AN INVESTIGATION OF DAYLIGHTING IN HOSPITAL DESIGN
A CASE OF NAIROBI

EDGER AYIER
B02/0814/2011
Declaration

This thesis is my original work and has not been presented for an award of a degree in any institution to the best of my knowledge. This thesis proposal is submitted in partial fulfillment of the examination requirements for the award of the Bachelor of Architecture degree in the Department of Architecture and Building Science at the University of Nairobi.

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to FAMILY
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Properly daylight spaces can give character to a building or it spaces. Daylight can also create unwanted lighting conditions of discomfort and glare for building users which affects building occupant’s performance and health. Current and future hospital designs need to provide healthier healing environments by improving access to daylight and a connection to nature through provision of view. Most Kenyan hospitals have been designed with a focus on providing service efficient healing environments at the expense of physiological and psychological comfort of patients, staff and visitors.

This study explored daylighting strategies and how their application in hospital design to create a healing environment. The analysis of two case studies put forth five design parameters that guide the design of a naturally lit hospital which are: orientation, building footprint, sun control, courtyards, skylights and clerestories. These parameters were used to evaluate the design of the local case studies. The author then developed design recommendations that would improve daylighting of hospitals in Nairobi.

Case study approach was used to carry out fieldwork due to its flexibility and expansiveness as a research method. Kenyatta National Hospital, Mater Hospital and Mama Lucy Hospital were chosen as case studies for this thesis. Fieldwork findings affirm the statement that the design of modern hospitals prioritizes efficiency of services over patient comfort and healing. The study recommends the sensitization of stakeholders in the built environment on the importance of daylighting and sustainable design in creating healing environment; formulation of legislation on the specifics of daylight required for building types and the upgrading of the three hospitals studied to ensure visual comfort where possible.
CHAPTER ONE
INTRODUCTION
1.1 PREAMBLE

“No space, architecturally, is a space unless it has natural light.” Louis Kahn (Loud & Kahn, 1989, P262).

Daylighting is an architectural strategy used in designing high performance buildings which have a positive impact on its users and the environment as a whole. The use of natural light has traditionally been a desirable feature and evidence of good design in hospitals which have a critical demand for natural light which creates a healing environment for patient recovery. Hospitals properly designed for daylight have created quality indoor environments of visual comfort.

According to Malkin (2008), having access to daylight can influence well-being by promoting healing, relieving patient pain and stress. It also reduces medical errors by hospital staff and is effective as an anti-depressant. Daylight plays a major role in resource conservation, occupant’s level of productivity, health and comfort. Furthermore day lit hospitals have a great capacity for energy savings since their design integrates relevant sustainable strategies in response to local climatic conditions. A hospital is a high performance building that should attract, retain and enhances patient healing process and enhances patient healing and workers well-being.

The sun is the major source of daylight. It radiates electromagnetic waves with a balanced spectrum ranging from ultra-violet (100nm) to infrared radiation(10nm) with a small part of this light visible to the human eye. Daylight is a combination of skylight and sunlight and constantly changes in character throughout the day and over different seasons of the year. This gradual change in color, intensity and direction helps control human behavior in a way that artificial lighting cannot because of its static qualities of color and intensity.

With the advent of global warming present and future architects are challenged to design hospitals that minimize greenhouse gas emissions, energy emissions and energy consumption. One sustainable strategy used to minimize these factors is daylighting of the interior spaces which can be most effective in tropical countries like Kenya thereby enhancing healing whilst reducing global warming.

This study investigates daylighting strategies/techniques in hospital design and how they can be applied to create a healing environment.
1.2: PROBLEM STATEMENT

Daylight and view. These are fundamental variables in the design of hospitals and may at times prove the difference between life and death. The existence of sufficient natural light in indoor spaces is preferred and more important to excessive or insufficient natural light. Sufficient daylighting achieved through architectural design reduces energy consumption and enhances the environmental quality of hospital spaces.

Hospital staff, patients and visitors are impacted negatively when natural light is either excessive or lacking. Most hospitals in Kenya are designed without proper consideration of daylighting principles since they are service oriented. This has resulted in hospitals that are:

- Energy efficient with high operation costs
- Contribute more to global warming through greenhouse gas emissions
- Visually uncomfortable and do not contribute positively to healing as they should

This study intends to establish daylighting strategies in hospital design and investigate the daylighting conditions of local hospitals in Nairobi and how it can be improved on.
1.3: RESEARCH QUESTIONS

The main guiding questions that this research seeks to answer are:

1. What are the daylighting principles and strategies in hospital design?
2. What is the daylight performance of hospitals in Nairobi?
3. How can the daylighting performance of hospitals in Nairobi be enhanced?

1.4: RESEARCH OBJECTIVES

This research thesis aims to:

1. Establish daylighting principles and strategies in hospital design
2. Determine the daylighting performance of hospitals in Nairobi
3. Develop design recommendations that would enhance daylighting of hospitals in Nairobi.
1.5: JUSTIFICATION

The positive effects of daylighting on human health, behavior and performance provides a justification as to why daylight in hospital design should be studied and used as one of the physical aspects in healing environment creation. Studies on daylighting has always focused on schools, offices and commercial buildings despite it having a more profound effect on hospitals more than any other building especially for those who are bedridden. The findings of this study will provide an architectural insight into the design of hospitals that connect patients and staff to environmental conditions of daylight and view.

1.6: SIGNIFICANCE OF STUDY

There is need to pay particular attention to daylight performance of hospitals. The findings of this study will contribute to the benefit of the society considering that hospitals play a key role in a patient’s recovery and the health of hospital professionals. This thesis will propose strategies for designing hospitals in Nairobi that would enhance visual comfort. It will also highlight the importance of daylight in order to draw the attention of architects and policy makers to sustainable design initiatives. For the researcher, this study will be a learning experience into critical areas of hospital design.

1.7: SCOPE AND LIMITATIONS

An immense amount of literature has been written on healthcare buildings over the past century with extensive research carried out on daylight. This study will limit itself to the most contemporary of this research literature and the most relevant knowledge to the study.

Nairobi city has a variety of hospitals that would benefit from the findings of this thesis. In this study, the researcher investigates in depth three main hospitals designed and built during different eras of Nairobi’s history with focus on daylighting due to time constraints.

This does investigate the thermal comfort performance of the hospitals or how the daylighting techniques enhances or inhibits thermal comfort.
AN INVESTIGATION OF DAYLIGHTING IN HOSPITAL DESIGN

1.8: ORGANIZATION OF STUDY

Chapter one introduces the topic of study and gives an overview of the study questions and objectives. Chapter one also provides a preview into daylight: its effects on hospital patients and their environs.

Chapter two analyses existing literature on daylighting, thermal comfort and ward design. Acceptable levels of daylight, thermal comfort are also reviewed. Relevant international case studies of hospital wards are also discussed in this chapter. All information and data collected and analyzed in this chapter form the basis for the study thereby acting as a reference for the researcher during field work.

Chapter three establishes and examines the various methods and equipment of field research for this study. It identifies the case study method as the main research method naming Kenyatta National Hospital, Mama Lucy Kibaki Hospital and Mater Hospital as the local case studies.

Chapter four outlines an in-depth analysis of the case studies. The analyses focuses on existing daylight and thermal comfort in the hospital wards. This chapter also highlights the various factors that affect daylight and thermal comfort in these wards and provides a comparative analysis between the ideal daylight and thermal comfort levels and the existing daylight and thermal comfort levels in these two hospitals.

Chapter five provides a brief summary of the findings derived from chapter four deducing conclusions based on the research findings. The chapter then suggests directions for future design of better day lit hospital in Nairobi.

Fig 1.08: Organization of Study
Source: Author modified on August 11th, 2016
1.9: Definition of Terms

1) Hospital - An institution providing medical and surgical treatment and nursing care for sick or injured people

2) Daylight – The practice of bringing natural light into a building and distributing it in a way that provides more desirable and better quality illumination than artificial sources

3) Glare - Strong and dazzling light

4) Radiation – the emission of energy as electromagnetic waves or as moving subatomic particles, especially high-energy particles that cause ionization

5) View – ability to see something

6) Sustainability - conserving an ecological balance by avoiding depletion of natural resources

7) Energy – Power provided from the utilization of resources, especially to provide light and heat

8) Typology – A classification according to general types

9) Circadian rhythm - any biological process that displays an endogenous, entrainable oscillation of about 24 hours. These 24-hour rhythms are driven by a circadian clock, and they have been widely observed in plants, animals, fungi, and cyanobacteria.