	<ul style="list-style-type: none"> - nurses still measuring BP in patients rooms - nurse administering medication - NI to NS to fetch plaster - NI to NS to upload medication records - nurse (1) to sluice room to empty tray (wash) - nurse sit @ NS 	<ul style="list-style-type: none"> A - still administering medicine - nurse (1) washing hands at basin - nurse (2) @ station filling - Reporting to sister in charge of all wards (N.I. reports) @ NS - nurse to STOP TEST (15 min) - all nurses standing @ NS, only 1 sitting 9:15, done with medication 	<ul style="list-style-type: none"> - pills to restless patient from patient trolley - dirty linen to sluice room - Food trolley collecting tea time cutlery - nurse to patient room - nurse (1) to sluice room - nurse (2) to NS to do reports 	<ul style="list-style-type: none"> - nurse (2) to patient room - nurse from patient room - nurse sitting @ NS - 2 nurses to patient room
ENVIRONMENT		<ul style="list-style-type: none"> - All lighting still on - No visible aircon in passage, only at/in NS - noise from sluice room as door is open - Bulkhead lights above counter are off no fluorescent lights - ward quiet in general 	<ul style="list-style-type: none"> - ward door bell ringing (visitor who's lost) - ward quite quiet 	<ul style="list-style-type: none"> E - lights still same as when I arrived - noise from workers (cleaning staff) 	<ul style="list-style-type: none"> - Temperature regulated - a lot quieter - lights still on - cleaned room lights left on 	<ul style="list-style-type: none"> - Lights still on - noise from cutlery in kitchen - 10:30 all lights still on - 10:55 lights off - 6 downlights on - Lights at nurse station left on
INTERACTION		<ul style="list-style-type: none"> - phone ringing - cleaner bring floor mopping "trolley" to empty room - phone ringing nurse walk back & forth to fetch phone - anti septic (disinfectant) by room door - nurse to "sign" out medication 	<ul style="list-style-type: none"> - food porter fetches list from NS - open ward door by entrance - food porter to kitchen to get cutlery for tea time 	<ul style="list-style-type: none"> I - medicine trolley parked @ NS - dirty cutlery to kitchen - tea trolley to kitchen - cleaning lady still busy in room - clean linen to patient room - Ward door opener @ NS not working 	<ul style="list-style-type: none"> - cleaning staff to fetch linen in linen room (has to walk through NS!) 	<ul style="list-style-type: none"> - nurses at nurse station - one nurse sitting - other nurse leaning on counter
OBJECT	<ul style="list-style-type: none"> * wooden doors & wooden joinery - Bump rolls plastic? * flag signage standing nurse station 	<ul style="list-style-type: none"> - medication trolley in passage - most room doors closed - 4 trolleys in passage 	<ul style="list-style-type: none"> - on phone with doctor - Food trolley arrived - ward door bell - food trolley bumps against wall & not bump roll is in the way 	<ul style="list-style-type: none"> O - bell from patient room - basin @ NS - 9:10 (6) trolleys in passage - mask on when entering p. room no. 109 - clean linen to room - phone ringing 	<ul style="list-style-type: none"> - phone ringing (nurse in bathroom & other 2 in patient room) - scratching of room door - food trolley left in passage - nurse took chair from empty room to be NS (not empty chairs) 	<ul style="list-style-type: none"> - phone ringing - nurse sitting on chair from patient room
USER		<ul style="list-style-type: none"> - Nurses - nurse from other ward come to fetch meds - patient out of room to return phone to NS 	<ul style="list-style-type: none"> - doctor arrives - doctor to p. room & left again 	<ul style="list-style-type: none"> U - nurses - Food porter - Visitors arriving (don't know where bell is) 	<ul style="list-style-type: none"> - visitors leaving 	<ul style="list-style-type: none"> - nurses

JOURNEY MAPPING - AEIOU

OBSERVATION NO. 1

PARTICIPANT LOCATION: K6 (New)

SHIFT: 7:00 - 19:00 (7:30 - 11:30)

* ward 16 of 17 rooms are full

9:30 - 10:30 (10-11) (3-7) (go in groups to get tea) - same as lunch time

± 6 nurses min. 5

	8:30	9:00	10:00	10:30	11:00	11:30
ACTIVITY	<ul style="list-style-type: none"> Phoning from nurse station Patient room, back to nurse station Breakfast tray out of patient room Pill prescription after doctor generally stand @ nurse station spent 10 min in patient room 	<ul style="list-style-type: none"> nurses struggle to see patients unless they come to NS nurses @ NS writing reports (NU stamping) to NS & back to room to sluice room phone calls nurse tidying NS 	<ul style="list-style-type: none"> All nurses at nurse station cleaning passage so all objects in passage get into tea time cleaners still busy cleaning nurse to new admitted patient 10:20 NS empty 	<ul style="list-style-type: none"> Nurse take cutlery to kitchen cleaners still cleaning nurse on phone @ NS patient discharged preparing for 12:00 medicine distribution send prescriptions to pharmacy get meds trolley with life & heart rate machine 	<ul style="list-style-type: none"> nurse sitting @ NS 10:50 5 nurses @ station cleaner from entrance all the way to sluice room sister sitting @ NS porter collecting pharmacy baskets 	<ul style="list-style-type: none"> nurse into room with doctor Bring out BP machine & write in regulate temp. same lighting as morning aircon switched off again more rooms open
ENVIRONMENT	<ul style="list-style-type: none"> All lights still on Quite warm & gloomy Lighting coming through patient rooms (but little natural light in ward itself) Noise from bells & small from patient rooms 	<ul style="list-style-type: none"> Artificial lighting insufficient but not stimulating Bell of ward rang Noise from fluorescent light Noise from patient TV's Bell rang "bulbhead" lights @ high counter @ NS are off on 	<ul style="list-style-type: none"> Aircon switched on @ NS - cold noise from patient coughing most doors closed so little sunlight/natural light noise from ward bell quiet (few nurses @ station) 	<ul style="list-style-type: none"> Noise with nurses & visitors 10:40 4 nurses @ NS moderate temperature noise, noise from patient rooms (TV) phones ringing 	<ul style="list-style-type: none"> regulated temp. same lighting as morning aircon switched off again more rooms open 	<ul style="list-style-type: none"> noise from patient room early nurse walk up corridor to kitchen phone ringing more natural light
INTERACTION	<ul style="list-style-type: none"> with patients with nurses @ nurse station hand sanitizer opening ward door (only possible @ nurse station) with other nurses @ NS: becomes cramped (passage) 	<ul style="list-style-type: none"> nurse to patient room with trolley nurses @ nurse station discussing patients with computer 	<ul style="list-style-type: none"> with other nurses Food trolleys collect breakfast cutlery & give care with patient care 	<ul style="list-style-type: none"> Nurse sitting at station while on phone nurse at trolley busy with files 	<ul style="list-style-type: none"> doctor & nurse meet at NS nurse still at NS sitting portable phone to patient room 	
OBJECT	<ul style="list-style-type: none"> Files Chair Phone hand sanitizer by almost every door linen trolleys standing to be taken away 	<ul style="list-style-type: none"> phone ringing cupboards trolley in the middle of passage cleaners clean rooms & take out furniture & plate in passage medication trolley stay @ NS 	<ul style="list-style-type: none"> Bell from ward door only opens @ NS + room door tea time trolley difficult to close chair @ nursing station not being used cleaners place chairs in bump passage dukkard shelf 	<ul style="list-style-type: none"> phone ringing in room trolleys into passage from kitchen store Fridge @ NS for medicine wooden joinery (obsorb sand) phone ringing trolleys moved against bump rail 	<ul style="list-style-type: none"> phone ringing only BP & trolleys in passage map left in passage Trolley @ NS 	
USER	<ul style="list-style-type: none"> Nurse & doctor only 3 nurses on duty Nurse with doctor Nurse with patient care physio come to ask about any new referrals 	<ul style="list-style-type: none"> nurse with patient All nurses have been standing since they arrived 	<ul style="list-style-type: none"> visitors entering patient wheeled in visitor got lost in ward no nurse @ NS & bell ringing nurses on tea visitors struggle to ring bell some doors open left, others right 	<ul style="list-style-type: none"> path care gully back (reports to NS) doctor came in (nurse followed into room) interaction with visitor doctor came to ward on phone @ NS on other phone 	<ul style="list-style-type: none"> visitors leaving nurses interacting with each other 	

* If nurse goes into room then a green light shines above door

trolleys in way in passage (food & linen) - rather nurse struggled to see patient light @ door!