



UNIVERSITY OF NAIROBI

# FAMILY CENTRED APPROACH FOR THE DESIGN OF NEWBORN UNITS

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# **FAMILY CENTRED APPROACH FOR THE DESIGN OF NEWBORN UNITS**

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## Declaration

This thesis is my original work and has not been presented in any other University or Institution for the purpose of awarding a degree to the best of my knowledge. This thesis is submitted in partial fulfilment 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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# Abbreviations

- AAP American Academy of Pediatrics
- dB Decibel
- NICU Neonatal Intensive Care Unit
- NH DU Neonatal High Dependency Unit
- SFR Single Family Room
- dBA Decibel A-weighted
- KMC Kangaroo Mother Care
- CRI Colour Rendering Index
- NRC Noise Reduction Co-efficient

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# Abstract

Ever since the newborn unit has made significant strides to ensure reduction in mortality and morbidity of neonates. However, the spaces has been very anti-social with minimum interactions between the parents- neonates, parents - caregivers. Research has shown that such a setup has very low impact towards reducing pain and recovery on the neonate and stress and anxiety on the parents.

This study seeks to explore family centred design of newborn units, which research has identifies as a good strategy towards reducing the length of stay of the neonates and reducing morbidity and mortality in neonates. The study explores the different design strategies contemporary newborn units employ all over the world with the aim of making the unit more comfortable and habitable.

The investigation uses the case study method to conduct an exploratory study to determine the design parameters and operational principles that affect the design of family centred newborn units.

The study outlines the findings from Aga Khan Hospital, Kenyatta National Hospital and Rainbow Children's Hospital. The hospitals have different kind of configurations, layouts and principles of operation. Rainbow children's hospital focuses on giving family centred care to neonates with single family room layout. Aga Kahn focuses on giving a comfortable environment with average emphasis on family and uses a semi private layout. Kenyatta national hospital focuses on medical aspect having the largest population of neonates in the country and uses the open bay layout.

Fieldwork findings conclude that Kenyatta hospital employs few of the family centred design strategies while aga khan has a significant attempt toward a family centred care for neonates on the other hand Rainbow Children's Hospital is one of the best family centred newborn units in the globe.

Family centred design is a modern trend in providing neonatal care by involving the family and has been proven to provide quality health care to the comfort of the neonate, the staff and the parents. Hospitals in kenya are beginning to embrace the parent as a core participant in the recovery of the neonate. however the spaces are not favourable for all this participants. the design of newborn should take a holistic approach to not only design for the professional care givers and the neonates but also for the family-parents.



## CHAPTER 01: INTRODUCTION

Neonatal mortality rate in 2016 (deaths per 1,000 live births) vs. Country

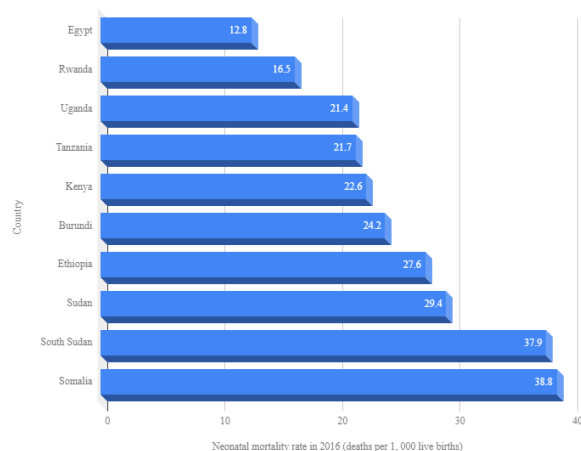


Fig. 1. Info graphic on the effects of noise on neonates

SOURCE | Evidence Based Info-graphics from USF Nursing-nursing-students/shows a neonate with non-magnetic covers to protect it from excess sound

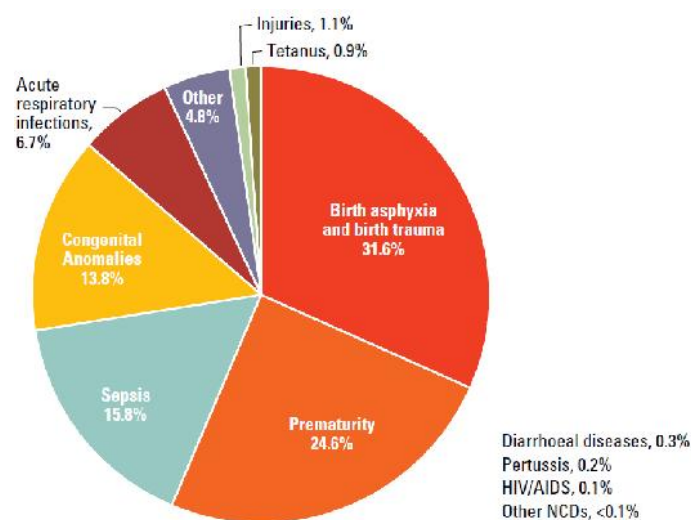


Fig. 2. Causes of neonatal mortality rates in Kenya.

»SOURCE | <https://slideplayer.com/slide/5901947/19/images/14/3.+Causes+of+Child+Mortality+%28Contd%29-+Kenya.jpg>

## 1.1 Background Of The Study

Neonatal care refers to the health of newborns during their first 28 days of life. It focuses on three essential elements; basic preventive care, including clean delivery practices and exclusive breastfeeding, early detection of danger signs and treatment of problems such as sepsis and birth asphyxia. Neonatal mortality is defined by World Health Organisation, “deaths among live births during the first 28 completed days of life, which can be further sub-divided into early neonatal deaths between 0 and 7 completed days of birth and late neonatal deaths after 7 days to 28 completed days of birth.” (WHO, 2014)

Neonatal units are focused specifically on the health of newborns and the “care for medically unstable or critically ill newborns requiring constant nursing, complicated surgical procedures, continual respiratory support, or other intensive interventions” (White, 2007).

As of 2016 the Kenya neonatal mortality was 22.6 per 1,000 live births. (Fig. 1) And 45.6 per 1,000 live births under 5 mortality rate. While the infant mortality rate in Kenya is 39 per 1,000 live births. (Fig. 5) This has been a slow progression in improving mortality on the neonatal and infant mortality rate. (UNFPA, 2016)

Factors contributing to high neonatal mortality and morbidity rates in Kenya, amongst those highlighted (Fig. 2) include; preterm complications, birth asphyxia and birth trauma, congenital anomalies and sepsis having the highest contributions to neonatal mortalities. (WHO, 2016). until 2014, Preterm birth was considered the most common cause of neonatal mortality worldwide. (Raina & Mehta, 2013) The main causes of neonatal mortality and under-five child mortality (Fig. 3) are contributed by pre-term related births and complications globally.

According to lancet 2014 report, Global reports indicate that the highest risk of neonatal death is in Sub-Saharan Africa, with Kenya among the 10 countries contributing most deaths. With high coverage of basic interventions, up to 71% of neonatal deaths could be averted with greater than 82% of this effect attributable to facility-based care. (Lancet Glob Health. 2014).

The world health organization recommends that babies should receive thermal protection by promoting skin-to-skin contact between mother and infant, hygienic umbilical cord and skin



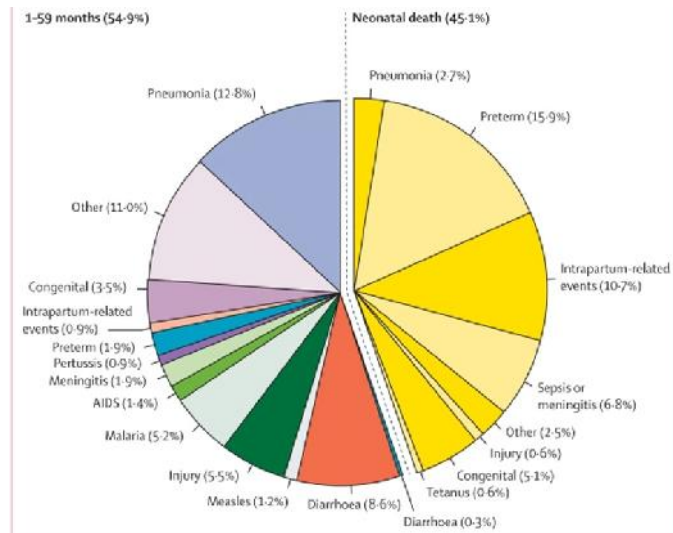


Fig. 3. Global causes of deaths under-five, 2015  
 ("Image: WHO | Child mortality", 2019) Retrieved from  
<https://www.google.com/imgres>



Fig. 4. Patients at the kangaroo mother care unit, Busia Referral Hospital.

Tony Omondi, Feb 3, 2017, <https://www.businessdailyafrica.com/corporate/Hospitals-kangaroo-technique-babies-incubator-shortage/539550-3798220-128xq5pz/index.html>

care, early and exclusive breastfeeding, assessment for signs of serious health problems or need of additional care amongst those that are low-birth-weight, sick or have an HIV-infected mother preventive treatment including immunization.

Kenya has the highest rate of neonatal mortality in East Africa (Fig. 3), about 200,000 children are born prematurely each year. The neonatal facilities are still at the level of reducing mortality and few advances towards reducing morbidity. Most of the newborn units have been adapted from the normal wards and modified without any specific design. The parents are still separated from the children and the recovery of the children is left up for the medical professional. Campaigns to sensitize the public as well as promote kangaroo mother care being launched in 30 out of 47 counties in Kenya as of November 2018, to prevent death of preterm babies. Newborn facilities have been enhanced with special design being employed to cater for the increasing numbers. However, there is still a long way to go.

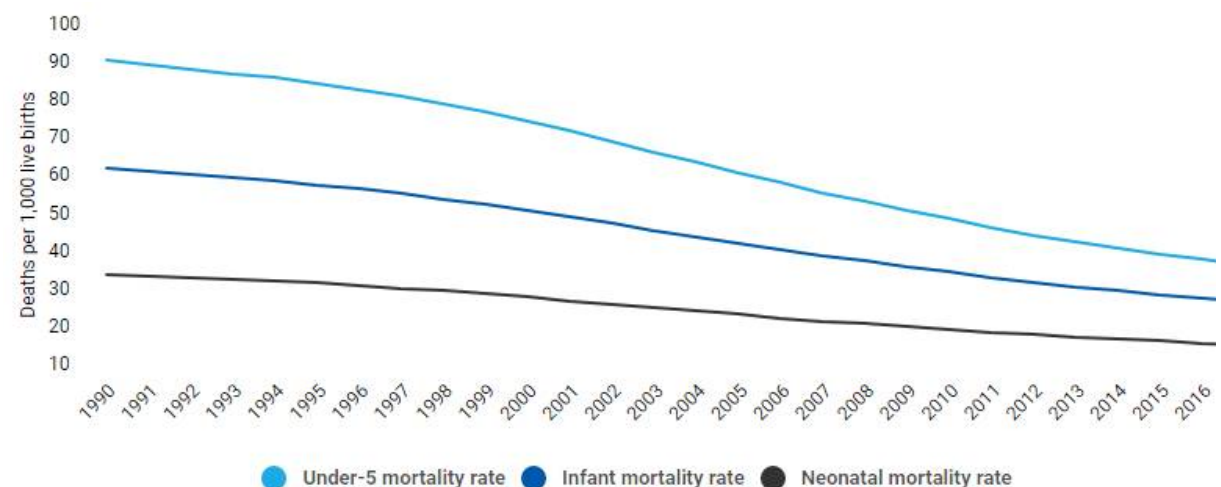


Fig. 5. infographic shows the under 5, infant and neonatal mortality rate in Kenya,  
 »SOURCE | ND, <https://data.unicef.org/topic/maternal-health/antenatal-care/UNICEF> 2016.

## 1.2 Problem Statement

Neonatal Intensive Care Units, or NICUs, are expressly built for newborn infants are a relatively new type of hospital unit. As recently as 30 years ago, most neonatal intensive care units (NICUs) were located in converted patient rooms. These converted spaces were rooms strung down a hallway; their only modification was the elimination of walls to create units. It was not until the late 1970s and 1980s that Nicu designed and built for the specific purpose of caring for critically sick neonates became commonplace.

As early as the 1920s, some hospitals began to experiment with using a larger proportion of semi-private and private rooms. The 1980s, concern about survival without disabilities also increased. (Chaudhury, et, al.2005)

Factors such as unit configuration, location of the neonatal within the hospital, airborne infection isolation rooms, family support space, ambient light in health care, procedure light in health care, illumination of the support area, daylighting, floor surface and finishes, wall surfaces, access to nature and noise levels affect the recovery of neonates. Moreover the light levels, noise levels, and room configurations affect the sensory environment of the baby. (Walsh-Sukys, Reitenbach, Hudson-Barr & DePompei, 2001)

The design of neonatal intensive care units plays a large role in patient safety, clinical outcomes. Design contributes to the type and quality of care given for all people involved in neonatal spaces, including newborns, parents, other family members, friends and professional care givers. Being transferred from the mother's womb to the intensity of a neonatal unit can be overwhelming for an infant, especially one who is premature and has not fully developed yet.( White 2007)

In countries with limited health resources, overcrowding in neonatal units is common. This leads to high morbidity and mortality among LBW infants, because of associated problems such as nosocomial infections. Additionally, prolonged separation between mother and LBW infants may contribute to newborn infant's abandonment, theft and/or abuse. (Gerhant, et al. 2016)

As we strive to continue to improve our morbidity and mortality rates, we are challenged to enhance the neuroprotective strategies for these infants, thus demonstrating the need for a

developmentally supportive environment that focuses on the interpersonal experiences of the preterm infant and family in the NICU. Every baby, regardless of gestational age, deserves neuroprotective care throughout their hospitalization due to rapid brain growth and neurologic development occurring during the early neonatal period.

In Kenya most of the neonatal spaces are presumed to be the incubators, in wards that have little is done to welcome the new family member. Parents have to follow a routine hospital timetable. Most of the hospitals have light levels as those presumed by the paediatrics for a little grown kids. ((Altimier & Phillips, 2016)

A consistent set of standards is needed so that health care professionals, architects, interior designers and health care regulators can have a base for the critical design of current and future neonatal units. According to Mardelle Shepley (2005), “conscientious architects are becoming increasingly aware of the impact of design decisions on the sensory environment of the neonatal intensive care unit.” Design strategies for NICUs need to address emotional, physical, developmental, medical and social needs for infants, families and hospital workers. (Shahheidari & Homer, 2012)

This study seeks to keep up with the current trends in neonatal care, bringing in the parents and siblings while keeping the light levels to the recommended amount both for task and ambient lighting and keeping the necessary noise in the neonatal environment.

### **1.3 Objectives of the Study**

This study highlights the design strategies employed in design of family centred neonatal care units which have tried to push towards quick recovery of neonates by bringing the family close to them without compromising on sensory needs on light and noise by;

- Document the trends in the modern neonatal settings that have sought to bring together the family and promote the well being of the neonates.
- Establish the existing conditions in Aga Khan and Kenyatta hospitals in regard to neonatal care and promoting family centred approach.



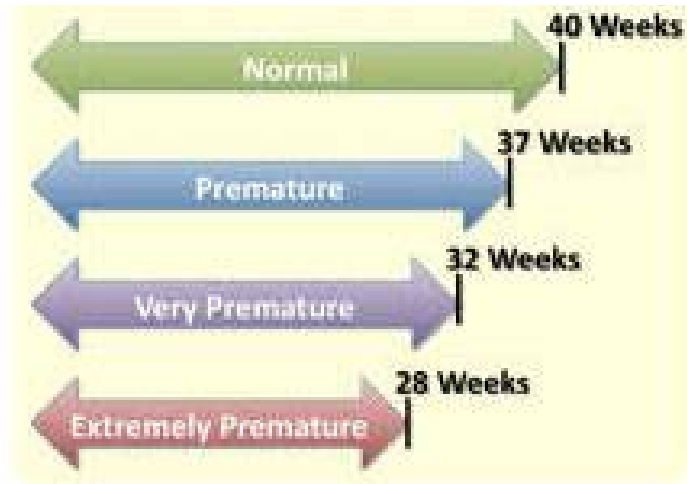


Fig. 6. Gestation of neonates. Digital image. Jan 2009.  
([http://www.hinnovic.org/wp-content/uploads/image/Janvier/birth\\_weightjpg](http://www.hinnovic.org/wp-content/uploads/image/Janvier/birth_weightjpg), 2019)

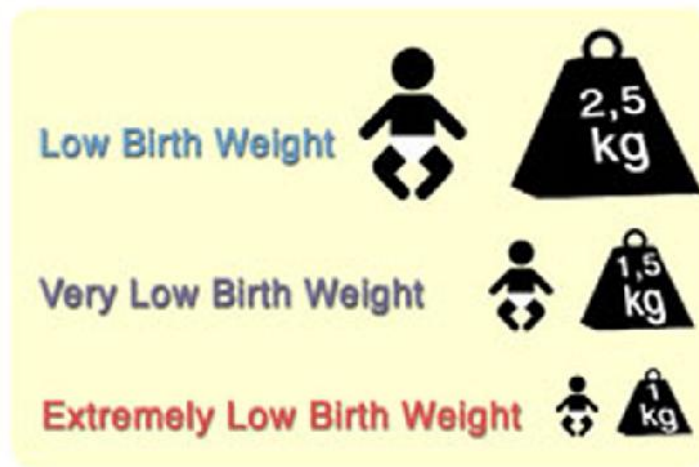


Fig. 7. Newborn birth weight categories. Digital image  
([http://www.hinnovic.org/wp-content/uploads/image/Janvier/birth\\_weightjpg](http://www.hinnovic.org/wp-content/uploads/image/Janvier/birth_weightjpg), 2019)

- Come up with mechanisms that encourage inclusion of the family while promoting the recovery of neonates in hospitals.

#### 1.4 Research Questions

- What are the modern neonatal settings that have sought to bring together the family and promote the well being of the neonates?
- What are the existing conditions in Aga Khan and Kenyatta hospitals in regard to neonatal care and promoting family centred approach?
- Which are the recommended mechanisms that encourage inclusion of the family while promoting the recovery of neonates in hospitals spaces?

#### 1.5 Justification of the Study

Mothers who play a big role in the development of the neonates have been given a back seat and the medical practitioners have been the sole drivers of the recovery process, developed yet. Lighting and acoustical quality are of particular importance, as are basic design principles such as layout and location and family and visitor comfort. Above all else, preterm babies (Fig. 6) and low birth weight who are the primary users of the NICU are the most vulnerable, their coping mechanisms are not yet developed. Hence the layout of the NICU affects the duration of stay of the neonates who are in this study intends to look at steps which architects and designers can take to promote better recovery of neonates.

#### 1.6 Significance of the Study

Sustainable Development Goals(SDGs) set by WHO are directed towards ensuring healthy lives and promoting well being at all ages. The purpose of these research is to highlight design strategies that may be used in newborn units to promote quick recovery and prevent morbidity effects on newborns. The research is of significance to hospital designers and healthcare providers. An increase in knowledge in the needs of neonates will help improve the layout of their spaces and consequently the hospital design.

## 1.7 Scope and Limitations of the Study

There has been some research done on the subject of maternity need. This paper will refer to the most recent publications and statistics only. Many of the studies focus on the wellness of the newborns with a bias on the NICU since they are the most vulnerable among the newborns for reasons discussed above. This research aims to extend the knowledge base on designers and hospital planners.

There are a number of medical institutions which provide maternal healthcare, due to time and resource constraints the study will focus on Aga Khan and Kenyatta Hospital. The two hospitals have the four levels (Table 1) of new born care that this research is looking at.

The target group was predominantly neonates and the hospital policies do not allow their photos taken.

## 1.8 Definition of Terms

A wet nurse is a woman who breast feeds and cares for another's child. Wet nurses are employed if the mother dies, or if she is unable or elects not to nurse the child herself. They may be special relationship of milk kinship.

Neonatal period is the first 28 days of life. New born infants (neonates) who have been born preterm or at full term but are unwell.

Neonatal mortality rate-Probability of dying during the first 28 days of life, expressed per 1,000 live births.

Perinatal morbidity a disorder in the neonate, child or family which occurs as a result of adverse influences or treatments acting either on the foetus during pregnancy and/or the infant during the first four weeks of life. (National Health and Medical Research Council)

Parent-interchangeably used for mother, father, two mothers, grandparents or other relatives who are the primary parents of the newborns.

Neuroprotection- strategies capable of preventing neuronal cell death.

# Born too soon

## Prevalence

**1 in 11** births in Kenya is preterm



**134,000**

Estimated number of children who are born prematurely annually in Kenya

## Deaths

**13X**

Death risk for preterm babies compared to full term babies



**27%**

Share of deaths of babies within the first month of life attributed to prematurity in Kenya

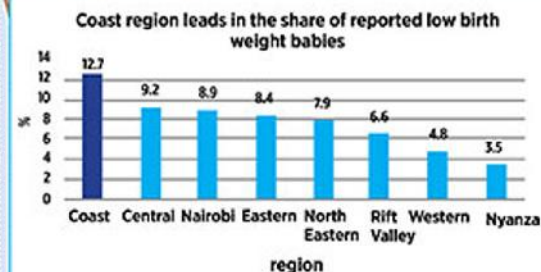
**1 in 8**

deaths among children under five years is linked to prematurity. It follows pneumonia and asphyxia with 14% each



**1/3**

Reduction in deaths of low birth weight infants who receive kangaroo mother care compared to conventional neonatal care



## Improving babies survival

**20%**

Expected drop in the number of deaths among premature babies within the first month of life if interventions including use of safe childbirth checklist, training of nurses in preterm care and constant monitoring of care services are fully executed



**Sh1.5 million**

Estimated cost of buying one incubator for a health facility, exclusive of maintenance costs. Kangaroo mother care is free

**3 in 4** deaths of premature babies could be prevented with feasible, cost-effective care

**2/3**

Reduction in risk of hypothermia among babies by the time of discharge due to kangaroo mother care

**20 hours**

Minimum amount of time that kangaroo mother care should be done per day



**55%**

Decline in the risk of severe infection among babies due to kangaroo mother care

## Globally

**1 in 15** preterm babies worldwide dies due to complications

**12**

Number of premature births per 100 live births in Kenya, placing it 51 globally. Malawi leads globally with 18, followed by Comoros, Congo, Equatorial Guinea and Zimbabwe with 17 each



## Health facilities

**20**

Minimum number of beds that should be at kangaroo mother care wards at county referral hospitals. National referrals should have at least 40 beds, according to the health ministry

**55%**

Share of health delivery facilities that have space designated for kangaroo mother care in Kenya

**30**

Number of counties with at least one kangaroo mother care unit, a 43% increase from 21 in 2017

Fig. 8. Statistics on pre-term neonates in Kenya

Digital image. Oscar Anaswa, 2018. Retrieved from <https://www.nation.co.ke/newsplex/prematurebabies/2718262-4854982-t2qk6g/index.html>