PREVALENCE OF READMISSION AND EARLY MORTLITY OF LATE PRETERM INFANTS COMPARED TO TERM INFANTS AT THE KENYATTA NATIONAL HOSPITAL

A Thesis Submitted In Part Fulfillment of the Degree of Master of Medicine (M.Med) in Paediatrics and Child Health

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DECLARATION

I hereby certify that this is my original work and it has not been submitted to any other University or forum

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ABBREVIATIONS

CS: Caesarian Section

GA: Gestational Age

HMD: Hyaline Membrane Disease

JAMA: Journal of the American Medical Association

KNH: Kenyatta National Hospital

NBU: Newborn Unit

UK: United Kingdom

UON: University of Nairobi

USA: United States of America

ABSTRACT

Title: Prevalence of hospital readmissions of Late Preterm neonates compared to term infants born in the Kenyatta National Hospital**.**

Background: Late preterm neonates account for 62% of all preterm births in Kenyatta National Hospital (KNH). They are often the size and weight of some term neonates. Because of this, they may be treated by parents, care givers and health care professionals as term neonates as they are thought to be developmentally mature and at a low risk of morbidity. They are often managed in newborn level 1 (basic) nurseries or remain with their mothers[1] although they are physiologically and metabolically immature[2-6] and as a consequence have a higher risk than term babies of developing medical complications that result in higher rates of morbidity and mortality.[6-8]

Study Utility: Without new developments in the prevention of preterm births, it is important to focus on improving care of the late preterm and prevent readmission.[9.] No studies have been done to determine the prevalence of readmission of late preterms in Nairobi and its surroundings

Primary Objective: To compare the prevalence of readmission of late preterm neonates versus term infants born in the Kenyatta National Hospital.

Secondary Objectives: To determine the factors associated with readmission of late preterm neonates and term infants.

To determine the mortality and morbidity of late preterm infants and term who are readmitted within 6 weeks of delivery

Methodology: A short longitudinal cohort study was carried out at KNH, Nairobi, Kenya. Late preterm infants aged between 34 weeks gestation to 36 weeks and six days gestation and term infants aged between 37 weeks – 42 weeks gestational age were identified using the new Ballard Score in the KNH maternity and labour wards. The neonates together with their mothers or care givers were consecutively recruited until the desired sample size was achieved. Recruited mothers or caregivers initially answered questions from a questionnaire administered before the initial hospitalization discharge. They were then followed up by a phone call once weekly where required information was gathered by use of a follow up questionnaire for a period of 6 weeks.

Data analysis: Data was collected and entered into a clinical records form by the primary investigator. The data was subsequently checked and entered into a computerized data base using STATA version 23. Continuous variables were analyzed using mean and standard deviation for normally distributed variables. Percentiles and mean will be used for normally distributed variables and categorical variables presented as frequencies and rates.

Results: One hundred and two patients were enrolled in each group. Overall 27 0f the 102 late preterm neonates were readmitted representing 26.5% compared to 9 term infants (8.8%) of

readmitted term neonates. Our study showed that among late preterm infants, those who stayed in hospital less than 48 hours during the initial hospitalization had significantly higher readmission rates compared to those with longer hospital stays. (P value 0.05). Duration of initial hospital stay was not statistically significant among the term neonates. However, term infants born to single mothers were more likely to be readmitted than those born to married mothers. *(P value 0.003).* Breast feeding, maternal pregnancy and delivery complications, birth order and mode of delivery were found to not be significant risk factors for readmission in both groups. The most common morbidities among the readmitted late preterm infants were neonatal sepsis (92%), acute kidney injury (55%) and hyperbilirubinemia (32%) while neonatal sepsis (67%) and hyperbilirubinemia (55%) were the most common morbidities among the readmitted term infants.

Conclusions: Late preterm infants had higher rates of readmission compared to term infants with the most common morbidities being neonatal sepsis, acute kidney injury and hyperbilirubinemia among late preterm infants. Neonatal sepsis and hyperbilirubinemia were the most common causes of readmission among term infants. A short duration of initial hospital stay was associated with readmission among late preterm infants while term infants born to a single mother were more likely to be readmitted.

Study limitations: Some study participants were not reachable and some were lost to follow up. The study also depended on the willingness of participants to provide adequate and truthful information during the follow up phone calls.

Key recommendations: Hospital discharge of late preterm neonates should be delayed and a full assessment done before discharge to identify any morbidities. Mothers of late-preterm infants should be also be educated on how to evaluate feeding success and to assess for danger signs of sepsis.

DEFINITIONS AND CLASSIFICATIONS

Late preterm infants are defined at birth at 34 weeks gestation through 36 weeks and 6 days gestation from the first day of last menstrual period[10]

This gestational age was selected by an expert panel assembled by the National Institutes of Health.

It was chosen as acknowledgement that the 34th to 36th weeks of gestation represents a key gestational age used for obstetric decision making and infants born at this gestational age are physiologically immature and have limited compensatory responses to the extra uterine environment when compared to term neonates.

Late preterm infants are born near term, but are immature.[11-12.] The late premature birth interrupts normal in utero fetal development during the last 6 weeks of gestation that represents a critical period of growth and development of the fetal brain and lungs. Kinney defined a critical period as a time-sensitive, irreversible decision point in the development of a neural structure or system in which deprivation of the normal environment interrupts the maturational trajectory of the structure/system.[13]

Term infants are defined as those born between 37 0/7 through 41 6/7 weeks of gestational age.

A hospital readmission is defined as when a patient who had been discharged from a hospital is admitted again to that hospital or another hospital within a specified time frame. The original hospital stay is often called the "index admission" or “initial hospitalization” and the subsequent hospital stay is called the "readmission." Different time frames have been used for research purposes, the most common being 30-day, 90-day, and 1-year readmissions. Readmission rates have increasingly been used as an outcome measure in health service research and as a quality benchmark for health systems

INTRODUCTION

Late preterm births account for 62% of all preterm births in the Kenyatta National Hospital[14]. Usually they are the physical size of term infants, and because of this many parents and caregivers believe that the risk of morbidity and mortality is low.

However, they are physiologically and metabolically immature and because of this their risk of developing various complications is higher compared to term infants. This therefore results in higher rates of mortality and morbidity during the initial birth hospitalization.[6-8]

Normal fetal development is also interrupted during the last weeks of gestation. This time is an important period of fetal growth and development especially of systems such as the neurological and respiratory ones

Along these lines, it is obviously perceived that late preterm babies have a higher danger of creating inconveniences in the prompt infant time frame contrasted with full term newborns. These complications lead to higher rates of hospital readmission during the neonatal with these morbidities extending beyond the initial hospitalization. It is recognized that readmission rates of late preterm infants are 1.5 to 3 times that of term infant term infants.[2,4,7,8,15]

A few vital variables may incline late preterm newborn infants to morbidities related with immaturity such as:

i. Apnea (4%-7% more than term neonates),
ii. Poor cold response and more heat loss than term neonates
iii. Hypoglycemia due to immature glucose regulation and immature gastrointestinal function
iv. Feeding difficulties
v. Hyperbilirubinemia

APNEA

Late-preterm infants are predisposed to apnea due to several underlying factors including

Higher susceptibility to hypoxic respiratory depression

Reduced central chemosensitivity to carbon dioxide

Immature pulmonary irritant receptors

Higher respiratory inhibition sensitivity to laryngeal stimulation

Reduced upper airway dilator muscle tone.[16-20]

It is likewise suspected that late preterm infants might be at an expanded danger of midway intervened apnea, in light of the fact that their focal sensory systems are formatively juvenile (i.e. less sulci and gyri and less myelin) and their minds are around 66% the extent of a term infant

THERMOREGULATION

A newborns regulation to heat and cold repsonses after birth is influenced by their gestational age and is affected by their physical size, the amount of mature brown and white adipose tissue, and additionally the development of the hypothalamus.[21-23] However, accumulation of brown-fat and the maturation and proper concentrations of hormones responsible for its metabolism such as prolactin, leptin, norepinephrine, triiodothyronine, cortisol peak at term[24-25].

The outcome is that late preterm infants have lower levels of white adipose tissue for insulation, and can't create enough warmth from brown adipose tissue as successfully as infants born at term.

What's more, late-preterm infants lose warm more promptly than term babies, since they have a bigger proportion of surface region to weight and are smaller in size

GLUCOSE METABOLISM

Fasting babies of every single gestational age might be influenced by hypoglycaemia. This happens due to insufficient metabolic reactions to the sudden loss of maternal glucose supply after birth.[26-30] It has been discovered that the rate of hypoglycemia is conversely relative to gestational age and thus late preterm infants are at expanded danger of developing hypoglycemia

after birth. This is because of juvenile hepatic glycogenolysis and fat tissue lipolysis, hormonal dysregulation, and deficient hepatic gluconeogenesis and ketogenesis. [26-30]

FEEDING DIFFICULTIES

Late preterm babies are formatively not ready for fruitful oral sustaining practices important for exrta uterine life. This is because brain maturation corresponds to a pattern of development which influences feeding behaviors. The physiologic development required to ace suck-swallow–inhale coordination is typically achieved between 34 and 36 weeks gestation

Lactogenesis begins as prolactin rises during mid-pregnancy up to about the second postpartum day. Following delivery of the placenta, there is a rapid drop in maternal progesterone initiating the second phase of lactogenesis. Copious milk production however does not begin until about 3-8 days postpartum. Late preterm infants are unable to establish successful feeding – suck coordination. This results in delayed second phase of lactogenesis with reduced milk volume during the first few days after birth.

HYPERBILIRUBINEMIA

Jaundice and hyperbilirubinemia occur at an increased rate and are for longer durations among late-preterm infants compared to their term counterparts. This is because of the reduced concentration and delayed maturation of the enzyme uridine diphosphoglucuronate glucuronosyltransferase.[31-32.] This results in late-preterm infants being twice as likely as term infants to have significantly elevated bilirubin concentrations and higher concentrations on the 5^{th} and 7^{th} days after birth.[31]

Late preterm infants also have immature gastrointestinal function[33-34] and feeding difficulties which predisposes them to a longer entero hepatic circulation, dehydration, diminished stool recurrance and hyperbilirubinemia.[35-44] Although they may establish feeding successfully at birth they may not be able to sustain this after discharge. The typical hospitalization after vaginal delivery is 24 hours and after Cesarean delivery is 96 hours. Discharge within 48 hours does not take into account the time required for lactogenesis to occur and sufficient maternal breast milk supply to be established[62]. These feeding difficulties in late-preterm infants occur due to factors such as relatively low motor tone, reduced motor function, and neural immaturities and hence incline these infants to dehydration and hyperbilirubinemia[13, 42-45]

LITERATURE REVIEW

EPIDEMIOLOGY

Currently, the number of preterm births in Kenya has increased to 193,000 infants from 188,000 in 2010

During the past few years it has been noted that there has been an increase in the number of late-preterm births worldwide. It is not well understood why this increase has occurred in the past ten years but one hypothesis attributes it, in part, to the medical advances that have occurred in obstetric practice. Because of this, there has been better surveillance and timely medical interventions during pregnancy[45-49], resulting in infants at risk such as those with intrauterine growth restrictions, fetal abnormalities and fetal anomalies being identified and hence being delivered earlier. Another reason is that it may be due to higher use of reproductive innovations and technologies and, as a such, an increase in multi fetal pregnancies[45-48]

As shown in *Table 1*, late preterm births account for the majority of preterm births worldwide

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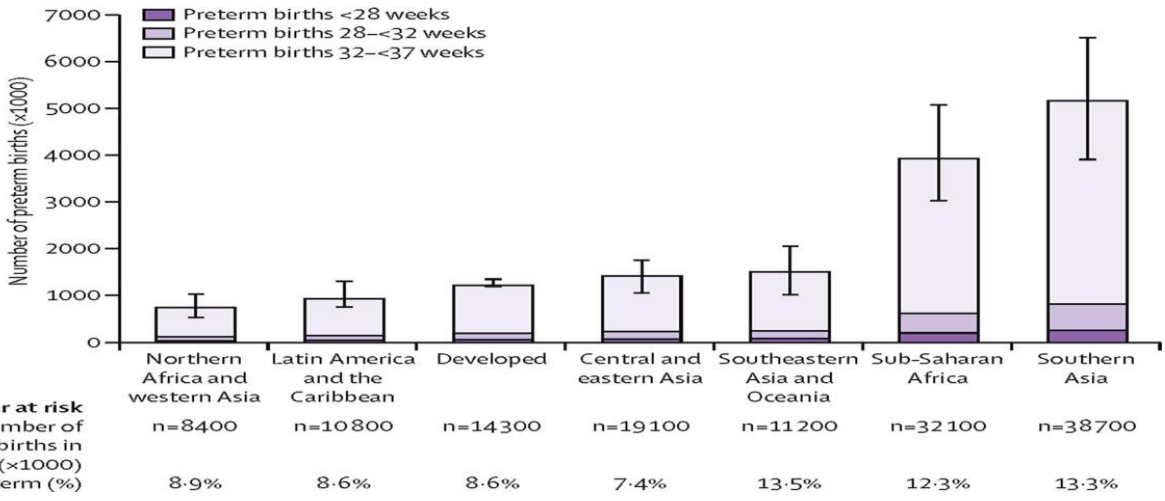
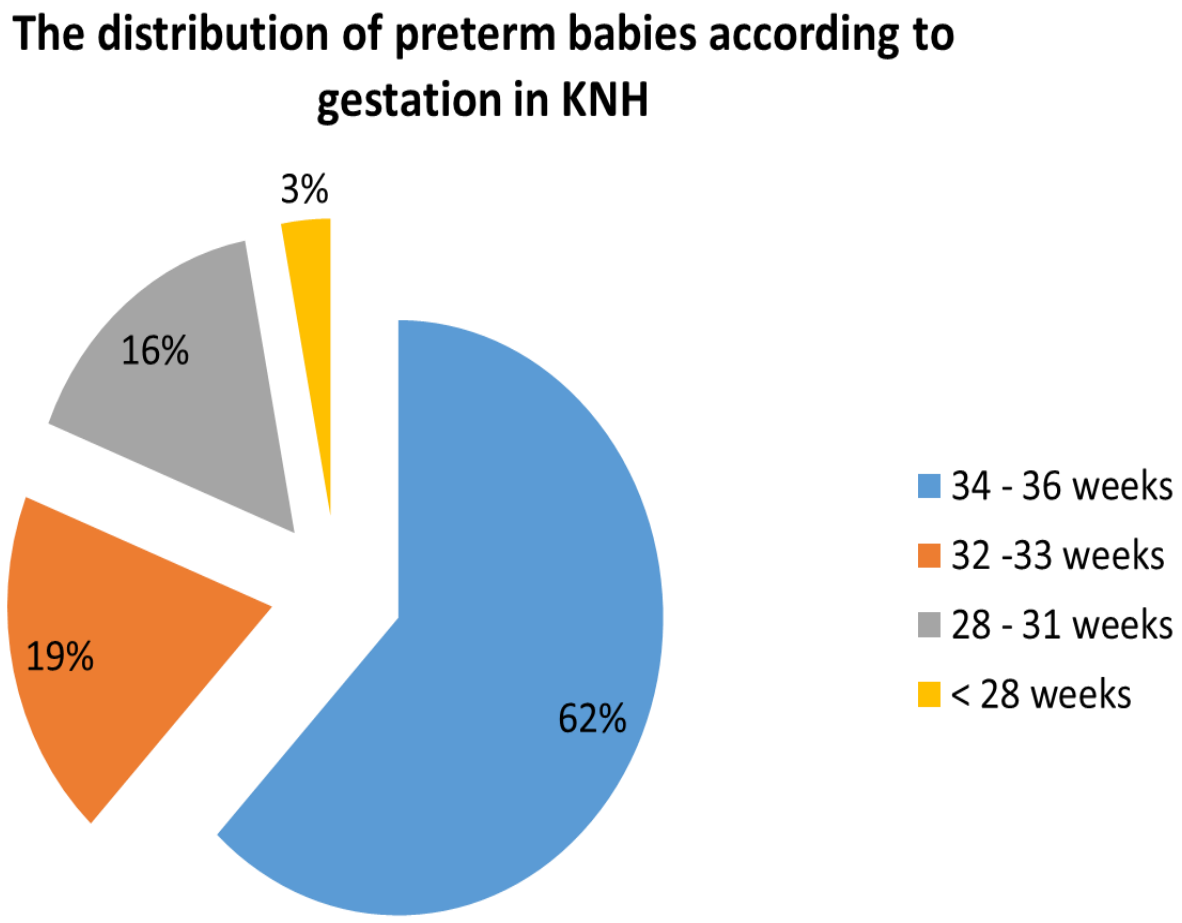


Table 1: Preterm births by gestational age and region for the year 2010. Based on Millennium Development Goal regions. Source: Reproduced from Blencowe et al. (2012) National, regional and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: a systematic analysis and implications. Lancet 379(9832): 2162-2172

About 5% of preterm births occur at a gestation less than 28 weeks, 15% at 28–31 weeks, 20% at 32–33 weeks and 60–70% at 34–36 weeks[50-51]

The preterm birth rate in KNH as found in a study by Wagura et al 2014 was found to be 18.3% of all births. Late preterms were found to account for 62% of these cases.

Figure 1: Distribution of preterm infants at Kenyatta National Hospital



CAUSES OF READMISSION

Various studies have evaluated the various risk factors for neonatal hospital readmission after the initial birth hospitalization late-preterm birth has been identified as a significant risk factor.[39-39,41,44,60]

A large cohort study by Oddie SJ *et al*[4] in the UK in 1998 identified that those infants born between 35 weeks' and 37 weeks' of gestation were 1.7 times more likely to be readmitted during the neonatal period than those infants born at term (38 weeks' to 40 weeks' gestation).

A retrospective cohort study by Escobar *et al*[3] of all newborn infants who were discharged after the initial birth hospitalization in 7 hospitals in a large managed care organization found that 4.4% of all late-preterm infants were readmitted within 2 weeks after discharge. This study also found that in 3.0% of discharged premature infants born at less than 34 weeks' gestation were readmitted and 2.0% of infants born at term were also readmitted. The risk of re-hospitalazation was higher in those late preterm infants who had not been admitted to the NICU. The study likewise discovered that having a booked home visit or a planned outpatient visit inside 72 hours after release was related with a diminished risk of re-hospitalization. In addition, a population-based study found that late-preterm infants who were not admitted to the NICU after birth were 2 to 3 times more probable than term infants to be re-hospitalized for medical conditions such as hyperbilirubinemia.[35]

Late-preterm infants who are discharged early (<48 hours hospital stay) from the hospital after a vaginal delivery were also found to be at an increased risk of neonatal morbidity compared with term infants who are discharged at the same time[8]

A population-based study that compared the rates of post discharge neonatal morbidity between singleton late-preterm and term infants who were discharged early found that 4.3% of late preterm infants either had an observational stay or were readmitted compared to 2.7% of term infants; 3.5% of the late preterm newborns and 2.0% of the term newborns were readmitted. Jaundice and infection accounted for the highest morbidity with an occurrence of 77.1% of the readmissions among late-preterm infants and 60.3% of readmissions among term infants. This study also found that breastfed late-preterm infants were 1.8 times more likely to require hospital-related out patient care and 2.2 times more likely to be readmitted than breastfed term

infants. However there was no difference in need for subsequent hospital-related care or readmission between the late-preterm and term infants who were not breastfed.

During the neonatal period, late preterm infants have been found to have a higher risk than term infants to develop hyperbilirubinemia [8,31,36,58-59] and to be readmitted due to this[3,35,40] and other related morbidities such as neonatal sepsis and feeding difficulties.

A study by Tomashek et al[8] reported hyperbilurubinemia in 77.1% of late preterm newborns while that by L.Sreelaxmi *et al*[42] reported similar findings with 76.7% of late preterm newborns and 26% of term babies being readmitted with jaundice

Studies have additionally discovered that late-preterm infants are at increased risk of developing more severe morbidities than term infants.[2,3,54] Jaundice has been observed to be severe requiring more exchange transfusions among late preterm babies and is the commonest cause of readmission during the neonatal period[8,42]

However, in 2015 in India, L.Sreelaxmi *et al*[42] showed a 14% readmission rate of late preterm infants mainly because of early discharge. Jaundice (81%) & sepsis (52.4%) were the most common causes of readmission while Kaplan M *et al* showed jaundice & feeding difficulties as the most common causes. The mortality rate of readmitted infants as per Raju *et al*[5] study in Maryland USA was 5.2% while L. Sreelaxmi *et al* showed 8% morality with the most common cause being sepsis. 31.3% of late preterm infants & 16% of term babies of those who were readmitted were diagnosed with clinical and blood culture positive sepsis.

As shown in the table below, a study by Ming-Luen Tsai *et al* in Taiwan in 2011 also found late preterm infants had a higher rate of hospital readmission during the neonatal period in contrast to full-term infants (4.4 % vs. 2.3%, $p < 0.001$) the most common morbidities during readmission in order of decreasing frequency were hyperbilirubinemia needing phototherapy, urinary tract infections, lower respiratory tract infections and feeding-related problems in both late preterm and full-term infants

Table 2: Incidence of NICU/Special care admission/readmission and mortality rate in late preterm infants and term infants

Incidence of NICU/special care nursery admission/readmission and mortality rate in late preterm and term infants.

	Late preterm				Term (n = 6507)	p value*
	34 wks (n = 157)	35 wks (n = 274)	36 wks (n = 483)	Total (n = 914)		
Admission (n, %)	116 (73.9)	119 (43.4)	101 (20.9)	336 (36.8)	471 (7.24)	< 0.001
Readmission (n, %)	10 (6.4)	13 (4.7)	17 (3.5)	40 (4.4)	150 (2.3)	< 0.001
Mortality (n, %)	1 (0.6)	1 (0.4)	1 (0.2)	3 (0.3)	5 (0.08)	0.03

*Total late preterm infants compared with term infants.

Risk factors that were identified for patients who required hospital care or experienced morbidity included

I. Infants who were the first born
II. Infants who were breastfed at discharge
III. Infants whose mother had either labor or delivery complications.

MORBIDITY AND MORTALITY

Late-preterm infants have also been shown to have an increased risk of neonatal morbidity compared with their term counterparts. During the initial birth hospitalization, late-preterm babies have been observed to be multiple times more probable than term newborn children to have no less than 1 medical diagnosis and 3.5 occasions bound to have at least two or more medical diagnoses[2]. A study by L.Sreelaxmi *et al* in 2015 in India showed that a late preterm required a mean duration of 5.63 +/-3.2 days of initial hospitalization while a term baby required 3.85+/-2.2days.This was similar to a study by Mcintire and Leveno in Texas[52]

As shown in Table 3 below, during the initial birth hospitalization, late-preterm newborns are also more likely than term infants to be diagnosed with thermoregulation instability[2] hypoglycemia,[2] respiratory distress[2,3,53-55] apnea,[56-57] jaundice[2] and feeding difficulties

Table 3: Late preterm infants and the most frequent complications during the birth hospitalizations

Late-Preterm Infants and the Most Frequent Complications of Prematurity During the Birth Hospitalization

Outcome During Initial Birth Hospitalization	Late-Preterm Morbidity		Term Morbidity		OR (95% CI)	*P*
	No.	%	No.	%		
Feeding difficulties						
Wang et al[2] (35–36⅞ wk)	29	32.2	7	7.4	—	—
Hypoglycemia						
Wang et al[2] (35–36⅞ wk)	14	15.6	5	5.3	3.30 (1.1–12.2)	.028
Jaundice						
Wang et al[2] (35–36⅞ wk)	49	54.4	36	37.9	1.95 (1.04–3.67)	.027
Temperature instability						
Wang et al[2] (35–36⅞ wk)	9	10.0	0	0.0	Infinite	.0012
Apnea						
Henderson-Smart[38] (34–35⅞ wk)	—	7.0	—	<0.1	—	—
Merchant et al[40] (35–36⅞ wk)	6	12.0	0	0.0	12.0 (4.5–24.3)	.0267
Wang et al[2] (35–36⅞ wk)	4	4.0	0	0.0	—	.054
Respiratory distress						
Escobar et al[34] (34–36⅞ wk)	345	10.7	975	2.7	—	—
Gilbert et al[30] (34–36⅞ wk)	1167	3.6	843	0.8	—	—
Rubaltelli et al[33] (34–36⅞ wk)	314	9.6	359	0.6	—	—
Wang et al[2] (35–36⅞ wk)	26	28.9	4	4.2	9.14 (2.9–37.8)	.00001
Received intravenous infusion						
Wang et al[2] (35–36⅞ wk)	24	26.7	5	5.3	6.48 (2.3–22.9)	.0007
Underwent sepsis evaluation						
Wang et al[2] (35–36⅞ wk)	33	36.7	12	12.6	3.97 (1.8–9.2)	.00015
Received mechanical ventilation						
Gilbert et al[30] (34–36⅞ wk)	1103	3.4	950	0.9	—	—

OR indicates odds ratio; CI, confidence interval; —, data not reported.

The study by L.Sreelaxmi *et al* also showed that respiratory distress occured in 40% of late preterm infants compared to their term counterparts at 15%. These results were similar to that of a study conducted in US published in JAMA journal in July 2010. [70% and 9% respectively]. But this study showed a higher rate of respiratory distress among both late preterm infants (40%) & term infants (15%) in contrast to Wang *et al*[2] (28.9% and 4.2% respectively) and Rubaltelli *et al* (30.8%).[53] This was attributed to a larger number of asphyxiated term babies in the India study

STUDY JUSTICIFICATION AND UTILITY

The rates of preterm birth are higher now worldwide and there is proof that this increase is for the most part because of newborn children born in the range of 34 and 36 weeks of gestational age (GA) the purported late preterm baby. They are the quickest developing subset of neonates representing roughly 60-74% of all preterm births around the world.

Most studies have described the unfavorable outcomes associated with preterm births. However these studies base the cut- off point of 37 weeks, without considering the developmental differences that may exist between an infant born at 35 weeks and one born at 37 weeks.

Barely any studies have shown the various medical consequences of late preterm births when compared with term births. Because of their large numbers, the morbidity and mortality of newborns born in the late preterm period represent a larger etiologic fraction of the overall infant morbidity and mortality than do the more premature new born infants.

The comprehension of the developmental and physiological biology and mechanisms of disease experienced by late preterm infants is largely deficient because they have not been studied frequently. Management strategies are hence developed based on general principles, the clinical experience, and knowledge extrapolated from very preterm and term newborns. It is however important to understand the unique medical complications that late preterm newborn infants may experience.

In our set up, these infants are usually considered by their parents, guardians and medical professionals as term neonates as they are thought to be developmentally and physiologically mature and at a low risk of morbidity yet they remain immature.

According to the Kenya profile of preterm and low birth weight prevention and care programme, preterm births in Kenya in 2014 were 193,000. Of these, direct preterm deaths were 13,300. Because late-preterm infants account for the highest number of preterm births and are also at greater risk of neonatal morbidity and neonatal mortality than are term neonates, guardians of late-preterm infants may require guidance and special instruction and before the initial hospital discharge and subsequently closer follow-up after discharge.

An increasing number of late preterm neonates delivered at KNH seem to be re-hospitalized in the general paediatric wards shortly after discharge. Neonates who do not exhibit overt signs and symptoms of disease are not routinely reviewed by pediatricians in KNH following delivery hence risk discharge with undiagnosed illnesses. Mothers are also likely to leave the hospital with inadequate information with regards to proper breastfeeding practices.

No studies have been done yet to determine the prevalence of readmission of late preterms compared to term neonates in Nairobi and its surroundings. Without new developments in the prevention of preterm births, it is important to focus on improving care of the late preterm infants and to prevent readmission.

This data can be used to impact on policy and protocols to ensure specialized minimum criteria for discharge and increase targeted interventions to prevent readmissions

STUDY OBJECTIVES

Primary Objective

- To compare the prevalence of readmission between late pre term infants and term infants who are born in KNH within the first 6 weeks of life

Secondary Objective

- To determine the factors associated with readmission of late preterm neonates and term infants.
- To determine the mortality and morbidity of late preterm infants and term infants who are readmitted within 6 weeks of delivery.

METHODOLOGY

STUDY DESIGN

This was a short longitudinal cohort study.

STUDY AREA

The study was carried out in the KNH labour ward and the KNH Post-natal wards. Kenyatta National Hospital is one of two national referral hospitals in Kenya. There are about 450 total deliveries of babies per month in KNH. Of these, approximately 81 births are of preterm babies and 370 are term infants.

STUDY POPULATION

Late pre term infants (34 weeks to 36 weeks and 6 days gestation) and term infants (37 weeks to 41 weeks and 6 days gestation) who are not admitted to the KNH NBU.

Inclusion criteria

- Late preterm neonates born at gestation age 34 weeks-36 weeks and 6 days in the Kenyatta National Hospital who were discharged within 24- 72 hours after delivery. Gestation was determined by the use of Gestation Dates using Nageles formula and confirmed by use of the New Ballard Scoring System.
- Term neonates born at gestational age 37 weeks to 41 weeks and 6 days in the Kenyatta National Hospital who were discharged within 24-72 hours after delivery

Exclusion criteria

- Late preterm infants and term infants admitted to the NBU within 72 hours of delivery
- Lack of access to a mobile phone by the primary care giver
- Lack of informed consent

SAMPLE SIZE

$$\frac{2(Z_{1-\alpha} + Z_{1-\beta})^2 \times P(1-p)}{(P_1-P_2)^2}$$

Where:

Type I error is 0.05 Thus $Z_{1-\alpha}$=1.96

Type II error is 0.2 (Power of 80%) Thus $Z_{1-\beta}$= 0.842

L.Sreelaxmi *et al*[42] showed a 14% readmission rate of late preterm infants in and a 3% readmission rate of term infants in India.

P = Pooled prevalence. = {prevalence in group 1 (p1) + prevalence in group (p2)}/@

P1- P2 = Difference in the prevalence of the two groups

$$N = 2 \times \frac{(1.96 + 0.8420)^2 \times 0.155(1-0.155)}{(0.11)^2}$$

= 102

The attrition rate is expected to be 10% by the end of the study

Hence 113/ (1-0.1)

= 113

We therefore recruited 113 patients for each group.

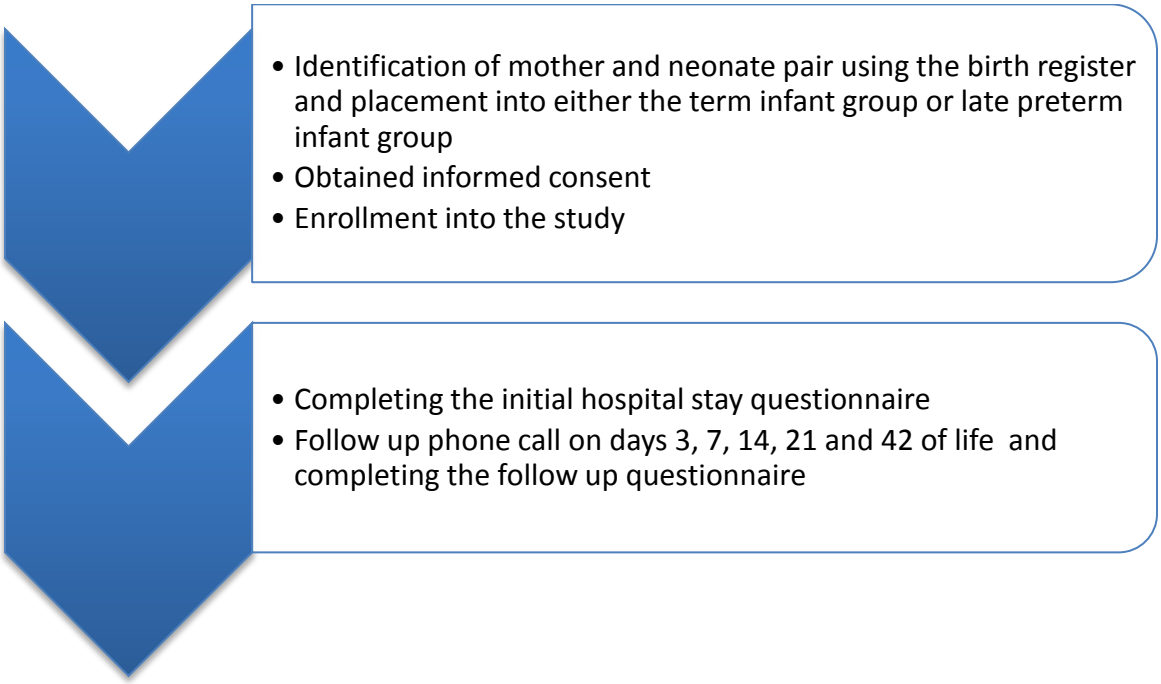
SAMPLING METHOD

Consecutive sampling was done until the desired sample size was achieved

STUDY TOOLS

We used 2 questionnaires. The first one was administered during the initial hospital stay while the second one was administered after discharge.

STUDY FLOW DIAGRAM



STUDY PROCEDEURES

Recruitment and Enrollment

Recruitment took place in the KNH post-natal wards. All mothers who delivered in KNH were identified within 24 hours of delivery using the Birth Register. Neonates were initially identified using birth records to determine their gestational age which was then confirmed by use of the New Ballard Scoring System. The mother and neonate pairs that met the inclusion criteria were identified and recruited into the study.

Consecutive recruitment and enrollment of selected patients was continued until the desired sample size was achieved. Parents of those selected were given written information on a sheet of paper in the language of their choice, either English or Kiswahili. Details of the study were also discussed with them. If they agreed to participate, written informed consent was consequently obtained from the parent/legal guardian for study participation. A pre-discharge questionnaire was issued and filled on the day as enrollment.

- The initial questionnaire assessed

I. Demographic characteristics,

II. Social economic status,

III. Type of delivery method.

IV. Pregnancy complications if any

V. Type of birth – Singleton vs Multiple births

VI. Length of initial hospital stay

VII. Infant birth weight

VIII. Delivery complications

IX. Intended method of feeding after discharge

X. Scheduled follow up appointments

Refer to appendix 1 for the questionnaire.

- After discharge, I engaged the parent/legal caregiver in a phone call at ages 3, 7, 14, 21 and 42 days (once weekly for 6 weeks) and obtained information available in the follow up questionnaire

- The follow up questionnaire assessed

I. Age of infant during each subsequent phone call

II. Method of feeding during each subsequent phone call

III. Readmission dates (if readmission occurred)

IV. Age of neonate at readmission

V. Diagnosis at readmission

VI. Discharge and readmission weight of the infant

VII. Length of hospital stay during readmission

VIII. Outcome of the readmission

Refer to Appendix 2 for the Questionnaire

DATA PROTECTION, MANAGEMENT AND ANALYSIS

The completed questionnaires were stored in a locked cabinet by the primary investigator during data collection and in a locked cabinet in the statistician's office during data entry. None of the participants' questionnaires had information that could directly identify the participants; rather the participant's questionnaires had serial numbers instead of names. The computer used for data entry and analysis was password protected and only the principle investigator and statistician had the password

Data was collected and entered into a clinical records form by the principle investigator who thereafter compared contents of the data base with the hard copy files of the participants to identify any data errors.

Each question had a code. The data was subsequently checked and entered and analyzed into a computerized database using STATA 23.0 statistical software.

Baseline characteristics were compared between the two groups. All variables significant in the Chi-square with $P<0.05$ were included in the regression models. Continuous variables were analyzed using mean and standard deviation for normally distributed variables. Percentiles and medians were used for non-normally distributed variables and categorical variables presented as frequency and rates with brief write ups to describe the results and interpretation derived from the results

DATA DISSEMINATION

The Overall Study Findings will be availed to the Specialists and the ante natal, post-natal and paediatric wards Staff management at KNH in hopes of disseminating the knowledge gained on neonatal care. The study findings will also be presented to the University of Nairobi (UON)

Department of Paediatrics and Child Health academic staff and students in fulfillment of the requirements of the Masters of Medicine in Paediatrics and Child Health Program

ETHICAL CONSIDERATIONS

Before the research was conducted, ethical approval was obtained from the Ethical and Research committee of KNH/UON. Approval to conduct the study was obtained from the Department of Paediatrics and Child Health before commencement of the study to collect and analyze data collected in the study as part of the Thesis Dissertation. Copies of the questionnaires, the Informed consent Form as well as any subsequent modifications to either document were presented to the above named committee for written approval prior to commencing the study.

The purpose of the study was also carefully explained to all the parents/legal guardians and written consent obtained prior to enrollment to the study. Strict confidentiality was observed throughout the entire study period. The completed questionnaires were stored by the principle investigator under a locked cabinet and the key kept by the principal investigator. There were no names on the participants' questionnaires; rather they had serial numbers. Participation in the study was voluntary and parents/legal guardians who refused to participate in the study or who opted out were not prejudiced against.

Appropriate patient referral was made when the patient was found to have any health ailments during the follow up phone calls.

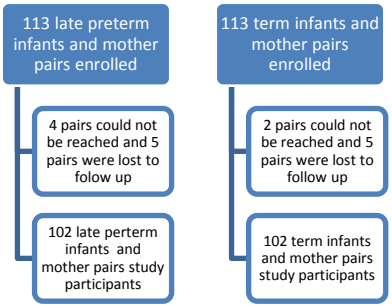
The study participant's phone numbers were not stored on the phone. Rather, the principal investigator referred to the questionnaires every time they made a follow up phone call. The mobile phone was kept by the Principle investigator under a locked cabinet and the key kept by the Principal investigator. No information concerning the individual study findings was released or will be released to any unauthorized third party without prior written approval of the study institution or the Ethics Research Committee

No Experimental Investigations or products were employed in this study

RESULTS

CHARACTERISTICS OF THE POPULATION

We identified 113 late preterm neonates and mother pairs and 113 term neonates and mother pairs. In the late pre term group, 4 primary care givers could not be reached and 5 were lost to follow up(they did not pick up their phone calls on all attempts). In the term group, 2 primary care givers could not be reached while 5 were lost to follow up. We analyzed data from 102 term study participants and 102 late pre term study participants



Demographic characteristics of the mothers did not differ significantly between the two groups.

Table 4: Demographic Characteristics of the mothers

	Pre-term N=102 (%)	**Term N= 102 (%)**	**P value**
Mean maternal age (SD)	28.2 (6.0)	27.7 (5.8)	0.592
Marital status Married Unmarried	 91 (89.2) 11 (10.8)	 85 (84.2) 16 (15.8)	0.289
Level of education Primary Secondary University College	 30 (30.3) 46 (46.5) 6 (6.1) 17 (17.2)	 17 (17.5) 52 (53.6) 9 (9.3) 19 (19.6)	0.199
Household income < 20000 20001-50000 > 50000	 78 (88.6)) 10 (11.4) 0	 71 (81.6) 14 (16.1) 2 (2.)	0.224
Mean parity (SD)	2.1 (1.3)	2.1(0.9)	0.637

Among the late preterm babies that were enrolled, the 36 week babies were more in number (Table 5).The mean birth weight of late preterm babies was 2.477 +/- 0.4177kilograms which was statistically significant while that of the term babies was 3.358 +/- 0.4785 kilograms. The mean gestational age at birth in the late preterm group was 36.6 weeks and 39.7 weeks in the term neonates. (Table 6)

Among the late preterm babies 52% were males and 48% were females. The difference in sex distribution was not statistically significant but females also outnumbered male infants among term babies. (Table 6)

Although not statistically significant more term babies (82.2%) were delivered by caesarian section compared to late preterm infants (75%). The type of birth was statistically significantly where 12.9% of all preterm births were multiple births compared to only 2% of all term births. *P value 0.03.* (Table 6)

Table 5: Gestational age of late preterm infants

Gestation age (weeks)	**Frequency (%)**
34	6 (5.9)
35	12 (11.8)
36	83 (81.4)

Table 6: Demographic Characteristics of the Neonates

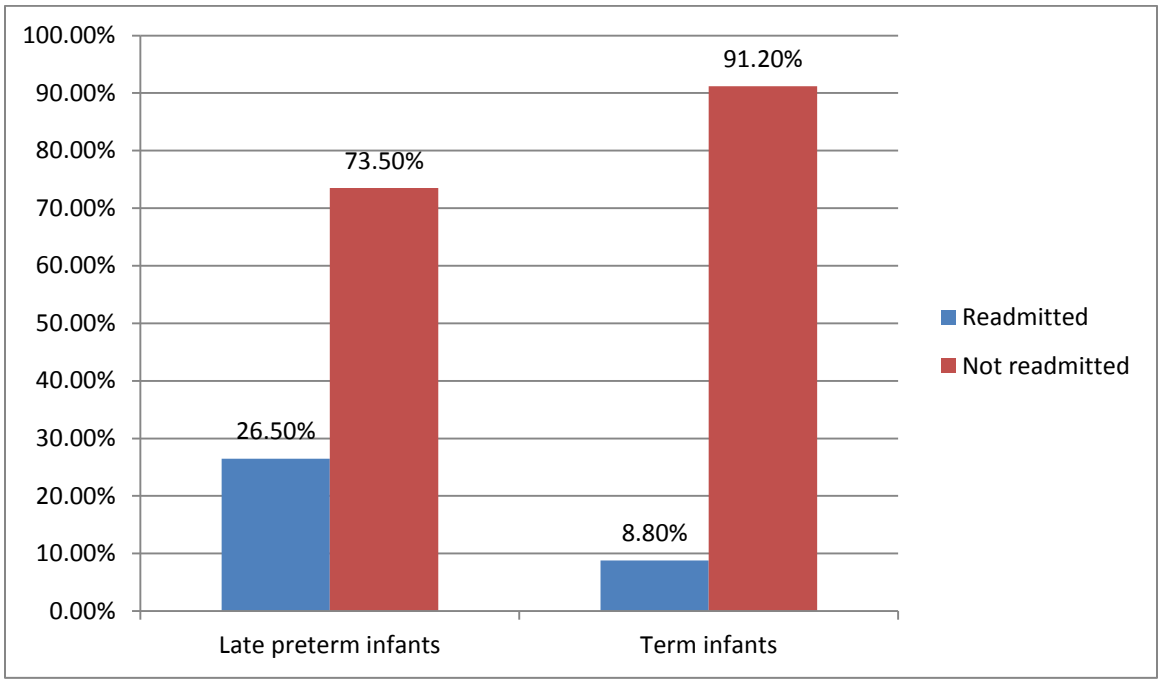
Variable	**Pre-term N=102(%)**	**Term N= 102(%)**	**P value**
Mean parity (SD)	2.1 (1.3)	2.1 (0.9)	0.637
Mean infant birth weight in weeks (SD)	2477.0 (441.3)	3358.6 (478.5)	<0.001
Mean infant BW at initial discharge (SD)	2439.0 (449.7)	3361.5 (455.2)	<0.001
Mean gestation age at birth in weeks (SD)	36.6 (2.2)	39.7 (1.5)	<0.001
Sex of the infant			
Male	49 (48.0)	47 (46.1)	0.779
Female	53 (52.0)	55 (53.9)	
Mode of delivery			
Spontaneous vertex delivery	25 (25.0)	18 (17.8)	0.215
Caesarian section delivery	75 (75.0)	83 (82.2)	
Type of birth			
Singleton birth	88 (87.1)	99 (98.0)	0.003
Multiple birth	14 (12.9)	2 (2.0)	

PREVALANCE OF READMISSION

Hospital readmission was defined as admission to any health facility within 6 weeks of birth hospital discharge

As shown in *Figure 2* below, 27 0f the 102 late preterm neonates were readmitted representing 26.5% compared to 8.8% of readmitted term neonates. (*P value 0.001. adjusted odds ratio: 1.7; 95% confidence interval: 1.3-2.2)*

Figure 2: Prevalence of readmission of late preterm infants compared to term infants.



FACTORS ASSCOCIATED WITH READMISSION AMONG LATE PRETERM INFANTS AND TERM INFANTS

We evaluated factors associated with readmission among both late pre term neonates and term neonates. There were no statistically significant maternal factors associated with readmission among late preterm infants (Table 7). Among term infants it was noted that term babies born to single mothers were more likely to be readmitted than those born to married mothers. *(P value 0.003. adjusted odds ratio: 1.0)* (Table 8)

Table 7: Maternal factors associated with readmission among late preterm neonates

	Re-admitted N=21 (%)	**Not admitted N=75 (%)**	**RR (95% CI)**	**P value**
Mean maternal age (SD)	26.9 (5.7)	28.6 (6.1)	-	0.216
Marital status				
Married	23 (85.2)	68 (90.7)	0.7 (0.3-1.6)	0.476
Single	4 (14.8)	7 (9.3)	1.0	
Level of education				
Primary	8 (30.8)	22 (30.1)	2.7 (0.5-14.7)	0.243
Secondary	13 (50.0)	33 (45.2)	3.0 (0.6-14.8)	0.187
University	3 (11.5)	3 (4.1)	7.5 (0.9-66.1)	0.070
College	2 (7.7)	15 (20.5)	1.0	
Household income				
< 20000	20 (83.3)	58 (90.6)	0.6 (0.3-1.5)	0.451
20001-50000	4 (16.7)	6 (9.4)	1.0	

Table 8: Maternal Factors associated with readmission among Term Neonates

	Re-admitted N=9 (%)	**Not admitted N=93 (%)**	**RR (95% CI)**	**P value**
Mean maternal age (SD)	25.6 (5.1)	27.9 (5.8)	-	0.242
Mean parity (SD)`	1.8 (0.8)	2.1 (1.0)	-	0.242
Marital status				
Married	5 (55.6)	80 (87.0)	0.2 (0.1-0.8)	0.033
Single	4 (44.4)	12 (13.0)	1.0	
Level of education				
Primary	1 (11.1)	16 (18.2)	0.5 (0-6.4)	0.619
Secondary	4 (44.4)	48 (54.5)	0.7 (0.1-4.2)	0.705
University	2 (22.2)	7 (8.0)	2.4 (0.3-20.8)	0.418
College	2 (22.2)	17 (19.3)	1.0	
Household income				
< 20000	7 (87.5)	64 (81.0)	1.0	
20001-50000	1 (12.5)	13 (16.5)	0.7 (0.1-6.2)	0.751
>50000	0	2 (2.5)	-	0.999

Late pre term neonates who had a shorter initial hospitalization stay *(P value 0.05)* and weighed less *(P value 0.002)* had significantly higher readmission rates. The sex of the infant and the type of birth were not statistically significant factors (Table 9). Among term neonates, only weight at initial hospitalization proved to be significant with those weighing less at initial discharge, having higher readmission rates (Table 10)

Table 9: Infant factors associated with readmission among late preterm neonates

Variable	**Re-admitted N=21 (%)**	**Not admitted N=75 (%)**	**RR (95% CI)**	**P value**
Mean weight at initial discharge (SD)	2219.6 (323.6)	2527.4 (464.9)	-	0.002
Mean gestation age at birth in weeks (SD)	36.2 (2.2)	36.7 (2.1)	-	0.266
Sex of the infant				
Male	14 (51.9)	35 (46.7)	1.2 (0.6-2.2)	0.644
Female	13 (48.1)	40 (53.3)	1.0	
Length of initial hospital stay				
Less than 24 hours	2 (8.0)	1 (1.4)	1.0	
Between 24-48 hours	13 (52.0)	12 (17.1)	0.4 (0-5.3)	0.0500
Between 48-72 hours	10 (40.0)	56 (80.0)	0.1 (0-1.4)	0.088
Type of birth				
Singleton birth	21 (77.8)	67 (90.5)	0.5 (0.3-1.0)	0.103
Multiple birth	6 (22.2)	7 (9.5)	1.0	

Table 10: Infant factors associated with readmission among term neonates

Variable	Re-admitted N=9 (%)	Not admitted N= 93 (%)	RR (95% CI)	P value
Mean weight at initial discharge (SD)	3114.4 (279.6)	3389.6 (463.9	-	0.006
Mean gestation age at birth in weeks (SD)	39.6 (1.7)	39.7 (1.4)	-	0.809
Sex of the infant				
Male	5 (55.6)	42 (45.2)	1.5 (0.4-5.1)	0.729
Female	4 (44.4)	51 (54.8)	1.0	
Mode of delivery				
Spontaneous vertex delivery	1 (11.1)	17 (18.5)	0.6 (0.1-4.3)	1.000
Caesarian section delivery	8 (88.9)	75 (81.5)	1.0	
Type of birth				
Singleton birth	8 (88.9)	91 (98.9)	0.2 (0-0.8)	0.171
Multiple birth	1 (11.1)	1 (1.1)	1.0	
Length of initial hospital stay				
Less than 24 hours	1 (11.1)	1 (1.2)	4.0 (0.1-137.0)	0.442
Between 24-48 hours	0	6 (7.4)	0	0.999
Between 48-72 hours	7 (77.8)	70 (86.4)	0.4 (0-4.1)	0.440

Parity, pregnancy complications and delivery complications were found to not be significant risk factors for readmission among both late preterm infants (Table 11) and term infants (Table 12).

Table 11: Obstetric Factors associated with readmission among late preterm infants

Variable	Re-admitted N=27 (%)	Not admitted N=75 (%)	RR (95% CI)	P value
Mean parity (SD)`	1.9 (1.0)	2.2 (1.8)	-	0.240
Pregnancy complication				
Yes	12 (44.4)	24 (32.0)	1.5 (0.8-2.8)	0.246
No	15 (55.6)	51 (68.0)	1.0	
Delivery complications				
Yes	4 (14.8)	6 (8.0)	1.6 (0.7-3.7)	0.449
No	23 (85.2)	69 (92.0)	1.0	
Scheduled follow up appointment				
At 2 weeks	2 (7.4)	3 (4.1)	1.5 (0.5-4.7)	0.610
At 6 weeks	25 (92.6)	70 (95.9)	1.0	

Table 12: Obstetric factors associated with readmission among term infants

Variable	Re-admitted N=9 (%)	Not admitted N=93 (%)	RR (95% CI)	P value
Mean parity (SD)`	1.8 (0.8)	2.1 (1.0)	-	0.242
Pregnancy complication				
Yes	2 (22.2)	22 (23.7)	0.9 (0.2-4.2)	1.000
No	7 (77.8)	71 (76.3)	1.0	
Delivery complications				
Yes	0	12 (12.9)	1.1 (1.0-1.2)	0.594
No	9 (100.0)	81 (87.1)	1.0	
Intended mode of feeding after discharge				
Breastfeeding	8 (88.9)	91 (97.8)	0.2 (0-1.4)	0.244
Bottle feeding	1 (11.1)	2 (2.2)	1.0	
Scheduled follow up appointment				
At 2 weeks	0	1 (1.1)	1.1 (1.0-1.8)	1.000
At 6 weeks	9 (100.0)	87 (98.9)	1.0	

MORBIDITY AMONG LATE PRETERM INFANTS AND TERM INFANTS

Late preterm infants were more prone to developing neonatal sepsis compared to term infants (24.5%. *P value <0.001*). They were also more prone to developing acute kidney injury (14.7% P value <0.001). Overall, 6 term infants were diagnosed with neonatal sepsis at readmission representing 5.9% of all term infants and 4.9% of all term infants had hyperbilirubinemia. These were the highest causes of morbidity among term neonates. Late preterm babies had greater feeding difficulties compared to term babies although not statistically significant. (Table 13) (Figure 3).

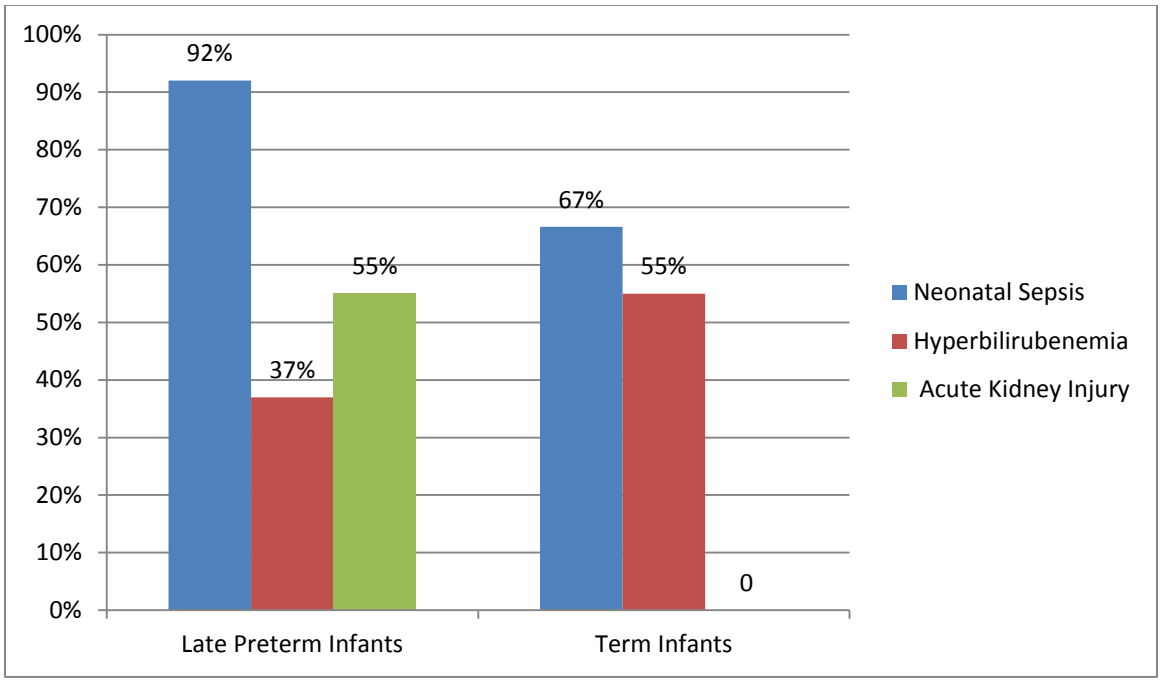
Late preterm infants were readmitted on average 4 days after initial hospital discharge compared to term infants who were readmitted 2 days after initial hospital discharge. *(P value 0.03).* However, late preterm infants had a longer duration of stay in the hospital with 55.5% of them staying in hospital for more than 7 days compared to 11.1% of term infants (P Value 0.005) (Table 13).

Table 13: Readmission Diagnosis and Length of stay of Preterm infants Vs Term Infants

	Pre-term N=102 (%)	**Term N=102 (%)**	**RR (95% CI)**	**P value**
Hyperbilirubinemia				
Yes	10 (9.8)	5 (4.9)	1.4 (0.9-2.0)	0.180
No	92 (90.2)	97 (95.1)	1.0	
Neonatal sepsis				
Yes	25 (24.5)	6 (5.9)	1.8 (1.4-2.3)	<0.001
No	77 (75.5)	96 (94.1)	1.0	
Acute kidney injury				
Yes	15 (14.7)	0	2.2 (0.9-2.5)	<0.001
No	87 (85.3)	102 (100.0)	1.0	

Feeding problems				
Yes	3 (2.9)	3 (2.9)	1.0 (0.4-2.3)	1.000
No	99 (97.1)	99 (97.1)	1.0	
Metabolic illness				
Yes	1 (1.0)	0	2.0 (1.8-2.3)	1.000
No	101 (99.0)	102 (100.0)	1.0	
Weight loss				
Yes	1 (1.0)	0	2.0 (1.8-2.3)	1.000
No	101 (99.0)	102 (100.0)	1.0	
Length of initial hospital stay				
48 or less hours	25 (26.3)	8 (8.9)	1.6 (1.2-2.0)	0.002
Greater than 48 hours	70 (73.7)	82 (91.1)	1.0	
Days from discharge to readmission	4.0 (2.0-5.0)	2.0 (1.5-4.5)		0.003
Length of stay during readmission				
< 7 days	11 (40.7)	8 (88.8)	0.6 (0.4-0.9)	0.005
>7 days	15 (55.55)	1 (11.1)	1.0	

Figure 3: Readmission Diagnosis. Late preterm infants Vs. Term Infants



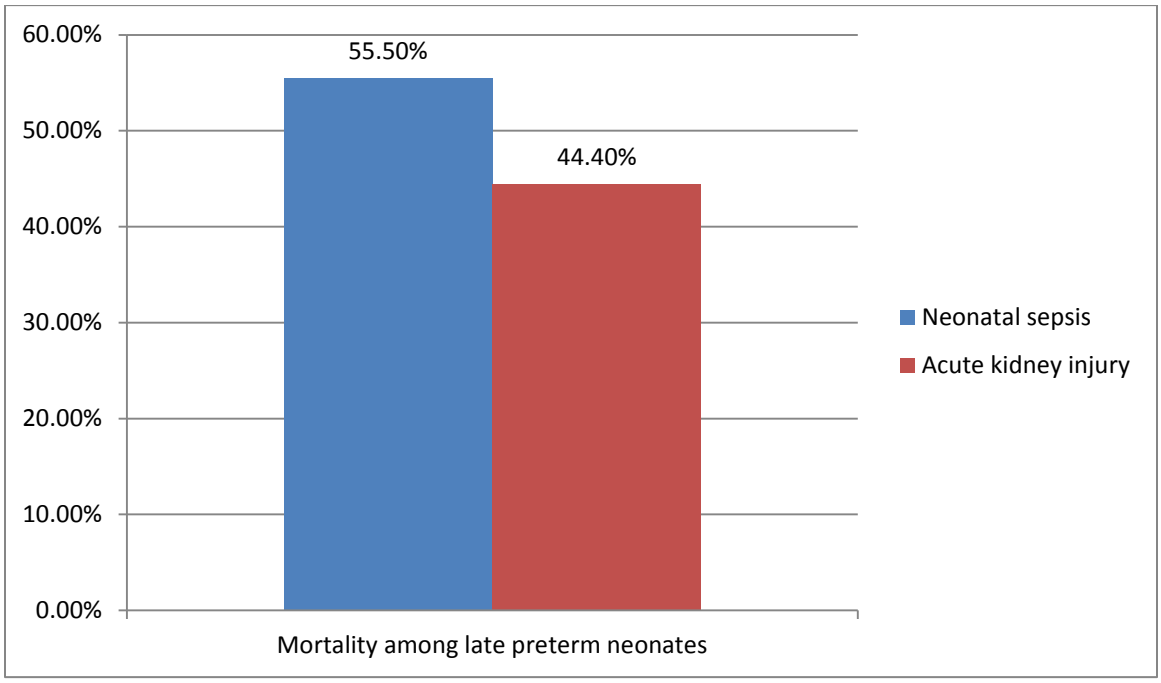
MORTALITY AMONG TERM INFANTS AND LATE PRETERM INFANTS

There were no mortalities among the term infants. Mortality occurred in 8.8% of all preterm infants (Table 14). This represented 33.33% of the readmitted late preterm infants with the most common cause of mortality being neonatal sepsis (Table 2) (Figure 4).

Table 14: Mortality among late preterm infants

Variable	Frequency (%)
Mortality	
Yes	9 (8.8)
No	93 (91.2)

Figure 4: Causes of mortality among late preterm infants



An interaction between readmission rates of late preterm infants and length of initial hospitalization was tested and found to be statistically significant. *(P value 0.07).* Multiple births among late preterm infants was also found to be a significant risk factor for readmission *(P value 0.04)* (Table 15)

Table 15: Multivariable analysis: Risk of readmission among preterm babies adjusted for multiple births and pregnancy complications

Variable	Adjusted OR (95% CI)	P value
Readmission	3.2 (1.4-7.4)	0.006
Length of initial hospitalization	1.07 (0.99-1.16)	0.070
Multiple births	5.2 (1.1-24.6)	0.040
Pregnancy complications	1.4 (0.7-2.7)	0.319

DISCUSSION

Our study set out to determine the prevalence of readmission of late preterm newborns compared to term newborns born at the Kenyatta National Hospital. We enrolled 113 study participants in each group but lost 8 study participants to follow up from each group

The overall readmission rate in late preterm infants was found to be 26.5% compared to 8.8% in the term neonates. (*P value 0.001. adjusted odds ratio: 1.7; 95% confidence interval: 1.3-2.2)*

This overall readmission rate was observed to be higher than that reported in similar selected cohorts in India whereby Sreelaxmi et al investigated the prevalence of readmission of late preterm infants compared to term infants. She found a readmission rate of 14% among late preterm infants and 5.5% among term infants.[42] Readmission rate of late pre terms infants was 6.3% according to Oddie et al[4] and 4.8% in Shapiro Mendoza et al study.

Available data on readmission of late preterm babies originates from developed countries, whereas what happens in developing countries is not well known**.** Our study found late preterm neonates were 1.7 more times likely to be readmitted compared to term infants. (Adjusted odds ratio: 1.7; 95% confidence interval: 1.3-2.2) This is similar to large study in the United Kingdom by Oddie et al where he found that infants born between 35 weeks gestation and 37 weeks' gestation were 1.7 times more likely to be readmitted during the neonatal period than those born between 38 weeks and 40 weeks' gestation (adjusted odds ratio: 1.7; 95% confidence interval: 1.2–2.6)[4]

However a retrospective cohort study by Escobar et al of all newborn infants after the initial birth hospitalization in 7 hospitals in Canada found that 4.4% of all late-preterm infants were readmitted during the first 14 days after discharge compared to 2.0% of infants born at or after 37 weeks' gestation. Late-preterm infants who had not been admitted to the NICU were at the highest risk of rehospitalization[3]. This differs significantly with our study findings although our time line was readmission within 6 weeks compared to readmission within two weeks in this study.

FACTORS ASSOCIATED WITH READMISSION

Globally several factors have been found to be associated with a higher risk of an observational hospital stay, hospital readmission, or severe illness among late preterm newborns. Late-preterm infants with an early discharge (<48 hours hospital duration) from the hospital after a vaginal delivery are at an increased risk of neonatal morbidity compared with term infants who are discharged early. Our study showed that among late preterm infants, those who stayed in hospital less than 48 hours during the initial hospitalization had significantly higher readmission rates compared to those with longer hospital stays. *(P value 0.05. RR: 0.4 95% confidence interval 0.5-3).* Short hospital stays were attributed to vaginal deliveries. Lactation is not properly established in late preterm infants resulting in feeding difficulties. Our findings differ from those of Oddie et al study done in the northern parts of UK where he found that early discharge was not associated with readmission of preterm infants. Its however important to note that in the UK, midwives have a mandatory obligation to visit, assess, and manage newborns at home after initial postpartum discharge regardless of the timing of discharge.

Our multivariate analysis also demonstrated a significant association between length of initial hospitalization duration and the risk for readmission *(P value 0.070. RR 1.07. 95% Confidence interval 0.99-1.16).* Each additional length in stay was shown to be associated with a reduced likelihood of late preterm readmission. Additional stay was due to Caesarian delivery with discharge being 96 hours on average after delivery. This interaction between length of stay and mode of delivery may reflect an intersection of increased level of support (e.g. increased nursing care). Additional factors that were significantly associated with readmission among late preterm infants were multiple births (*P value 0.04. RR 5.2. 95% Confidence interval 1.1-24.6*)

Other components have been identified to be associated with readmission among late preterm infants including breast feeding and maternal complications during pregnancy and delivery. In a population-based cohort study in various Massachusetts hospitals of healthy of singleton late-preterm infants delivered vaginally between 1998 and 2002 it was found that 6.1% received hospital care after the birth hospitalization or died during the neonatal period. Risk factors for requiring hospital care or experiencing morbidity included being the first born child, being breastfed at discharge and having a mother who had labor and delivery complications.

In our study, we found no significant correlation between breast feeding, maternal pregnancy and delivery complications and birth order with hospital readmission. Breastfeeding was the mode of feeding chosen by 99% of mothers of term infants and 98% of care givers of late preterm infants. Maternal delivery complications resulted in longer duration of the birth hospitalization.

Maternal factors such as marital status, level of education and the household income were not significant factors for readmission among late preterm infants. However, among term infants, those born to single mothers had a higher readmission rate *(P value 0.03*) compared to those born to married mothers. This may be attributed to social support given to a mother after birth

The mode of delivery was also not a significant risk factor in our study. The rates of Caesarian births were high in both groups. Caesarian section births attributed to 75% of all late preterm births and 82.2% of term infants births. This may be attributable to KNH being a National Referral Hospital with complicated deliveries being referred for caesarian births.

CAUSES OF MORBIDITY AND MORTALITY

We observed neonatal sepsis as the most common morbidity among both the late preterm and term neonates. Of all late preterm neonates 25 were readmitted with neonatal sepsis compared to only 6 term neonates. *(P value <0.001. RR 1.8. 95% adjusted confidence interval 1.4-2.3)*. These 25 neonates represent 92.5% of the late preterm babies who were readmitted whereas 66.6% of the readmitted term babies had sepsis. This differs to the Sreelaxi et al study which reported Neonatal sepsis in 52.4% of late preterm infants. Wang et al and Raju et al studies found neonatal sepsis in 31.3% & 16% of late preterm & term infants respectively. This difference may be attributed to poor knowledge instilled in mothers upon discharge on identification of neonatal sepsis danger signs. Although outside the scope of this study, it was noted that no information was given to care givers regarding cord care and identification of neonatal sepsis danger signs.

Acute Kidney injury also occurred in 55.5% of the late preterm neonates. *(P value <0.001 RR 2.2, 95% adjusted confidence interval 0.9-2.5).*This could be attributable to both Neonatal sepsis and feeding difficulties seen in these babies due to prematurity. Early discharge could also lead to feeding problems as these mothers may not have significant knowledge in breast feeding practices.

Hyperbilirubinemia with levels requiring phototherapy occurred in 55.5% of all term neonates who were readmitted and in 37% of the late preterm infants. This differed from Sreelaxmi's study where 76.7% of late preterm babies were admitted with jaundice where as 26% of term babies had jaundice. Tomashek et al study also reported hyperbilurubinemia in77.1% of late pre terms. This variation may be due to later discharge in our setting. Babies born vaginally are discharged before 48 hours and therefore jaundice noted within this time can be investigated and treated. In India, neonates born vaginally are discharged within the 1st 24 hours of life hence jaundice occurring after this may be missed and the neonates readmitted later. Jaundice was severe to require an exchange transfusion in one of the term neonates

Late preterm infants were admitted on average 4 days after the initial hospital discharge compared to term infants who were readmitted on average 2 days after discharge. This may be attributed to presence of physical signs in term infants with hyperbilirubemenia who may have yellow skin and conjunctiva compared to non-specific signs and lack identification of danger signs of sepsis. Identification of physical signs prompts earlier health seeking behaivours.

Late preterm infants had a longer duration of stay in the hospital during readmission with 55.5% of them staying in hospital for more than 7 days compared to 11.1% of the term infants (P value 0.005%). This could be attributed to more severe disease and co-morbidities among late preterm infants.

Mortality rate among late preterm neonates was 8.8% with the most common cause being neonatal sepsis. Mortality rate as per Raju et al study was 5.2% with the most common cause also being sepsis

CONCLUSIONS

The prevalence of readmission of late preterm infants is 26.5% while that of term infants is 8.8%

Late preterm infants are 1.7 times more likely to be readmitted compared to term infants

Risk factors for readmission among late preterm neonates include early discharge while term infants born to single mothers had a higher readmission rate compared to those born by married mothers

The most common morbidity among both groups was Neonatal Sepsis with Acute Kidney injury also very common among late preterm neonates

The mortality rate was 8.8% in the late preterm group while there was no mortality among the term neonates. The most common cause of mortality was Neonatal Sepsis.

STUDY LIMITATIONS

It is acknowledged that some study participants were unreachable during the follow up phone calls. To minimize this, patients were followed up on phone calls until they respond with a maximum of 3 attempts per day for 2 days in a given week. When this failed, I then attempted to get in touch with the patients using an alternative phone number if one had been provided by the parent/Guardian. Some participants also provided us with wrong contact information and we could not contact them

The study also depended on the willingness of participants to provide adequate and truthful information during the follow up phone calls.

KEY RECOMMENDATIONS

Hospital discharge of late preterm neonates should be delayed and a full assessment done before discharge to identify any morbidities.

Mothers of late-preterm infants should be educated on how to evaluate feeding success and to assess for danger signs of sepsis.

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APPENDICES

Appendix 1: INITIAL HOSPITAL ADMISSION QUESTIONNAIRE

STUDY TITLE: The prevalence of readmission rates of late preterm born in Kenyatta National Hospital

The Principal Investigator: Dr. Lily Kaguongo

Department of Paediatrics and Child Health

Mobile no: 0725507582

Email: kaguongolily@gmail.com

Introduction

1. The questionnaire that follows contains 22 questions
2. Participant are not required to fill in their names
3. The responses given herein are confidential
4. Ask for clarification where needed
5. The interview will take approximately 15 minutes

Instructions

1. *One questionnaire will be administered to one participant*
2. *The investigator will seek written consent prior and attach consent form to the questionnaire*
3. *The responses will be filled in by the investigator*

1. Date:

   _____/_____ /_____

2. Reference no:

   _____

3. Mobile no

   _____

4. Alternative mobile no

   _____

5. Maternal age:

   _____ Years

6. Marital status
   a. Married
   b. Single
   c. Divorced
   d. Widowed
   e. Others _____

7. Parity:

   _____

8. Gravity:

   _____

9. Date of Last Menstrual Period

   _____ /_____ /_____

10. Level of Education:
    a. Primary Level
    b. Secondary Level
    c. University Level

11. Household Total income:
    a. Less than Kshs 20,000
    b. Kshs 20,001 – 50,000
    c. More than Kshs 50,000

12. Infants Date of birth:

_____ / _____ / _____

13. Infants gestational age (by dates) at time of birth:

_____ Weeks _____ Days

14. Infants age using New Ballard Scoring System:

_____ Weeks _____ Days

15. Sex:
    a. Male
    b. Female

16. Infant Birth Weight:

_____ Grams

17. Mode of Delivery:
    a. Spontaneous Vertex Delivery
    b. Caesarian Section Delivery
        i. Elective Caesarian Delivery
        ii. Emergency Caesarian Delivery

18. Type of birth
    a. Singleton birth
    b. Multiple birth

19. Birth Order:

_____

20. Pregnancy complications:
    a. Diabetes
    b. Hypertension
    c. Cardiac disease
    d. Asthma
    e. Ante Partum Haemorrhage
    f. Premature Rupture Of Membranes

g. Others. _____

21. Delivery complications
    a. Post-Partum Haemorrhage
    b. Cervical tear
    c. Others _____
22. Intended mode of feeding after discharge
    a. Breastfeeding
    b. Bottle feeding
    c. Both
23. Scheduled follow up appointment:
    a. At 2 weeks
    b. Between 2 – 4 weeks
    c. Between 4 – 6 weeks
    d. At 6 weeks

***Appendix 2:*FOLLOW UP QUESTIONAIRRE**

STUDY TITLE: The prevalence of readmission rates of late preterm infants born in Kenyatta National Hospital

The Principal Investigator: Dr. Lily Kaguongo

Department of Paediatrics and Child Health

Mobile no: 0725507582

Email: kaguongolily@gmail.com

Introduction

1. The questionnaire that follows contains 11 questions.
2. Participants are not required to fill in their names.
3. The responses given herein are confidential.
4. Ask for clarification where needed.
5. The interview will be over the phone and will take approximately 15 minutes.

Instructions

1. *One questionnaire will be administered to one participant with a similar reference number to a corresponding "initial hospital admission" questionnaire*
2. *The questionnaire will be administered over a phone call with the investigator asking the questions*
3. *The responses will be filled in by the investigator*

1. Reference No:

   _____

2. Date of discharge:

   _____/_____/_____

3. Weight at initial hospital discharge:

   _____ Grams

4. Length of initial hospital stay:
   a. Less than 24 hours
   b. 24 – 48 hours
   c. 48 – 96 hours
   d. Greater than 96 hours
5. Mode of feeding after discharge:
   a. Breastfeeding
   b. Bottle feeding
   c. Both
6. Readmission date:

   ____/_____/_____

7. Readmission weight:

   _____ Grams

8. Hospital where Readmitted:

   _____

9. Readmission diagnosis:
   a. Hyperbilirubinemia
   b. Neonatal sepsis
   c. Acute kidney injury
   d. Feeding problems
   e. Metabolic illness _____
   f. Injury _____
   g. Respiratory illness
   h. Weight loss
   i. Acute diarrheal diseases

j. Others _____

10. Length of hospital stay during readmission

_____ Days

11. Mortality

a. Yes

b. No

Name and Signature of Person administering the questionnaire

Name: _____ Signature: _____

Appendix 3:THE NEW BALLARD SCORING SYSTEM

Assessment of gestational age can be made postnatally by the New Ballard Scoring system which was developed by Dr. Jeanne L. Ballard. It is based on neurological and physical maturity to assign gestational age accurately

Appropriate time: for neonates >26 weeks gestational age (by dates), it can be performed 30 minutes - to 96 hours, ideally within 24 hours.

Interpretation:

For scores between numbers on the grid, we interpolate as follows:

25 = 34 weeks

26 = 34 weeks

27 = 34 weeks

28 = 35 weeks

29 = 35 weeks

30 = 36 weeks

Record only completed weeks of gestation and not partial weeks.

If weeks by dates fall within 2 weeks of KNOWN maternal dates, preferably confirmed by early ultrasound, then the maternal dates are more likely correct.

If weeks by dates are greater than 2 weeks outside of maternal dates in either direction, then the clinical gestational assessment is more likely corr

MATURATIONAL ASSESSMENT OF GESTATIONAL AGE (New Ballard Score)

NAME _____ SEX _____
HOSPITAL NO. _____ BIRTH WEIGHT _____
RACE _____ LENGTH _____
DATE/TIME OF BIRTH _____ HEAD CIRC _____
DATE/TIME OF EXAM _____ EXAMINER _____
AGE WHEN EXAMINED _____
APGAR SCORE: 1 MINUTE _____ 5 MINUTES _____ 10 MINUTES _____

NEUROMUSCULAR MATURITY

NEUROMUSCULAR MATURITY SIGN	SCORE							RECORD SCORE HERE
	-1	0	1	2	3	4	5	
POSTURE								
SQUARE WINDOW (WRIST)	 >90°	 90°	 60°	 45°	 30°	 0°		
ARM RECOIL		 180°	 140 - 180°	 110 - 140°	 90 - 110°	 <90°		
POPLITEAL ANGLE	 180°	 160°	 140°	 120°	 100°	 90°	 <90°	
SCARF SIGN								
HEEL TO EAR								
							TOTAL NEUROMUSCULAR MATURITY SCORE	

SCORE
Neuromuscular _____
Physical _____
Total _____

MATURITY RATING

SCORE	WEEKS
-10	20
-5	22
0	24
5	26
10	28
15	30
20	32
25	34
30	36
35	38
40	40
45	42
50	44

GESTATIONAL AGE (weeks)
By dates _____
By ultrasound _____
By exam _____

PHYSICAL MATURITY

PHYSICAL MATURITY SIGN	SCORE							RECORD SCORE HERE
	-1	0	1	2	3	4	5	
SKIN	sticky friable transparent	gelatinous red translucent	smooth pink visible veins	superficial peeling &/or rash, few veins	cracking pale areas rare veins	parchment deep cracking no vessels	leathery cracked wrinkled	
LANUGO	none	sparse	abundant	thinning	bald areas	mostly bald		
PLANTAR SURFACE	heel-toe 40–50 mm: -1 < 40 mm: -2	>50 mm no crease	faint red marks	anterior transverse crease only	creases ant. 2/3	creases over entire sole		
BREAST	imperceptible	barely perceptible	flat areola no bud	stippled areola 1–2 mm bud	raised areola 3–4 mm bud	full areola 5–10 mm bud		
EYE / EAR	lids fused loosely: -1 tightly: -2	lids open pinna flat stays folded	sl. curved pinna; soft; slow recoil	well-curved pinna; soft but ready recoil	formed & firm; instant recoil	thick cartilage ear stiff		
GENITALS (Male)	scrotum flat, smooth	scrotum empty faint rugae	testes in upper canal rare rugae	testes descending few rugae	testes down good rugae	testes pendulous deep rugae		
GENITALS (Female)	clitoris prominent labia flat	prominent clitoris & small labia minora	prominent clitoris & enlarging minora	majora & minora equally prominent	majora large minora small	majora cover clitoris & minora		
							TOTAL PHYSICAL MATURITY SCORE	

reference
ballard a, khoury jc, wedig k, et al: new ballard score, expanded to include extremely premature infants. j pediatr 1991; 119:417-423. reprinted by permission of carolard and wedig—year book, inc.

Appendix 4:EXPLANATION FORM AND CONSENT FOR PARENT/GUARDIAN

Study title

Prevalence of readmission rates of late preterm infants compared to term infants in KNH

PART I: Information Sheet

Introduction/ Purpose of the study

My name is Dr. Lily Kaguongo from the University of Nairobi, Department of Paediatrics and Child Health. I am conducting a study to determine the rates of readmission of late preterm infants and term infants.

Participant selection

I am inviting any mother who has had an uncomplicated delivery and is due for discharge and has a mobile phone to participate in this research. You are requested to participate in the study because your child meets the qualification to be included in my study.

Voluntary Participation/Participants rights and roles

Your participation in the study is voluntary and you are free to withdraw from the study even after recruitment without any consequences

Procedure

Once you agree to participate in my study, I will ask you some questions using two questionnaires. The 1st questionnaire will be administered during the initial hospital admission. I will do a clinical examination and measure the weight of your baby. After you and your baby are discharged, I will then follow you up with a weekly phone call and administer a second set of questions and record them on the 2nd questionnaire.

Confidentiality

Neither your child's name or your name or contact details will appear on the questionnaire. Instead the questionnaires will have serial numbers. The form containing your information will be kept in a locked cabinet and I will be the only person with access to the cabinet. The information that will be obtained from the research will be used strictly for research purposes. All the information obtained during the research will be kept confidential to everyone who will participate in it

Benefits and Reimbursements

If you participate in this research, there will be follow up on you and the newborn for the next six weeks by the doctor and you can have any queries and concerns attended to during this period and be advised accordingly. There will however be no monetary compensation and we will not be responsible for your mobile phone charges. The findings obtained will be important for the management of late preterm infants and term infants and will be used by health care providers and policy makers.

Risks

Participation in this study will not put you and your baby in danger.

In case of any questions:

If you have any questions regarding the study, feel free to contact me or any of my supervisors or the Chairman of the KNH/UON Ethics and Research committee on Tel: 72630 , Ext: 44102

Principal Investigator: Dr. Lily Kaguongo 0725507582

Supervisors: Dr. Florence Murilla, Dr. Daniel Njai, Professor Dalton Wamalwa

Department of Paediatrics and Child Health,

University of Nairobi.

PART II: Certificate of Consent

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to have my child and I participate in this research.

Name of Parent/Legal Guardian: _____

Signature/ thumbprint of Parent/ Legal Guardian: _____

Date: _____

Day/month/year

Statement by person taking consent:

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:

1.

2.

3.

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Name of person taking the consent: _____

Signature of person taking the consent:_____

Date: _____

Dr. Lily N. Kaguongo

Signature _____

Date _____

Appendix 5:**KIELELEZO KWA WAZAZI NA IDHINI KUSHIRIKI KATIKA UTAFITI (KISWAHILI)**

Swala kuu la utafiti:

Kiwango cha kuwapokea tena hospitalini watoto wachanga wasiofikisha muda wa kuzaliwa.

Jina langu ni Dr. Lily Kaguongo kutoka Chuo Kikuu cha Nairobi, Idara ya Paediatrics na Afya ya Watoto.

Nafanya utafiti kuchunguza kiwango cha kuwapopokea tena hospitalini watoto wachanga waliozaliwa kabla ya kufikisha muda wa kuzaliwa wakilinganishwa na wale waliozaliwa wakati wameatimisha muda wa kuzaliwa

Unaulizwa ushiriki katika utafiti kwa sababu mtoto wako anahitimu

Utafiti huu unahitaji nikuulize maswahili mwanzo na baada ya kupewa ruhusa ya kwenda nyumbani, nitakupigia simu mara moja kila wiki na kuuliza maswali mengine

Taarifa na matokeo yote yatawekwa siri.

Ushiriki wako katika utafiti huu ni wa hiari na uko huru kutoka hata baada ya kuajiri bila matokeo.

Taarifa zitakazopatikana katika utafiti zitakuwa na umuhimu katika matibabu ya watoto wote wachanga wanaozaliwa kabla ya kuatimiza muda wa kuzaliwa. Taarifa hii itatumiwa na watunga sera na wahuduma wa afya peke yake

Kama una jambo la kimaadili kuhusiana na utafiti, unaweza wasiliana na mweyekiti wa kamati ya maadili na utafiti katika KNH, simu 726300, upanuzi 44355

Mpelekezi Mkuu: Dr. Lily Kaguongo

Wasimamizi: Dr Florence Murilla, Dr. Daniel Njai

Idara ya Pediatrics na Afya ya watoto

Chuo Kikuu cha Nairobi

IDHINI

Nimesoma ama nimesomewa juu ya utafiti huu.

Mimi …….. nimeelewa maana na jinsi utafiti huu utakavyofanywa. Nimepeana idhini ya mtoto wangu/ mtoto ninayemsimamia kushiriki

Sahihi ……. Tarehe
……

Kuchapa Kidole …….. Tarehe
……

Sahihi (Shahidi) …….. Tarehe
……

Appendix 6: **STUDY BUDGET**

NAME OF THE ITEM	COST OF EACH ITEM	NUMBER OF ITEMS NEEDED	TOTAL COST
Pens	Ksh 10	5	Ksh 50
Printing questionnaires and consent forms	Ksh 10	1605	Kshs 16,050
Lamination of ballard score sheets	Kshs 20	5	Kshs 100
Mobile phone	Ksh 10,000	1	Kshs 10,000
Airtime			Kshs 5,000
Statistician			Kshs 16,000
Ethics Committee KNH			Kshs 2,000
Dissemination costs	Ksh 6000		Kshs 6000
GRAND TOTAL			Kshs 55,200

Source of funds: Personal Savings.

Appendix 7: **TIME LINES/ GANTT CHART (Time in months: Nov 2016 – Feb 2018)**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Proposal writing																
Submission to Ethics																
Data Collection																
Data analysis																
Report Writing																
Presentation of Results																