DETERMINANTS OF PNEUMONIA ASSOCIATED READMISSIONS AMONG CHILDREN AGED UNDER FIVE ADMITTED AT KENYATTA NATIONAL HOSPITAL

By

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DECLARATION

I, Beatrice declare that this Study on Determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital is my original work and has never been presented for an academic award in any other University or institution of higher learning.

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CERTIFICATE OF APPROVAL

We the undersigned certify that, this research has been submitted for the degree of Masters in Science nursing (Paediatric nursing), of the University of Nairobi under our supervision and approval.

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DEDICATION

I dedicate this work to my family. Thank you for the love and care.

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I wish to acknowledge and sincerely thank my supervisors Dr. Eunice A. Omondi and Dr. Emmah K. Matheka for their effective guidance, supervision and expert advice as I undertook this research work. I also wish to acknowledge the caregivers of children aged under five admitted with pneumonia in KNH's Pediatric Unit who participated in this study hence making it a success. I am also thankful to Kenyatta National Hospital for allowing me to carry out the study in the facility. My regards also go to my family for its unwavering support. I also wish to appreciate my colleagues for their moral support and encouragement throughout the study period.

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ABBREVIATIONS AND ACRONYMS

ARI	Acute Respiratory Infections
CAP	Community-Acquired Pneumonia
COPD	Chronic Obstructive Pulmonary Disease
ICU	Intensive Care Unit
KDHS	Kenya Demographic and Health Survey
GAPPD	Global Action Plan for Pneumonia and Diarrhoea
GVAP	Global Vaccine Action Plan
Hib	Haemophilus Influenzae Type b
HIV	Human Immunodeficiency Virus
HRR	Hospital readmission rate
KNH	Kenyatta National Hospital
LRI	Lower Respiratory Infections
SDGs	Sustainable Development Goals
SPSS	Statistical Package for Social Science
UNICEF	United Nations International Children's Fund
US	United States
WHO	World Health Organization

OPERATIONAL DEFINITIONS

Under five children refers to all children aged below 5 years, including neonates, rehospitalized with pneumonia at KNH.

Patient related determinants are factors related to the individual under five children that may be associated with them being diagnosed with pneumonia.

Caregivers related determinants are factors related to the caregivers of the children aged under five that may be associated with occurrence of pneumonia among the under five children.

Environmental related determinants: are the factors related to the children's household socio-setting that may be associated with occurrence of pneumonia among the children aged under five.

Health system related determinants: are factors related to nature of care and health institutions' aspects that may be associated with occurrence of pneumonia among the children aged under five.

Hospital readmission refers to subsequent admission(s) at Kenyatta National Hospital within a specified period after the initial hospitalization.

Pneumonia associated readmissions refers to rehospitalizations among the study group attributable to pneumonia.

ABSTRACT

Background: Pneumonia, according to WHO, is the leading single cause of mortality in children worldwide, accounting for 16% of all deaths of under five children globally, with 95% of these episodes occurring in developing countries. Despite gains made in the management of pneumonia, pneumonia readmissions among under five children still remain high, exerting a huge burden on health care systems of many countries, Kenya included.

Study objective: This study assessed the determinants of pneumonia associated readmissions among children aged under five admitted at KNH.

Study design and site: This was a hospital based descriptive cross sectional study. The study was conducted in the Pediatric Unit of Kenyatta National Hospital.

Participants and methods: Study population was caregivers of children aged under five readmitted with pneumonia in KNH's Pediatric Unit. The study sample size comprised of 165 caregivers selected using census method. A validated researcher-administered questionnaire was used to collect the data. In data analysis, quantitative data was analyzed using descriptive statistics using the Statistical Package for Social Sciences version 23. Association between the variables was estimated using chi square statistics at a significance level of 5%. The study results were presented in tables, graphs and charts.

Results: The patient related determinants of pneumonia associated readmissions among under five children admitted at KNH included - younger age (of ≤2 years) ($p = 0.016$); inadequate nutritional status ($p = 0.007$); having not been exclusively breastfed in the first six months ($X^2 = 5.797$, $df = 1$, $p = 0.015$) and having other pre-existing illnesses ($p = 0.023$). The caregiver related determinants of pneumonia associated readmissions among under five children admitted at KNH included - low education level ($p = 0.018$); low household monthly income level ($p = 0.029$); lack of training on handling domestic/indoor smoking ($p = 0.012$) and lack of awareness about the signs and symptoms of pneumonia in children prior to the current admission ($p = 0.006$). The environmental related determinants of pneumonia associated readmissions among under five children admitted at KNH included - use of firewood, kerosene and charcoal as the main kinds of fuel for cooking ($p = 0.013$); inadequate house ventilation ($p = 0.014$) and living with domestic animals in the same house ($p = 0.017$). The health system related determinants of pneumonia associated readmissions among under five children admitted at KNH included - congestion in hospital's children wards ($p = 0.025$); previous discharge before full recovery (, $p = 0.009$) and low/poor quality of care offered to pediatric pneumonia patients ($p = 0.012$).

Conclusion: There was a wide range of patient, caregiver, environmental and health system related determinants of pneumonia associated readmissions among under five children admitted at KNH.

Recommendations: There should be awareness creation programs, at hospital and community levels, to enlighten caregivers, their households and communities on various patient, caregiver and environment factors that contribute to pediatric pneumonia incidences and possible ways of mitigating them. Further, policy makers should institute necessary local and national policy to decongest pediatric wards in the country.

CHAPTER ONE: INTRODUCTION

This chapter introduces the topic under study by providing the study background, problem statement, and reasons for the research, research questions and the research objectives.

1.1 Background of the Study

Pneumonia is a form of acute respiratory infection marked by inflammation of the lungs (Shah, Bachur, Simel & Neuman, 2017). This respiratory infection leads when it comes to children mortality rates globally (Leung, Chisti & Pavia, 2016). The World Health Organization (WHO) notes that pneumonia is responsible for 16% of children deaths younger than five, mostly in developing countries (WHO, 2019). According to WHO data, pneumonia killed about 809,000 children in 2017 translating into approximately 2,216 children a day in 2017 (WHO, 2018). According to the WHO Child Health Epidemiology Reference Group data the medium occurrence of clinical pneumonia among children was estimated to be 0.28 attacks per child annually. This means that there are 150.7 million new cases of clinical pneumonia annually. Of these 7-13% which represent 11 to 20 million cases are said to be fatal or life-threatening and require hospital admission.

As documented by WHO ninety-five percent of all child clinical pneumonia cases happen in developing nations. The ones leading in pneumonia episodes and deaths are nations found in South Asian and the Sub-Saharan regions (WHO, 2019). Kenya is ayt number 15 among the nations that have the highest pneumonia caused deaths among children. The mortality rate due to pneumonia among Kenyan children is said to be 47.6 for every 10,000 children who are aged below five (KDHS, 2018). Pneumonia has been documented as the second leading reason for mortality among Kenyan children who are younger that five and it leads to 16% of the deaths among the children (Kimani-Murage & Mutua, 2018).

The causes of Pneumonia include fungi, viruses and bacteria. The most well known cause of bacteria pneumonia among young babies is streptococcus pneumonia. The second known cause is Haemophilus influenza type b (Hib). When it comes to viral

pneumonia the most common cause is the respiratory syncytial virus. Among children with HIV, the most popular pneumonia cause is Pneumocystis jiroveci. This cause is said to cause a quarter of all the pneumonia related deaths among HIV-positive children (Kallander, Burgess & Qazi, 2016). Some of the notable risk factors for infant pneumonia for toddler in the (≤ 2 years) bracket include, poor nutrition, lack of safe water and sanitation, pre-existing illnesses, compromised immune system, indoor air circulation, smoking parents, living in crowed places and in ability to access health facilities (Shah *et al*., 2017). The clinical presentation of pneumonia in toddlers below the age of five is difficulty in breathing, cough and these can be accompanied with fever or no fever. Another notable presentation is the drawing of the chest wall when the child is inhaling or the observation of fast breathing in the child. In case the child has viral pneumonia he or she may experience wheezing. If the child is several ill they may have a hard time feeding or drinking anything and they may convulse, become unconsciousness or have hypothermia (Bennett, 2018).

In an effort to reduce occurrence of pediatric pneumonia, the WHO members who are 194 in number came up with the Global Vaccine Action Plan (GVAP) in 2012. This was a commitment to ensure every child gets the crucial immunization and the target DTP3 vaccination coverage was targeted at 90% among the 194 countries by the end of 2015. However, in early 2016, the WHO warned that 5 of the 6 targets contained in the Global Vaccine Action Plan, including the DTP3 coverage target, were nothing to write home about. The only target that showed some progress was the use of under-utilized vaccines, particularly the pneumococcal vaccine (WHO, 2016). According to the WHO, Hib vaccine is available in all the WHO country members. The countries that had taken up to 3 doses of the vaccine was said to be at 64% although there were variations in the regions (WHO, 2016). In the Americas and Western Europe, Hib vaccine coverage was estimated at 90%, 25% and 56% in the Western Pacific and the South-East Asia Regions respectively. The African region was observed to have less than 20% coverage. The Pneumococcal vaccine is said to be available in 128 nations by 2015 while the coverage of this vaccine in the Sub-Saharan region was said to be about 28% (WHO, 2016).

In addition, the Global Action Plan for Pneumonia and Diarrhea (GAPPD) was taken up by both WHO and UNICEF. The action plan was meant to control and reduce the mortality rates caused by pneumonia to less than 3 children in every 1000 live births. This target was meant to be achieved by 2025 (Levy & Cohen, 2019). The GAPPD is made up of notable interventions that have been used and noted to effectively control the health of children, prevent illnesses and also efficiently treat those found to suffer from pneumonia and diarrhea (Zar, 2016). The GAPPD integrated approach aims to achieve pneumonia control through the use of several measures that are meant to treat, protect and prevent pneumonia in toddlers.one of the notable measures that has been greatly encouraged is exclusive breastfeeding children below and at six months. Other notable measures include use of enough complementary foods to feed the child once he or she reaches six months and above, the use of vaccinations, vitamin A supplementation, drinking safe water, promoting hand washing and encouraging the use of soap, reducing air pollution in homes, prevention of the spread of HIV and the use of co-trimoxazole prophylaxis for children infected with HIV or those exposed to a high risk of contracting HIV and also promptly treating pneumonia which ensuring children suffering from pneumonia can access the right care, to reduce preventable deaths (Rudan *et al*., 2018).

Although great efforts have been made to reduce the mortality rates among children, death caused by pneumonia among children aged under five years old still remain high and the burden from pneumonia continues to be significant in different countries (Hong, Choi & Park, 2017). Since there have been projected rise in deaths from pneumonia related causes such as smoking, poor air circulation, poor nutrition and the use of alcohol, it may become extremely hard for nations to reduce these deaths. Additionally, the progress made on the reduction of other infectious diseases cannot be compare to pneumonia as the latter has not had as much progress (McCollum *et al*., 2016). Since many countries are not taking significance action when it comes to pneumonia reduction, this can prevent their achievement of the 2030 health related goal in line with the new Sustainable Development Goals (SDGs) (Fischer, 2019).

For most of these nations pneumonia is the greatest challenge and the key barrier in the reduction of child mortality rate to about 25 deaths for every 1000 live births. It is also a major hurdle in the reduction of the communicable disease burden, improve access to vaccines, effective medicine and quality healthcare for all, as envisioned by SDG 3 (Jahan & Rahman, 2018). There's need for countries to come up with effective pneumonia control measures to reduce the risks of contracting the disease and also ensure the intervention adapted are cost effective when it comes to treating, preventing and diagnosing pneumonia more so in toddlers. Since pneumonia control in most of the vulnerable population is precise, there is hope that this can help in the achievement of the global health goals (Leung *et al*., 2016).

Hospital readmission rate (HRR) has been recognized as a measure and indicator of quality of care in paediatric healthcare services. Hospital readmission is defined as subsequent admissions within a specified period after the initial hospitalization. Pneumonia is one of the major causes of admission for children and readmission is not uncommon (Hong *et al*., 2017). Studies conducted in the United States showed that paediatric pneumonia HRRs ranged between 17% and 25% within 30 days of discharge (Zuckerman *et al*., 2016; Birmingham & Oglesby, 2018) while in Europe the rates are estimated to range between 7% and 29% (Zhang *et al*., 2016). Similar high rates of hospital readmission of children with pneumonia have also been reported in the Middle East region with estimates of paediatric pneumonia HRRs ranging between 21% and 35%. Even higher rates of paediatric pneumonia HRRs, ranging between 25% and 44% are prevalent in most of Sub-Saharan Africa (Brown *et al*., 2014). Hospital readmissions are not encouraged as they expose the readmitted person to hospitalization diseases, they area disruption to the patient and their families and they are also expensive as they take up a large percentage of healthcare costs. It has also been argued that hospital readmissions are associated with unfavorable patient outcomes and also deny other patients the opportunity to be equally served. Therefore, identifying factors associated with the high incidences of paediatric pneumonia re-admissions would help guide efforts to prevent them (Clarke, 2014).

According to Jahan and Rahman (2018), it is essential that the hospital and patient traits that are related to children admission to be identified especially among children previously treated for pneumonia. This will help come up with targeted interventions that can lower or eliminate readmissions among these patients. Given that pneumonia is a major cause of children hospitalization and after discharge readmission, identifying effective strategies to prevent these readmissions, may lead to quality of care improvement (McCollum *et al*., 2016). This is because early identification of pediatric pneumonia patients who have a high risk of being readmitted can help prevent reoccurring episodes of the disease and can also reduce the occurrence of other chronic illnesses. In addition, focusing on the needs of the noted patients can lead to more targeted and responsive health interventions and systems for the pediatric pneumonia patients (Zuckerman *et al*., 2016). Understanding the factors behind the high readmission rates amongst pneumonia pediatric patients forms the first critical step towards reducing these readmissions (Campione, Smith & Mardon, 2017).

In a study conducted at Kenyatta National Hospital (KNH), Jackson *et al*. (2013) opined that KNH being the leading public referral hospital in the country and the region received the highest number of pneumonia cases - majority of which were severe cases. Existing evidence from the hospital also indicates that there is high readmission rate amongst the pneumonia patients admitted at its Pediatric Unit (KNH Pediatric Records, 2019). However, there has been no study done at the facility to establish the factors associated with the high pneumonia readmission rates among pediatric patients in the hospital's Pediatric Unit, hence necessitating this study.

1.2 Statement of the Problem

In Kenyatta National Hospital Pediatrics Wards, the number of children seen with pneumonia has been on the rise over the last five years, as shown in Table 1.1.

Table 1.1 Pediatric pneumonia incidences at Kenyatta National Hospital

Time period	2014 - 2018	2009 - 2013
Average annual number of children admitted to	760	640

KNH's Pediatric Wards with pneumonia		
Proportion of pneumonia pediatric patients to the total pediatric patients admitted in the hospital	63%	52%

Source: KNH Health Information Systems Report, 2018/19

Similarly, the number of hospital readmissions among pneumonia pediatric patients at KNH has been on a steady rise and at worryingly increasing proportions as clearly illustrated by statistics shown in Table 1.2.

Table 1.2 Pneumonia paediatric patients' readmission rates at Kenyatta National Hospital

	May 2019	June 2019	July 2019	August 2019	September 2019	October 2019
Number of readmissions among pediatric patients whose index hospitalization cause was pneumonia	61	72	84	78	86	94
Remark	This represents a 54.1% rise in the incidence of pneumonia pediatric patients' readmission rates over the last 6 months period					

Source: KNH Health Information Systems Report, 2018/19

If left unattended, this trend risks reversing the gains made in children health outcomes in the country in turn jeopardizing the country's ability to realize the health based SDGs and Vision 2030. The reasons for the high readmission rates among pneumonia pediatric patients in the hospital, despite availability of effective pneumonia vaccine and treatment, are not clear. To address this existing research gap, this study will seek to determine the factors associated with high pneumonia

readmission rates among children aged under five admitted in the Pediatric Unit of Kenyatta National Hospital.

1.3 Justification of the Study

The reduction or elimination of unplanned readmissions attributable to pediatric pneumonia in Kenya is one of the major pathways towards reduction of children mortality in the country. This will greatly help Kenya to achieve its Vision 2030 goal of a healthy population served by a health care system of the highest possible standards for all (Odemba, 2018). In addition, the reduction of the high readmission rates amongst pneumonia pediatric patients in Kenya is one of the major pathways towards successful achievement of Sustainable Development Goals (SDGs) target 3 whose goal is the promotion of well-being for everyone at all ages by 2030 and the attaining of universal healthcare, making quality health care available and the easy accessibility of cheap, quality, effective and safe vaccines and drugs for everyone (KDHS, 2018).

Pneumonia is the elephant in the infectious disease debate and agenda. Millions of children lives are daily snatched by the pneumonia monster daily. Many nations Kenya includes hope to achieve their SDGs related to health by 2030. It is possible for countries to make a big leap towards ending the high mortality rates caused by pneumonia by use of affordable and effective solutions and this can also help achieve the SDG goal of achieving healthy lives for everyone and for all ages (UNICEF, 2018). This study is also critical as its findings could inform hospital-based policy formulation and/or review of interventions required to minimize pneumonia related pediatric readmissions in the country.

1.4 Research Question

The study sought to answer the following broad research question: What were the determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital?

1.5 Objectives of the Study

1.5.1 Broad Objective

To assess determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital.

1.5.2 Specific Objectives

1. To establish the patient related determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital.

2. To assess the caregiver related determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital.

3. To analyze the environmental related determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital.

4. To determine the health system related determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital.

1.6 Research Hypothesis

The study tested the hypothesis that patient, caregiver, environmental and health system related determinants had no significant association with pneumonia readmissions among children aged under five admitted at Kenyatta National Hospital.

1.7 Conceptual Framework

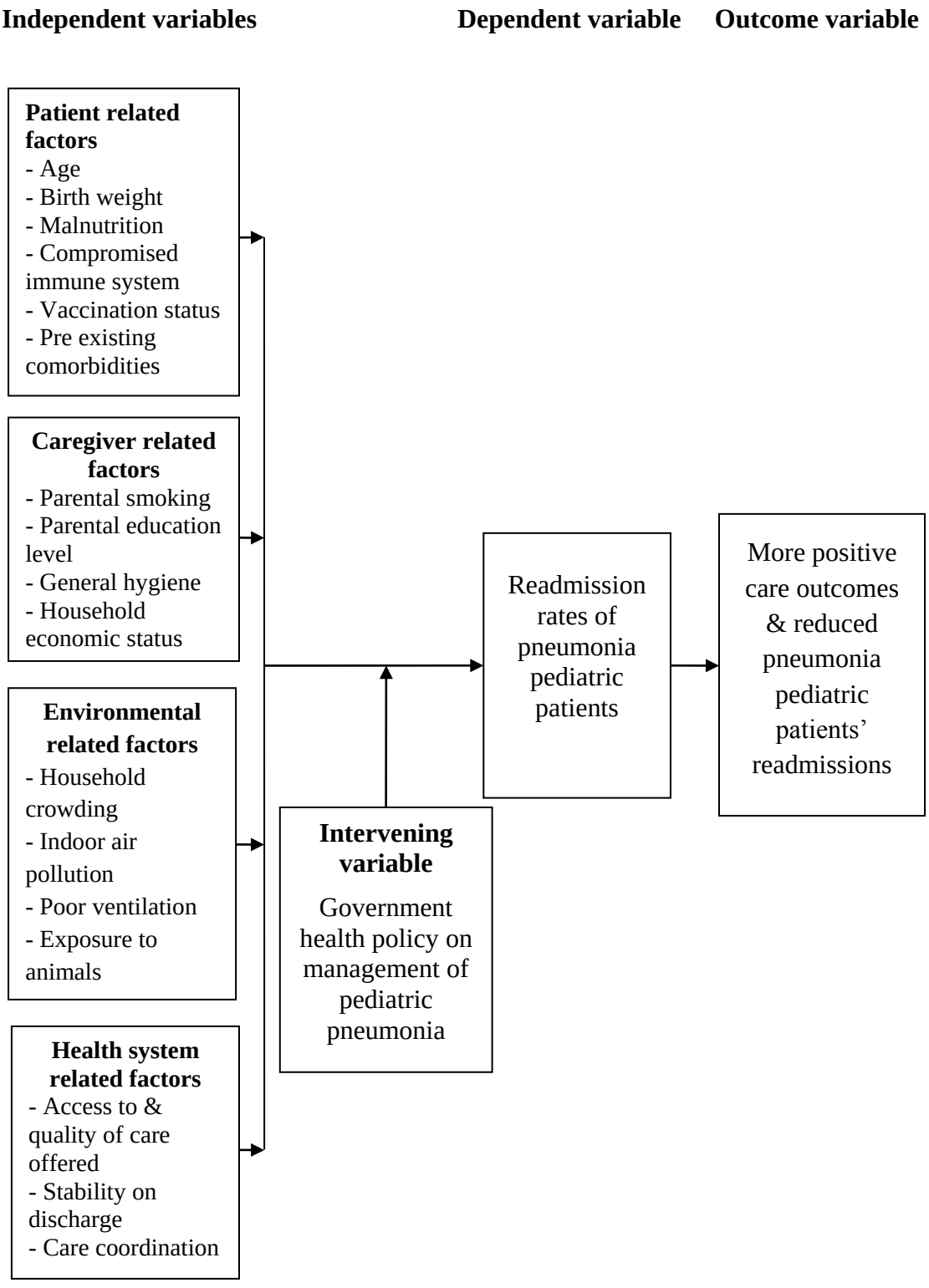

Figure 1.1 Conceptual framework

1.8 Definition of Terms

Pneumonia refers to an inflammation of the lung parenchyma caused by various infectious agents, including bacteria, viruses and fungi.

Pneumococcus is a bacterium of the genus Streptococcus that is the most common cause of bacterial pneumonia.

Pneumococcal conjugate vaccine is a vaccine used to protect infants and young children against disease caused by the bacterium *Streptococcus pneumonia* (pneumococcus).

Vaccine is a biological preparation that improves immunity to a particular disease.

Incidence of pneumonia refers to the number of people in a given community that develop pneumonia over a defined time period.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This in here the relevant literature is reviewed as guided by the study objectives. The chapter contains an empirical review on readmission rates among pneumonia pediatric patients. The chapter also contains an empirical review on socio-economic and health system related factors associated with readmission of pneumonia patients. The chapter then ends with a highlight of the research gaps in the literature reviewed.

2.2 Overview of Pneumonia

Pneumonia is a form of acute respiratory infection marked by inflammation of the lungs (Shah, Bachur, Simel & Neuman, 2017). Pneumonia is the leading single cause of mortality in children worldwide (Leung, Chisti & Pavia, 2016). The World Health Organization (WHO) notes that pneumonia accounts for 16% of all deaths of children under five years old, mostly in developing countries (WHO, 2019). Statistics from the World Health Organization indicates that pneumonia killed about 809,000 children in 2017 translating into approximately 2,216 children a day in 2017 (WHO, 2018). The WHO Child Health Epidemiology Reference Group estimated the median global incidence of clinical pneumonia to be 0.28 episodes per child-year. This equates to an annual incidence of 150.7 million new cases, of which 11-20 million (7-13%) are severe enough to be life-threatening and require hospital admissioon.

According to the World Health Organization, ninety-five percent of all episodes of clinical pneumonia in young children worldwide occur in developing countries with Sub-Saharan Africa and South Asia regions carrying the bulk of pneumonia episodes and deaths (WHO, 2019). Kenya currently ranks among the 15 countries with the highest estimated number of deaths due to clinical pneumonia, with a mortality rate of 47.6 per 10,000 under fives per year (KDHS, 2018). In Kenya, pneumonia is the second leading cause of death among children under

the age of five years and causes about 16% of deaths in this age group (Kimani-Murage & Mutua, 2018).

Pneumonia is caused by a number of infectious agents, including bacteria, viruses and fungi. Streptococcus pneumoniae is the most common cause of bacterial pneumonia in children with the Haemophilus influenzae type b (Hib) being the second most common cause. Respiratory syncytial virus is the most common viral cause of pneumonia. In infants infected with HIV, Pneumocystis jiroveci is one of the most common causes of pneumonia, responsible for at least one quarter of all pneumonia deaths in HIV-infected infants (Kallander, Burgess & Qazi, 2016). Some of the notable risk factors for pneumonia in children include age (≤ 2 years), poor nutrition, lack of safe water and sanitation, pre-existing illnesses, compromised immune system, indoor air pollution, living in crowded homes, parental smoking and inadequate access to health care (Shah *et al*., 2017). The clinical presentation of pneumonia in children under 5 years of age is cough and/or difficult in breathing, with or without fever, the presence of either fast breathing or lower chest wall in drawing where the chest moves in or retracts during inhalation. Wheezing is more common in viral infections. Very severely ill infants may be unable to feed or drink and may also experience unconsciousness, hypothermia and convulsions (Bennett, 2018).

In an effort to reduce occurrence of pediatric pneumonia, all 194 WHO Member States endorsed the Global Vaccine Action Plan (GVAP) in 2012. This was a commitment to ensuring no one misses out on vital immunizations, with a target of 90% DTP3 vaccination coverage in all countries by 2015. However, in early 2016, the WHO warned that 5 of the 6 targets contained in the Global Vaccine Action Plan, including the DTP3 coverage target, were worryingly off-track. Only one target, on the introduction of under-utilized vaccines, particularly the pneumococcal vaccine had achieved sufficient progress (WHO, 2016). According to the WHO, Hib vaccine had been introduced in 192 countries by the end of 2015. Global coverage with 3 doses of Hib vaccine was estimated at 64% with great variation between regions (WHO, 2016). In the Americas and Western Europe, Hib vaccine

coverage was estimated at 90%, 25% in the Western Pacific, and 56% in the South-East Asia Regions and below 20% in the African region. Pneumococcal vaccine had been introduced in 128 countries by the end of 2015, and global coverage was estimated at 37% and 28% in the Sub-Saharan region (WHO, 2016).

In addition, the WHO and UNICEF Integrated Global Action Plan for Pneumonia and Diarrhoea (GAPPD) aims to accelerate pneumonia control with the goal of seeing a drop in deaths from pneumonia to fewer than 3 children in 1000 live births by 2025 (Levy & Cohen, 2019). The GAPPD sets forth an integrated framework of key interventions proven to effectively protect children's health, prevent disease and appropriately treat children who fall ill with diarrhoea and pneumonia (Zar, 2016). The GAPPD integrated approach aims to achieve pneumonia control through a combination of interventions to protect, prevent, and treat pneumonia in children with actions to *protect* children from pneumonia through promoting exclusive breastfeeding for 6 months, adequate complementary feeding and Vitamin A supplementation; *prevent* pneumonia with vaccinations, hand washing with soap, safe drinking water and sanitation, reducing household air pollution, HIV prevention and co-trimoxazole prophylaxis for HIV-infected and exposed children and *treat* pneumonia by making sure that every sick child has access to the right kind of care, to reduce preventable deaths (Rudan *et al*., 2018).

2.3 Readmission Rates among Pneumonia Pediatric Patients

A retrospective cohort study carried out in the US characterized readmission rates, and came up with factors that were related to readmission of children who had earlier been hospitalized due to pneumonia. The study used 43 health facilities and looked at the children that were hospitalized due to pneumonia and the data was observed from the Pediatric Health Information System used in these hospitals between 2008 and 2011. The main outcome from this study was the all-cause readmission that occurred within a month after the patient was discharged. Then seconder outcome was readmission due to pneumonia. The study showed that 82,566 children were admitted to the sad hospitals due to pneumonia. The one month all-cause readmission rate was

7.7% while the readmission rate from pneumonia was at 8%. The study concluded that pneumonia was a key cause of hospitalization readmission among children (Neuman *et al*., 2014).

A systematic review, conducted by Prescott, Sjoding and Iwashyna, investigated the primary diagnoses of early (≤30 days) and late (>31 days) readmissions following index pneumonia hospitalization. The review centered on original research studies, done in US and Europe, of patients hospitalized for pneumonia, and them that were readmitted for cause-specific reasons were reported. The review observed that all-cause one month readmission rates showed a range of 16.8 to 20.1% across the reviewed studies. The review also established that pneumonia was the single commonest reason/cause for early readmission after pneumonia hospitalization. Pneumonia accounted for 18 to 30% of all 30-day readmissions in the reviewed studies. However, the review noted that few research studies had looked into the readmissions beyond the one month period. The data that was available through limited shower similar primary diagnosis for readmission that were both early and rate. The study concluded that pneumonia was the single most common readmission diagnosis after an index pneumonia hospitalization (Prescott, Sjoding & Iwashyna, 2014).

A study was carried out on hospital readmissions of children aged below 2 years that were suffering from acute infectious illnesses on admission. The New Zealand based study used children as the units of study who were born between 2005 and 2011. The admission due to infectious disease was considered before the child could reach 24 moths or two years. The study also noted the children who were readmitted suffering from an infectious illness with an year of the first admission due to an infectious illness. The admissions were categorized into urinary, soft tissue, skin, enteric, respiratory and other infectious illness. The study established that between 2005 and 2011 the children below two years admission from infectious illnesses were 46,657. From this number 22% which represented 10,205 children had at least one readmission due to an infectious illness within a year after the first admission. The study observed that respiratory infections, mostly pneumonia, accounted for 54% of

the said readmissions. It was further noted that there was a higher risk of the child being readmitted if they were first admitted at the facility due to an infectious illness that was respiratory in nature (Seibt *et al*., 2018).

Another study done in the US, the researchers sought to assess variation in pediatric lower respiratory infections (LRI) readmission rates and readmission diagnoses. The study analyzed data for pediatric patients in 26 states for the year 2008 - 2009. Lower respiratory infections hospitalizations were identified based on the diagnosis of community acquired pneumonia, influenza or bronchiolitis as the primary readmission factor. The secondary cause was noted to be any one of the pointed out LTIs in addition to being diagnosed with sepsis/ bacteremia, respiratory failure or asthma. The calculation of the readmission rates was based on them being a proportion of the hospitalizations and being followed by ≥1 unplanned readmission that happened within one month unplanned readmission within 30 days. The study outcomes showed that of the total hospitalizations 5.5% or 8,223 of them were followed by a 1 readmission while the medium rate was at 5.2%. Readmission rates however significantly varied across hospitals. The commonest primary reason that led to the readmission were LRIs (48.2%) with pneumonia being the lead cause. The study concluded that LRI readmissions were common and varied across hospitals and that readmission diagnosis seemed related to the original LRI (Nakamura *et al*., 2017).

In an empirical study carried out in China, the investigators assessed the risk factors that led to re-hospitalization after a 90 day period after the discharge of patients who were suffering from pneumonia. The study that was retrospective used observation method to study pediatric patients who were discharged with a diagnosis of pneumonia between 2016 and 2017 in a local Children's Hospital in Hebei Province. The research focus was the readmission rate of former pneumonia patients that occurred three months after discharge. The risk factors that could be said to be associated with readmission were sought by use of multiple regression models. The results revealed that of the 424 index pediatric pneumonia hospitalizations, 48(11.3%) came back for re-hospitalization after three months and these were said to suffer from pneumonia. The study closed by noting that readmissions among pneumonia pediatric

patients were common and actions were needed to reduce the rehospitalizations (Wang, Feng, Shuai, Liu & Li, 2019).

2.4 Patient Related Determinants of Pneumonia Associated Readmissions in Pediatric Patients

In a retrospective study carried out in South Korea, the researchers analyzed the risk factors affecting readmission of children with pneumonia. In the study, medical records of pediatric patients admitted in a local hospital were analyzed for the period January 2007 to August 2016. Patients who were readmitted with pneumonia within 30 days of discharge were categorized as the readmission group and patients who were admitted with pneumonia for the first time were categorized as the control (first admission) group. The readmission group included 82 patients while the control (first admission) group included 76 patients. Based on regression analysis, the study found that younger age, low birth weight, malnutrition and having not been exclusively breastfed were significant risk factors for pediatric pneumonia readmissions. The study thus concluded that a comprehensive approach was needed to reduce the rate of pediatric pneumonia readmissions with careful consideration to child related factors (Hong, Choi & Park, 2017).

In a literature review, Ramezani and others sought to deduce the factors affecting the rate of pediatric pneumonia and associated hospital readmissions in the developing countries. The researchers searched a wide range of international and national databases including Scopus and the Cochrane, WHO, Iran Doc, Med Lib, Pub Med, Magiran, Science Direct, Iran Medex, Google Scholar, Wiley, and SID. The keywords used in the study included developing countries, pediatric, infant, and pneumonia and the data used was between 1970 and 2004 data. The results showed that low birth weight, malnutrition, not being breast fed and young age of 2 years and below were the most important risk factors that affected the rate of pneumonia in children and its associated hospital readmissions in the developing countries. The review concluded that actions aimed at promoting the wellbeing of infants may have a significant impact in reducing the mortality and mobility among infants and its associated hospitalizations (Ramezani, Aemmi & Moghadam, 2015).

A study done on predicting the rate of readmission after a month of discharge of pneumonia patients made use of electronic health data and it was evidenced that boys were likely to be re-admitted compared to girls. This could be said to be caused by differences between the two groups related to function and structure of the lungs or differences in immunity and body inflammatory responses (Makam *et al*., 2017). Similarly, Leung *et al*. (2016) identified low birth weight, lack of exclusive breastfeeding for the first 4-6 months, under-nutrition, children with compromised immune systems and very young age as leading risk factors for pneumonia readmissions in low- and middle-income countries. On their part, Neuman *et al*. (2014) opined that being born prematurely and low birth weight were recognized risk factors for pneumonia hospitalizations. This study came to the conclusion that severe stunting and being underweight which indicate limited birth weight and slow growth plus poor postnatal nutrition. These factors were said to influence pneumonia hospitalization and readmission.

In another study that sought to determine the readmission risk factors for patients diagnosed with general illnesses noted that many pneumonia patients were readmitted to health facilities and it was hard to prevent them even if the best medicine was used on the patients as 1 in every 6 new cases of pneumonia is nit cured completely. It was not uncommon for such patients to have complications that led to readmission. The research also provided a host of factors including chronic conditions, heart failure, malignancy, immunodeficiency and age which are likely to increase the possibility of pneumonia-related readmission after the three months periods, this study was of the view that that most of the pneumonia readmissions are because of unavoidable causes. Patents that had multiple exacerbations conditions such as malignancy, diabetes, heart failure and the Chronic Obstructive Pulmonary Disease (COPD) had a higher risk of a being readmitted after the three months discharge period due to pneumonia (Allaudeen, Vidyarthi, Maselli & Auerbach, 2011).

Another research that was done on 10, 731 patients who were discharged from a US based teaching medical facility noted that patients suffering from heart failure, chronic kidney disease a, neoplasms were more likely to get readmitted due to

pneumonia compared to patients who didn't suffer from these illnesses. The research pointed out that it is essential to ensure that the commodities were stable during discharge especially for those patients whose risks of being readmitted due to pneumonia were high. Examples of such patients were those suffering from cancer, renal failure and heart failure. The conclusion made by this research was that there is need to do more extensive studies that would consider the most effective interventions that would ensure stability of patients at discharge, more so in patients with interrelated, active and more than one comorbidities. Such interventions would reduce re-admission rates especially those related to pneumonia patients (Donzé, Lipsitz, Bates & Schnipper, 2013).

In another cross-sectional study done in Taiwan, the factors evaluated were those that were related to hospitalization for home care patients that had community acquired pneumonia. The data used for the study was from electronic medical records of the patients in the period between 1 January 2017 and 31 December 2017. The researchers made use of multiple regression models to seek out these factors. According to the findings, 33.28% of hospitalized patients which were equivalent of 199 patients were admitted due to pneumonia. These patients symptoms were characterized with chronic liver disease, chronic respiratory disease, heart failure, dementia, stroke, polypharmacy, use of nasogastric tube, anemia, hypoalbuminemia and functional impairment. The study came to the conclusion that those patients with hypoalbuminemia, heart failure, dementia, chronic respiratory disease, anemia, use of nasogastric tube had a higher risk of being hospitalized due to CAP. The conclusion made was that caregivers ought to take quick action and offer preventive care in the said cases of patients to reduce the occurrence of CAP (Lin *et al*., 2019).

In yet another study that sought to research on community acquired pneumonia prevalent in the Sub-Saharan African region, the study found out that there was a higher risk of pneumonia occurrence in persons that had delayed vaccination as this delay lowered ones immunity. Another significant independent factor noted was exposure to the HIV virus. This factor was said to lead to severe pneumonia even when it was associated with other factors. This observation could be because of the

development abnormalities inherent in adaptive and innate in the patient's immune systems, lack of protection use which compromised the antibodies or the high exposure to infectious illnesses due to living with a household member who was HIV infected. This observation indicates that children who may not be HIV positive but are exposed to a person with the virus are at high risk of suffering from CAP (Aston & Rylance, 2016).

2.5 Caregiver Related Determinants of Pneumonia Associated Readmissions in Pediatric Patients

In an Ethiopian study, the determinants of hospital re-hospitalization for infants under five years in Gondar University Hospital were investigated. This controlled case study sought 435 participants where 290 of the participants were the controls while the cases were 145. The selection of participants was done using random sampling method and the analyses of data was done with the help of bivariable and multivariable logistic regressions. The factors that were identified to increase the risk of child pneumonia re-hospitalization as per the findings included infants of mothers who did not adhere to the proper hand washing practices, children who lived in householders where there was a lot of smoke and the mothers were not aware on how to handle this smoke, infants who had fathers who smoked. Thus, the determinants that were noted to cause readmission for pneumonia patients who were under five included poor hand washing practices, lack of knowledge on how to handle household smoke and parental smoking (Markos *et al*., 2019).

Another study that was done in Sudan sought to identify the risks associated with pneumonia for children who were below five years. The research also sought to come up with statistical and baseline data on the topic that could be used for future reference. The study location was at Mohamed Al-Amin Hamid Pediatric Hospital and it was done in February 2017. The participants were made up of parents of children aged below 5. These parents were 40 in total and had their children admitted at the facility during the time of research. The results from this study showed that low level of education among the infants' mothers and low socio-economic status were factors related to pneumonia among the admitted children. The disease was also found

to occur in high numbers of in fact patients who had parents that smoked. Yet other factors that increased the risk of child-related pneumonia cases was poor hand hygiene, poor feeding and limited knowledge on the symptoms related to pneumonia. The study made recommendations that focus on the completion of pneumonia vaccinations, health education among community members, early diagnosis and treatment of the disease could significantly reduce the occurrence of pediatric pneumonia (Gritly *et al*., 2018).

Ramezani, Aemmi and Moghadam did a literature review to investigate the factors affecting the rate of pediatric pneumonia and associated hospital readmissions in the developing countries. The researchers searched a wide range of international and national databases using key words 'Pneumonia, Infant, Pediatric and developing Countries' from 1970- 2014. The results showed that parental smoking, low economic status occasioning undernourishment and maternal education were significant predictors of the rate of pneumonia in children and its associated hospital readmissions in the developing countries. The review came to the conclusion that promoting the use of the right care methods among mothers with infants, coming up with strategies that can encourage parents to quit smoking and nutritional interventions could significantly reduce the high mortality and mobility occurrences among pneumonia patients aged below five and also reduce hospitalization of the patients (Ramezani, Aemmi & Moghadam, 2015).

A research conducted to predict one month re-admission from health recorded electronic data indicated that maternal smoking led to high rates of pneumonia re-hospitalization. The study pointed out that there were possible association between pneumonia cases and maternal smoking such as the in-utro impact of maternal smoking which led to a reduction in the child's lung growth or the exposure of the infant to cigarette smoke after its birth caused respiratory illnesses or wheezing disease. The results also showed educated mothers were more likely to take good care of their infants and this resulted to less readmission cases which led to the conclusion that maternal education could significantly improve the infant health status (Makam *et al*., 2017). In an India based study the researcher profiled the risk factors related to

pneumonia in infants under five. The cases were Acute Respiratory Infection (ARI) patients admitted in pediatric ward of VIMS hospital, a tertiary care centre. The findings revealed that an association was found between pediatric pneumonia and parental education, parental occupation, parental smoking and parents of low socio-economic status (Divyarani *et al*., 2014).

Another study carried out in India looked at the risk factors and the barriers affecting care and also impacting the prevalence of pneumonia and ARI. The cross sectional community study was done among slum dwellers located in Dibrugarh town. The researcher studied 624 children and the data was gathered through house to house visit. The results of the study showed that household socio economic status, education of mothers, mother's timely initiation of complementary feeding and mothers ensuring complete immunization of their children was significantly related to pneumonia incidents. Parental smoking was another factor significantly related to pneumonia. In addition, pneumonia was significantly associated with parental smoking. The study concluded that the high occurrence of the disease and its relation with various preventable influencers, in the region, needed to be addressed. There was need for community interventions such as community health education and the improvement in awareness among slum dwellers to address ARI and pneumonia risk factors (Nirmolia *et al*., 2018).

In a case-control study carried out in Pakistan, the researchers sought to determine the risk factors for complicated pneumonia and its associated hospital readmissions. The study was conducted in a Medical Unit of a Children's Hospital in one of the country's cities. Out of a total of 180 cases of pneumonia, 100 were labeled as complicated pneumonia (case) while 80 were labeled as uncomplicated pneumonia (control). Detailed history for both groups was taken and recorded on predesigned proforma. Data was analyzed both quantitatively and qualitatively using SPSS v.20. According to the study, the most significant risk factors associated with complicated pneumonia and its associated hospital readmissions were maternal and father education, maternal and father occupation, living in rural areas, bottle feeding of the infants by their caregivers, failure by parents to get their infants vaccinated and

infants whose parents engaged in tobacco smoking. The study concluded that important risk factors for complicated pneumonia and its associated hospital readmissions touching on their caregivers could be reduced by improving their socio-economic status and awareness creation on ways of preventing pneumonia (Aftab *et al*., 2017).

2.6 Environmental Related Determinants of Pneumonia Associated Readmissions in Pediatric Patients

A China based study that looked at the relation between infant pneumonia and indoor environmental influencers in the homes of modern parents located in the Nanjing region used SPSS and binary logistics models to deduce the relationship among home building traits, environmental risks exposure in homes, the home life style and the risk of occurrence of pneumonia. The factors that were found to be significant in the binary logistics models, they were analyzed using a multivariate logistic model to determine the adjusted odds ratios the disease infections. The results indicated that the prevalence of pneumonia infections was significantly high in the Nanjing region. The study established that wall covering, use of modern floor, new furniture, dampness, use of gas as a cooking fuel and lack of proper ventilation were all factors associated with occurrence of pneumonia. The research pointed out that improvements in homes and the living of a modern lifestyle had a significant impact in the development of pneumonia in children younger than five who were located Nanjing (Zheng *et al*., 2013).

Another study done in Canada looked at the environmental risk factors leading to hospitalization of adult pneumonia patients. The study gathered data using interviews that were done in 718 patients who were aged 65 and above who were admitted due to CAP in the period between September 2002 and April 2005. The study had 867 controls who were in the same age bracket and these were chosen randomly from the same hospital. The environmental factors noted to impact pneumonia related readmission included living in crowded areas, use of gasoline at home, and exposure to gasoline, paints and solvents fumes. The conclusion made was that present and past

exposure of elderly people to harmful environmental factors increased the risk of readmission due to CAP (Loeb *et al*., 2009).

Yet another study looked at the social factors that led to increased risk of readmission and deaths from pneumonia, Calvillo-King *et al*. (2013) pointed out that air pollution in the households due to biomass fuel fumes used for cooking, lighting and heating is one of the significance causes of children readmission after they are diagnosed with pneumonia. They also noted that poor ventilation and crowding in the homes may be a contributor to the pneumonia occurrence and its associated hospital readmissions. Similarly, Leung *et al*. (2016) identified household crowding, exposure to animals and breathing of polluted air in homes due to the use of biomass or solid fuels as one of the major causes of pneumonia readmission in developing nations. These sentiments are also espoused by the WHO which also notes that pneumonia risk is increased if one has inhaled toxic fumes, pollutants and chemicals as well as through exposure to animals (WHO, 2019).

Another review of literature that sough evidence of environmental risk factors associated with CAP and readmission cases used 29 nine research studies where one was a cross sectional study, 8 were cohort while 20 were case controls. The participants in these studies were made up 44.8% elderly participants who were aged 65 years and above and 34.5 were participants aged 14 and above. The review pointed out that those exposed to fumes or smoke at home and at work, toxic chemicals, environmental pollutants, those who lived in crowded areas, those who were exposed to animals and those who lived and worked in places with poor ventilation were at high risk of contracting CAP (Almirall *et al*., 2017).

Another study came up with risk factors associated with CAP as provided by community practitioners in the society, Farr *et al*. (2010) had provided evidence of the significant relationship between air pollution and pneumonia., the study pointed out that air pollution in homes can be reduced by deviating from the use of solid fuel to more quality and clean fuel, enhancing home ventilation among other factors could help reduce the high mobility and mortality rates caused by pneumonia. Further, Bennett (2018), noted when parents are aware of the risk factors causing pneumonia

there is a chance for primary prevention right from homes and in hospitals which can see pneumonia related mortality and mobility decline. Taksande and Yeole (2015) also agreed with these sentiments who looked into risk factors associated with acute respiratory infection (ARI) in children below five admitted at a health facility in Central India found that exposure to harmful smokes and fumes and general air pollution exposure as a result of burning of bio-mass fuels are as significant risk factors for pneumonia incidences and associated hospital admissions in the said region.

A control, study done in a hospital used case controls to study pneumonia related incidents of children that were aged from 1 to 59 months admitted in northern Brazil hospital. The study was done between October 2010 and September 2013. Pneumonia diagnosis was made in line with WHO guidelines. The investigated pneumonia risk factors were the possible, likely and definite factors as noted by WHO. Analysis of data was done using bivariate and multivariate regression models. The findings showed exposure to pollutants, toxic chemicals, fumes, crowding in homes and poor ventilation as the environmental factors that increased the occurrence of the disease. The study pointed out that change on these risk factors could be achieved by social improvements. The improvements however were not enough to do away with inequalities which resulted to socio-environmental factors being significant risk factors (da Fonseca Lima *et al*., 2016).

2.6 Health System Related Determinants of Pneumonia Associated Readmissions in Pediatric Patients

A study done on pneumonia readmissions sought to establish the risk factors and implications. This was achieved by undertaking a review of recent trends in Centers for Medicare & Medicaid Services data. The results indicated that most of pneumonia readmissions were attributable to modifiable health system-related factors which included fragmentation of healthcare, difference in practice style, availability of beds and the quality of care. Other health system related factors contributing to pneumonia readmissions were pneumonia illness severity, hospital complications and stability on discharge. The conclusion made was that most of the interventions taken up to reduce

readmission occurrences that focused on traditional care, post-discharge care and care coordination had a high potential to reduce readmission of pneumonia patients (De Alba & Amin, 2014).

Another retrospective study looked at readmission rates of pneumonia patients located in developing nations, the readmission rate was observed to be at 20%. The study found out that patients suffering from healthcare-related pneumonia had a high likelihood of 7.5 of being readmitted compared to those who had CAP. The researcher noted four health related pneumonia factors that were linked to readmission unlike in CAP. These factors were prior admission, prior use of antibiotics, being previously admitted and requiring long term care and immunosuppression,. The conclusion made was that the factors observed to cause readmission were beyond the control of the hospitals and the pneumonia readmissions that were common were nit preventable. Further, the researcher noted that although there was notable change in radiology, etiology and incidence of pneumonia readmissions, the reason for increased readmissions could be because of the inequalities when it came to access of health services and also due the intervention taken up by facilities in the studied countries (Shorr *et al*., 2013).

Another US study indicated that readmission pneumonia cases could be unrelated to the former pneumonia cases and could be caused by other related factors such as trauma, acquired conditions in the hospital after admission and acute diseases. The study noted that an analysis done on hospital readmission resulted to hospital acquired incidences of falls, catheter infections, pulmonary embolism, deep vein thrombosis which saw a 33% rise in the likelihood of the former pneumonia patients being readmitted to the hospitals. However, improved hospital care there would be reduction in readmission among pneumonia patients who came back due to hospital acquired conditions. However, there was still the likelihood that some of these cases may be unavoidable (Campione, Smith & Mardon, 2017).

In a US study that looked at the readmission of pneumonia patients, it was observed that 10% of the patients who had mechanical ventilation ventilator pneumonia and the ones who used gastric feeding tube were more likely to suffer from aspiration

pneumonia. This led to high likelihood of readmission (Zuckerman *et al*., 2016). A Pakistan study noted that there were delays of 1 day to a week when it came to seeking health care among patients. The factors that led to these delays included the lack of confidence in the health care facilities and the use of self-medication. The conclusion reached was that there was need for interventions that would target health care system weaknesses to reduce patient's delays in seeking care for their infants with pneumonia (Donzé *et al*., 2013).

Another Kenyan study indicated that delays occurring in the seeking of pneumonia treatment related to three days or more led to increased risk of contracting upper respiratory tract infections and this was a factor that led to frequent readmission cases among patients. The use of antibiotics at home was noted to be a protective factor against the illness. The recommendation made was that there is need for patients to be educated on the most appropriate health seeking behaviors and it was also prudent to make community workers part of pneumonia treatment, prevention and control team (Onyango *et al*., 2012). Similarly, in a study on risk factors causing under five acute respiratory infections in a central Indian rural health facility, Taksande and Yeole (2015) noted that there was a history of respiratory and lung conditions among the infants such as, cystic fibrosis, chronic obstructive pulmonary disease (COPD), asthma and heart disease; severity of the pneumonia infection; having not been vaccinated against pneumonia, having been hospitalized in the ICU and early hospital discharges as significant predictors for the higher rehospitalization rates among under-five pneumonia patients.

2.8 Gaps in Literature Review

The above reviewed empirical studies point to a general consensus that a wide range of patient, caregiver, environmental and health system related factors were predictors of pneumonia readmissions not only in adult populations but also in children. Most of the studies also indicate that pneumonia readmission rates varied widely within the same region, country or location. However, majority of the reviewed studies highlighted in the literature were largely conducted in the developed countries where healthcare systems were robust and effective contrary to the situation in developing

countries where they are largely failing – and to which Kenya is no exception. It is evident that there is dearth of empirical research on factors associated with pediatric pneumonia readmission rates in Kenya and there is need for the current study. Consequently, this research study will unveil results which may inform interventions for reducing the high pneumonia readmission rates among children aged under five in Kenya and particularly at Kenyatta National Hospital.

2.9 Theoretical Framework

The theoretical framework for this study was based on the Mosley & Chen's analytical framework developed in 1984. Mosley and Chen (1984), classified the determinants of infant and child mortality as exogenous (socioeconomic or extrinsic) such as cultural, socioeconomic, community and regional determinants and endogenous (bio-medical or intrinsic) such as maternal, environmental, nutrition, injuries and personal illness. Mosley and Chen (1984) set the framework of child survival based on the assumption of all socioeconomic factors of child mortality necessarily operate through a common set of intermediate factors to influence child morbidity and mortality. They defined five categories of a total of 14 proximate determinants: maternal factors (age, parity, birth interval); environmental contamination (air, food/water/ fingers, skin/soil/inanimate objects, insect vectors); nutrient deficiency (calories, protein, micronutrients); injury (accidental, intentional); and personal illness control (personal preventive measures; medical treatmment).

Determinants in the first four groups affect the rate at which children move from healthy to sick, whereas factors in the last group influence both this rate (through prevention) and the rate of recovery (through treatment). This list of proximate determinants is intended to be exhaustive, such that child health will change if - and only if - one or more of the determinants change. This framework thus is based on the premise that the proximate determinants through the socioeconomic factors operate to influence the infant and child mortality and socioeconomic, biological and environmental factors are the driving forces behind the reduction of infant and child mortality. This framework thus

provides a conceptual model for researchers, whether social scientists or epidemiologists, on child surrvival.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides a framework of the methods that will be used in the study. It outlines the study design, study area, targeted population, sample size and sampling technique, inclusion and exclusion criteria, data collection instruments and procedures, pilot testing, validity and reliability of research instrument, data analysis and ethical considerations.

3.2 Study Design

The researcher used a hospital based cross sectional descriptive study. This research design provides facts relating to the variables under investigation as they are at the time of research in addition to emerging trends. The researcher preferred a descriptive study method since it provides an accurate and complete description of the issues at hand which means there was little to no bias when it came to the gathering of data (Kothari, 2004).

3.3 Study Area

The research was conducted in the Pediatric Unit of Kenyatta National Hospital. Kenyatta National Hospital (KNH) is the biggest public hospital in the country and it is located four kilometers from the city of Nairobi, off Ngong road on Hospital road. The current bed capacity of the hospital is about 2,000. The hospital offers various in and out-patient health care services in its several specialized clinics. The hospital in addition to providing specialized referral care services, the hospital also provides training in medical fields and research while also helping in formulating of polices and plans related to healthcare.

The KNH Pediatric Unit is located on the third floor and has a bed capacity of 230. The Unit admits pediatric patients with a wide range of illnesses from other KNH wards as well as referrals from other facilities across the country. Pneumonia pediatric patients in KNH are hospitalized in this Unit, hence its choice as the study area. In

addition, being the leading referral public hospital in the country, KNH handles many severe pneumonia cases among children aged under five. This setting provided a good platform for studying the factors associated with high pneumonia readmission rates among children aged under five.

3.4 Study Population

The population of this study was caregivers of children aged under five readmitted with pneumonia in KNH's Pediatric Unit. On average, 165 readmission cases of children aged under five with pneumonia were handled in KNH's Pediatric Unit every month. Hence, the study population comprised of 165 caregivers of children aged under five readmitted with pneumonia at KNH.

3.5 Sample Size and Sampling Technique

No sampling was done since the study population was small. As such, census method was applied to select the entire study population as the study sample. This was in accordance with Kothari (2004) who postulated that a sample of 100% of the target population is used when the target population is small. Hence, the study sample size comprised of 165 caregivers of children aged below 5 years readmitted with pneumonia in KNH's Pediatric Unit.

3.6 Inclusion and Exclusion Criteria

The study included all caregivers of children aged under five admitted with pneumonia in KNH's Pediatric Unit during the study period and who consented to take part in the study.

The study excluded caregivers of admitted pneumonia pediatrics aged 5 and above years. The study also excluded caregivers of children admitted with pneumonia who were critically ill. The study also excluded caregivers of subjects under study who declined to consent to take part in the study.

3.7 Data Collection Instruments

The research used a researcher-administered questionnaire (Appendix I) as its data collection instrument. The questionnaire was used as a data gathering instrument because it is practical and easily applicable to the population size and problem under study. A questionnaire is also not costly (Denscombe, 2014). The questionnaire contained both close ended and open ended questions. The questionnaire was structured to capture demographic data in the first part. The other parts of the questionnaire contained queries based on the research objectives. The questions in the questionnaire queried information relating to the patient, caregiver, environmental and health system related determinants/factors associated with pneumonia readmissions among the under-five children.

3.8 Data Collection Procedures

The researcher-administered questionnaires were administered to the caregivers of the children under study. The questionnaire was administered to the respondents by the principal researcher after providing an explanation to them on the purpose of the study and after obtaining their informed consent. The researcher provided guidance to the respondents in answering the questions, without influencing their responses, to ensure that they answered the questions properly for efficient analysis. Once the questionnaires were filled in, the researcher scrutinized them for completeness before receiving them. The filled-in questionnaires were then stored safely under lock and key in readiness for data entry and analysis. The data collection exercise took four weeks.

3.9 Pretesting of Tools

Pretesting of the questionnaire was done at Mbagathi District Hospital where 16 questionnaires (representing 10% of the research sample) were used. Pretesting was carried out to refine the research tool. Upon pretesting, the data collection instrument was adjusted where necessary and a final validated form of the study instrument was made.

3.10 Validity and reliability of the research instrument

Validity refers to the extent to which the data gathering tool quantifies what its expected to measure (Kothari, 2010) or the extent to which the research results are an actual representation of the problem under study (Denscombe, 2014). The data gathering tool was availed to the supervisor and other students who assisted in confirming if the tool had construct and content validity so that the research items and results were an adequate representation of the topic under study.

Reliability quantifies the extent to which a data gathering tool provides consistent outcomes after many trials (Nsubuga, 2006). The pilot study data helped in estimating the research tool reliability by use of Cronbach's Alpha Coefficient. A Cronbach's Alpha Coefficient value of 0.70 was acceptable. In case the coefficient was lower, the researcher would have made changes to the data gathering tool to ensure the tool was reliable.

3.11 Data Analysis

The filled questionnaires were coded and checked for completeness and consistency at the end of each day before storage. The quantitative data generated from the closed ended questions was analyzed through descriptive statistics using the Statistical Package for Social Science (SPSS, version 23) and presented through percentages and frequencies. The qualitative data generated from the open ended questions was analyzed using content analysis. Association between the variables was estimated using chi square statistics at a significance level of 5%. The study results were presented in tables, graphs and charts, as apppropriate.

3.12 Dissemination of Study Findings

The study results would be disseminated through forwarding a copy of the final research project report to the UoN Library, publication in a peer reviewed journal and presentation in organized seminars and conferences.

3.13 Ethical Considerations

The authority to conduct the study was sought from the KNH/UoN Ethics and Research Committee. Permission to collect data was also sought from relevant authorities at Kenyatta National Hospital. Respondents' consent was sought individually before their participation in the study. Confidentiality was maintained for all information obtained from the study respondents. In addition, anonymity was observed by coding the questionnaires. No names or any other form of personal identification was written on the questionnaires and all information given was used strictly for research purposes only. Any emerging issues were only cited anonymously. Participation in the study was voluntary and the respondents were free to withdraw from the study at any time without victimization. No inducements or rewards were given to participants to join the study. There were no associated risks to the study respondents related to their participation in this study. All filled questionnaires were kept safely under lock and key in readiness for data analysis and presentation.

CHAPTER FOUR: RESULTS

4.1 Introduction

This chapter presents the study results as set out in the research methodology. The results were presented on the determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital. The chapter begins with highlighting the response rate and then provides results on the demographic characteristics of the respondents before outlining the findings based on the research objectives.

4.1.1 Response rate

The study targeted 165 caregivers of children aged under five readmitted with pneumonia in KNH's Pediatric Unit as respondents. From the interviews conducted, the researcher was able to obtain adequate responses from 125 of the respondents translating into a response rate of 75.8%. The study was unable to obtain responses from all the respondents due to the prevailing Covid 19 pandemic. This response rate was, however, considered sufficient and representative and conforms to Mugenda and Mugenda (2003) stipulation that a response rate of 50% is adequate for analysis and reporting, a rate of 60% is good while a response rate of 70% and over is excellent.

4.2 Demographic Characteristics of the Respondents

The study sought to establish the demographic profile of the caregivers as the study participants. The demographic attributes considered included: age, marital status and religion as depicted in Table 4.1.

Table 0.1 Respondents' demographic characteristics

		Frequency	Percent
Age	18 - 29 years	37	29.6
	30 - 49 years	80	64.0
	50 years & above	8	6.4
	Total	**125**	**100.0**
Marital status	Single	14	11.2
	Married	99	79.2
	Separated	7	5.6
	Divorced	1	0.8
	Widowed	4	3.2
	Total	**125**	**100.0**
Religion	Christian	93	74.4
	Muslim	23	18.4
	No religion	9	7.2
	Total	**125**	**100.0**

The findings indicate that about three quarters (64%, n = 80) of the caregivers were aged 30 - 49 years; most (79.2%, n = 99) were married and most (74.4%, n = 93) were Christians. This showed that most of the study participants were married women of child-bearing age and professed the Christian faith.

4.3 Nature of Readmission

The study sought to establish the child's nature of readmission. The results were as depicted in Table 4.2.

Table 0.2 Readmission incidences among the under-five children

	Number of readmissions	Frequency	Percent
How many times has the child been readmitted?	Twice	68	54.4
	More than twice	57	45.6
	Total	**125**	**100.0**

All (100%, n = 125) of the caregivers acknowledged that their child was being readmitted with pneumonia.

Further, 54.4% (n = 68) of the caregivers indicated that their child had been readmitted twice while 45.6% (n = 57) said that their child had been readmitted for more than 2 times. This implied a high readmission rate among the under five children admitted with pneumonia in KNH's Pediatric Unit.

4.4 Patient Related Determinants of Pneumonia Associated Readmissions in Under Five Children

The study sought to establish the patient related determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital. The patient related factors considered included the child's gender, age, current nutritional status, exclusively breastfeeding status, immunization status and whether the child had other pre-existing illnesses other than pneumonia. The findings were as described in the subsequent subsections.

4.4.1 Child's Gender and Association with Pneumonia Readmission

Results on the children's gender were as shown in Figure 4.1.

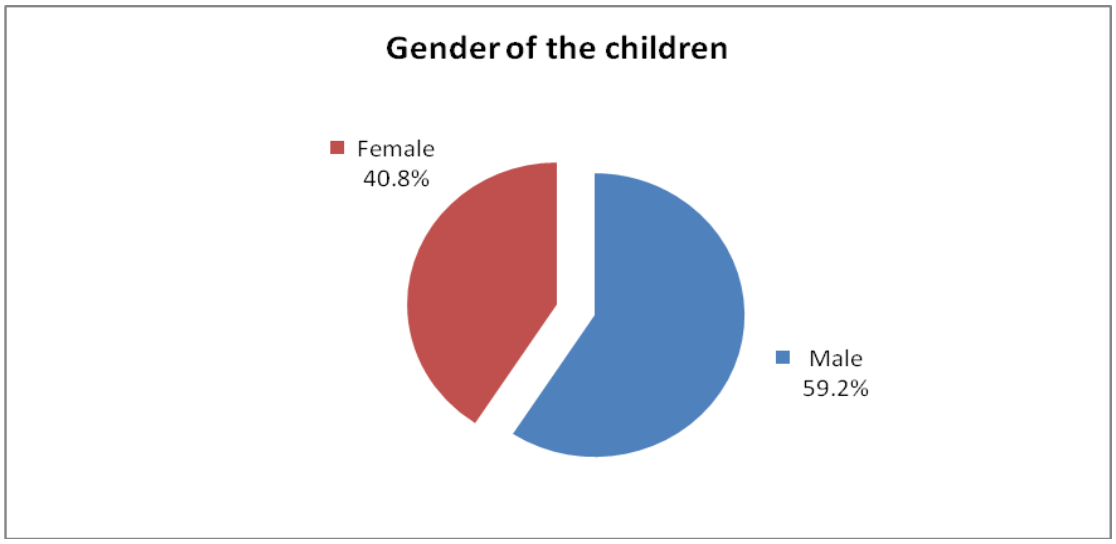

Figure 0.1 Gender distribution of the children

The results indicate that slightly above half (59.2%, n = 74) of the under-five children readmitted with pneumonia in KNH's Paediatric Unit were male while 40.8% (n = 51) were female.

The findings on the association between child's gender and pneumonia readmission were as illustrated in Table 4.3.

Table 0.3 Association of child's gender with pneumonia readmission

		Pneumonia readmissions			Chi-square p value (95% CI)
		2 times [N = 68]	> 2 times [N = 57]	Total	
Gender	Male	33	41	**74**	
	Female	35	16	**51**	0.127

No significant association was established between the children's gender and pneumonia readmission (X^2 = 3.823, df = 1, p = 0.127) as depicted in Table 4.3 above. This implied that child's gender was not a significant predictor of readmission for pneumonia among the under five children admitted in the hospital.

4.4.2 Child's Age and Association with Pneumonia Readmission

The findings on the children's age were as depicted in Figure 4.2.

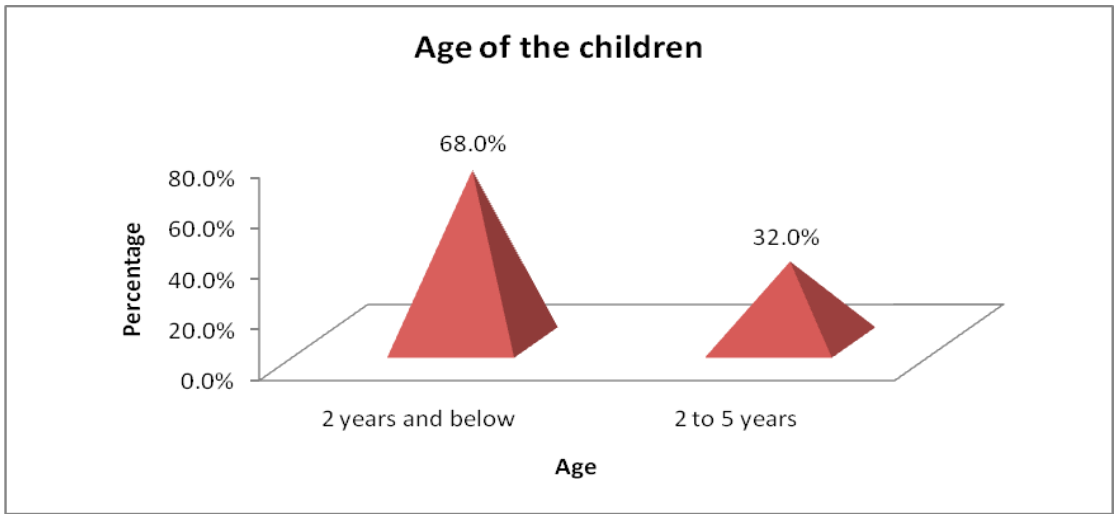

Figure 0.2 Age distribution of the children

Most (68%, n = 85) of the under-five children readmitted with pneumonia in KNH's Paediatric Unit were aged 2 years and below.

Further, the association between child's age and pneumonia readmission was as depicted in Table 4.4.

Table 0.4 Association of child's age with pneumonia readmission

		Pneumonia readmissions			Chi-sq. p value (95% CI)
		2 times [N = 68]	> 2 times [N = 57]	Total	
Is the child 2 years & below	Yes	43	42	**85**	
	No	25	15	**40**	0.016

A statistically significant association was established between younger age (that is, being aged 2 years and below) and pneumonia readmission ($X^2 = 5.781$, df = 1, p = 0.016) as denoted in Table 4.4 above. This implied that child's younger age (that is, of 2 years and below) was a significant determinant of readmission for pneumonia among the under five children admitted in the hospital.

4.4.3 Child's Current Nutritional Status and Association with Pneumonia Readmission

Figure 4.3 contains the findings on the children's current nutritional status.

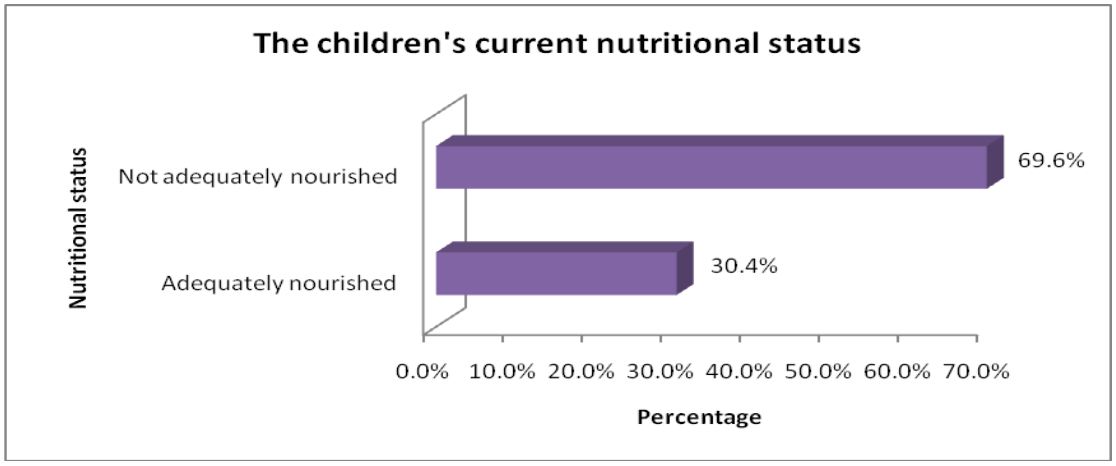

Figure 0.3 Current nutritional status of the children

The results indicated that most (69.6%, n = 87) of the under-five children readmitted with pneumonia in KNH's Paediatric Unit were not adequately nourished as depicted in Figure 4.3 above.

Table 0.5 Association of child's current nutritional status with pneumonia readmission

		Pneumonia readmissions			Chi-sq. p value (95% CI)
		2 times [N = 68]	> 2 times [N = 57]	Total	
Is the child's nutritional status adequate?	Yes	30	8	**38**	
	No	38	49	**87**	0.007

Further, a statistically significant association was identified between the children's inadequate nutritional status and pneumonia readmission (X^2 = 7.264, df = 1, p = 0.007) as shown in Table 4.5 above. This implied that child's inadequate nutritional status was a significant determinant of readmission for pneumonia among the under five children admitted in the hospital.

4.4.4 Child's Exclusive Breastfeeding and Association with Pneumonia Readmission

The results on the children's exclusive breastfeeding status in the first six months were as presented in Figure 4.4.

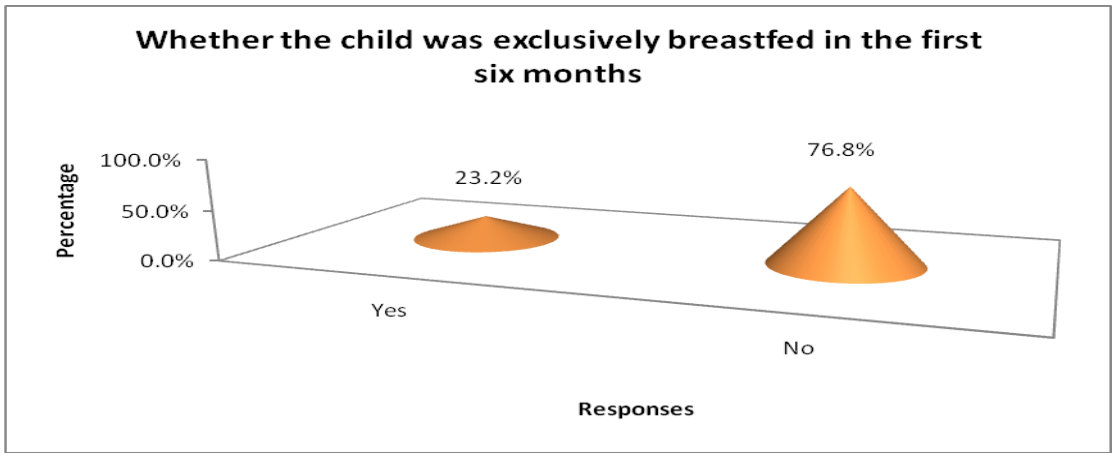

Figure 0.4 The children's exclusive breastfeeding status in the first six months

Most (76.8%, n = 96) of the under-five children readmitted with pneumonia in KNH's Paediatric Unit were not exclusively breastfed in the first six months as denoted in Figure 4.4 above.

Table 0.6 Association of child's exclusive breastfeeding with pneumonia readmission

		Pneumonia readmissions			Chi-sq. p value (95% CI)
		2 times [N = 68]	> 2 times [N = 57]	Total	
Child exclusively breastfed	Yes	25	4	**29**	
in the first 6 months	No	43	53	**96**	0.015

Having not been exclusively breastfed in the first six months was found to be significantly associated with pneumonia readmission among the studied children (X^2 = 5.797, df = 1, p = 0.015) as shown in Table 4.6 above. This implied that child's lack

of exclusive breastfeeding in the first six months was a significant determinant of readmission for pneumonia among the under five children admitted in the hospital.

4.4.5 Child's Immunization Status and Association with Pneumonia Readmission

The findings on the children's immunization status were as depicted in Figure 4.5.

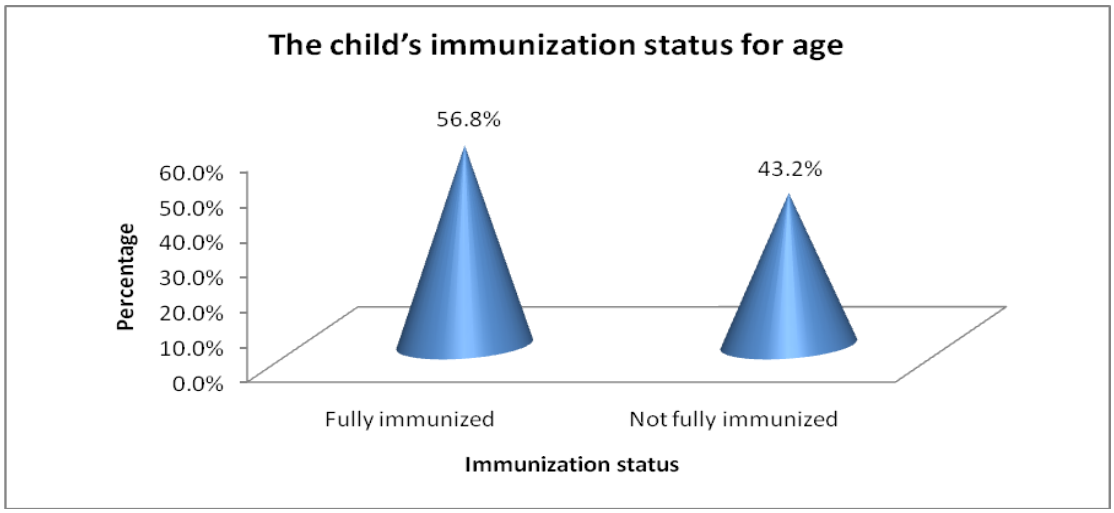

Figure 0.5 Children's distribution on the basis of immunization status for age

The findings indicated that slightly more than half (56.8%, n = 71) of the under-five children readmitted with pneumonia in KNH's Paediatric Unit were fully immunized while 43.2% (n = 54) were not, as depicted in Figure 4.5 above.

Table 0.7 Association of immunization status with pneumonia readmission

		Pneumonia readmissions			Chi-sq. p value (95% CI)
		2 times [N = 68]	> 2 times [N = 57]	Total	
Child fully immunized	Yes	48	23	**71**	
	No	20	34	**54**	0.033

Further, a statistically significant association was established between incomplete immunization status for age and pneumonia readmission (X^2 = 4.592, df = 1, p = 0.033) as illustrated in Table 4.7 below. This implied that a child's incomplete

immunization status for age was a significant determinant of readmission for pneumonia among the under five children admitted in the hospital.

4.4.6 Child's other illnesses and Association with Pneumonia Readmission

The study sought to find out whether the children had any other pre-existing illnesses other than pneumonia, and if so, the kind of illness (or illnesses) as illustrated in table 4.8.

Table 0.8 Whether the children had other illnesses and their nature

		Frequency	Percent
Whether the child had any other illness other than pneumonia	Yes	48	38.4
	No	77	61.6
	Total	**125**	**100.0**
If Yes, which one? [Answered only by those who said Yes]	COPD	27	56.3
	Congenital heart disease	11	22.9
	HIV	8	16.7
	Cancer	2	4.2
	Total	**48**	**100.0**

The results indicated that slightly over half (61.6%, n = 77) of the under-five children readmitted with pneumonia in KNH's Paediatric Unit had no other pre-existing illnesses other than pneumonia. However, about 40% (n = 48) of them had other pre-existing illnesses other than pneumonia as depicted in Table 4.8 above.

Table 0.9 Association of child having other pre-existing illnesses with pneumonia readmission

		Pneumonia readmissions			Chi-sq. p value (95% CI)
		2 times [N = 68]	> 2 times [N = 57]	Total	
Child has other pre-existing illnesses	Yes	13	35	**48**	
	No	55	22	**77**	0.023

In addition, the study established that there was a statistically significant association between the child having other pre-existing illnesses and pneumonia readmission (X^2 = 5.101, df = 1, p = 0.023) as depicted in Table 4.9 above. This implied that the child having other pre-existing illnesses was a significant determinant of readmission for pneumonia among the under five children admitted in the hospital.

In light of the findings described in sub-sections 4.4.1 to 4.4.6, the researcher rejects the null hypothesis that patient related factors had no significant association with pneumonia readmissions among children aged under five admitted at Kenyatta National Hospital. Consequently, the study holds that patient related factors had a significant association with pneumonia readmissions among children aged under five admitted at Kenyatta National Hospital.

4.5 Caregiver Related Determinants of Pneumonia Associated Readmissions in Under Five Children

The study sought to assess the caregiver related determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital. The findings were as described in the subsequent subsections.

4.5.1 Caregiver Related Determinants Associated with Pneumonia Readmissions

The caregiver related determinants evaluated included the caregiver's relationship with the child, education level, occupation, household monthly income level, place of residence, whether they lived with a person(s) who smoked cigarettes, handling of domestic/indoor smoking, hand washing practice and knowledge of the signs and symptoms of pneumonia in children. Table 4.10 highlights the findings:

Table 0.10 Descriptive statistics of the caregiver related determinants

Caregivers' determinants		**Frequency**	**Percent**
Relationship with the child	Parent	118	94.4
	Relative	5	4.0
	Friend to the parent(s)	2	1.6
	Total	**125**	**100.0**
Education level	No formal education	9	7.2

	Primary	35	28.0
	Secondary	64	51.2
	Tertiary	17	13.6
	Total	**125**	**100.0**
Occupation	Unemployed	27	21.6
	Self-employed	21	16.8
	In informal employment	63	50.4
	In formal employment	14	11.2
	Total	**125**	**100.0**
Household monthly income level	Kshs. 10,000 & below	88	70.4
	Above Kshs. 10,000	37	29.6
	Total	**125**	**100**
Place of residence	Rural	84	67.2
	Urban	41	32.8
	Total	**125**	**100.0**
Living with a person who smokes cigarettes	Yes	52	41.6
	No	73	58.4
	Total	**125**	**100.0**
Ever trained on how to handle domestic/indoor smoking	Yes	12	9.6
	No	113	90.4
	Total	**125**	**100.0**
Do you regularly observe proper hand washing practice?	Yes	18	14.4
	No	107	85.6
	Total	**125**	**100.0**
Were you aware of the signs and symptoms of pneumonia in children prior to this admission	Yes	15	12.0
	No	110	88.0
	Total	**125**	**100.0**
Sought treatment for the child promptly [without any delay]	Yes	7	5.6
	No	118	94.4
	Total	**125**	**100.0**

Most (94.4%, n = 118) of the caregivers were parents of the hospitalized child; most had low education level as only 13.6% (n = 17) had attained tertiary education; about half were in informal employment (50.4%, n = 63) with 21.6% (n = 27) being unemployed; most were from low income households as 70.4% (n = 88) had a household monthly income level of Kshs. 10,000 and below; most (67.2%, n = 84) lived in rural areas; slightly over half (58.4%, n = 73) did not live with a person who smoked cigarettes; most (90.4%, n = 113) had never been trained on how to handle

domestic/indoor smoking; most (85.6%, n = 107) did not regularly observe proper hand washing practice; most (88%, n = 110) were not aware of the signs and symptoms of pneumonia in children prior to this admission and that most (94.4%, n = 118) did not seek treatment for their sick child promptly.

This showed that majority of the caregivers of the under five children readmitted with pneumonia at Kenyatta National Hospital were of low social economic status. This was evidenced by their low education background and low household income levels. It was evident that they also had low knowledge regarding prevention of pneumonia in children given that they had never been trained on how to handle domestic/indoor smoking, they did not regularly observe proper hand washing practice; were not aware of the signs and symptoms of pneumonia in children prior to this admission and delayed in care seeking for their sick child.

4.5.2 Association between Caregiver Related Determinants and Pneumonia Readmission

The chi-square statistic at 95% confidence level was applied to ascertain the association between the various caregiver related determinants and pneumonia readmissions among under five children admitted at Kenyatta National Hospital. A p value of < 0.05 was considered as being statistically significant. Table 4.11 shows the findings:

Table 0.11 Association of caregiver related determinants with pneumonia readmission

Caregivers' determinants		**Pneumonia readmissions**			**Chi-sq. p value (95% CI)**
		2 times [N = 68]	**> 2 times [N = 57]**	**Total**	
Relationship with the child	Parent	65	53	**118**	
	Non-parents	3	4	**7**	0.163
Education level	Secondary & below education	56	52	**108**	
	Tertiary education	12	5	**17**	0.018

Household monthly income level	Kshs. 10,000 & below	53	35	**88**	
	Above Kshs. 10,000	15	22	**37**	0.029
Resides in a rural area	Yes	29	55	**84**	
	No	39	2	**41**	0.038
Living with a cigarette smoker	Yes	10	42	**52**	
	No	58	15	**73**	0.020
Trained on handling domestic/indoor smoking	Yes	8	4	**12**	
	No	60	53	**113**	
					0.012
Regularly observes proper hand washing practice	Yes	13	5	**18**	
	No	55	52	**107**	
					0.031
Whether aware of the signs and symptoms of pneumonia in children prior to this admission	Yes	11	4	**15**	
	No	57	53	**110**	
					0.006
Sought treatment for the child promptly	Yes	5	2	**7**	
	No	63	55	**118**	
					0.036

The caregiver related determinants found to have a statistically significant association with pneumonia readmissions among the under five children admitted at Kenyatta National Hospital, at 95% confidence level, were the caregiver's low education level ($X^2 = 5.721$, df = 1, p = 0.018); low household monthly income level ($X^2 = 4.747$, df = 1, p = 0.029); rural residence ($X^2 = 4.216$, df = 1, p = 0.038); living with a person who smoked cigarettes ($X^2 = 5.573$, df = 1, p = 0.020); lack of training on handling domestic/indoor smoking ($X^2 = 6.359$, df = 1, p = 0.012); failure to regularly observe proper hand washing practice ($X^2 = 4.728$, df = 1, p = 0.031); lack of awareness about the signs and symptoms of pneumonia in children prior to the current admission ($X^2 = 7.352$, df = 1, p = 0.006) and delays in seeking treatment for the sick child ($X^2 = 4.357$, df = 1, p = 0.036). However, no statistically significant association was found

between caregiver's relationship with the child and the under-five pneumonia readmissions at Kenyatta National Hospital ($X^2 = 3.632$, df = 1, p = 0.163).

This implied that the caregiver related determinants that had a significant association with pneumonia readmissions among children aged below five years admitted at Kenyatta National Hospital related to their education level, household income level, place of residence, knowledge on handling of domestic/indoor smoking, observance of proper hand washing practice, knowledge of signs and symptoms of pneumonia in children and delay in seeking treatment for the sick child.

In light of these findings, the researcher rejects the null hypothesis that caregiver related determinants had no significant association with pneumonia readmissions among children aged under five admitted at Kenyatta National Hospital. Consequently, the study holds that caregiver related determinants had a significant association with pneumonia readmissions among children aged under five admitted at Kenyatta National Hospital.

4.6 Environment Related Determinants of Pneumonia Associated Readmissions in Under Five Children

The study sought to analyze the environment related determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital. The environment related factors considered included family size, place where cooking was done, kinds of cooking fuel used, type of house lived in, house ventilation and living with domestic animals. The findings were as described in the subsequent subsections.

4.6.1 Family Size and Association with Pneumonia Readmission

Results on the caregivers' family sizes were as illustrated in Figure 4.6.

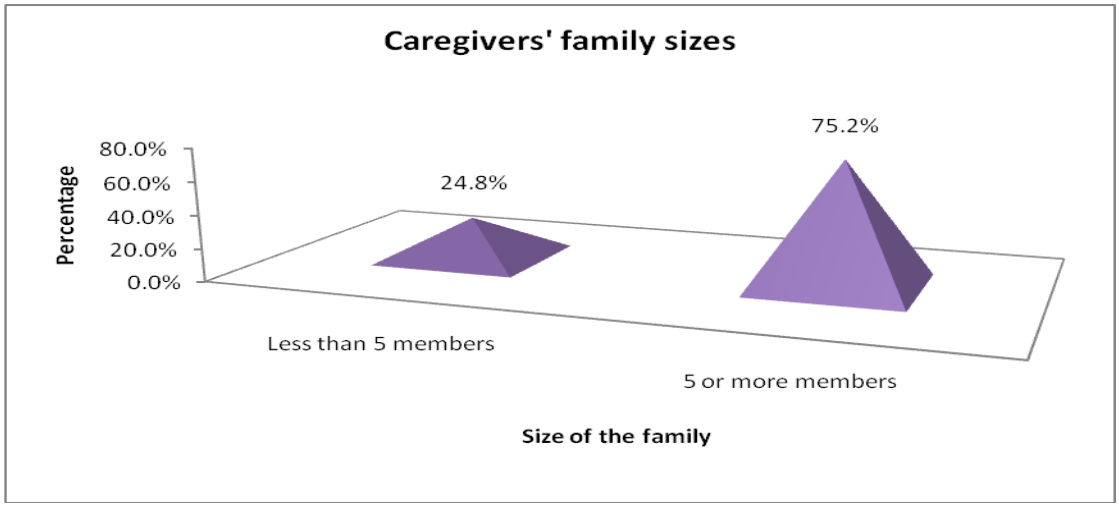

Figure 0.6 Caregiver's family size

Most (75.2%, n = 94) of the under-five children readmitted with pneumonia in KNH's Paediatric Unit lived in families with 5 or more members while 24.8% (n = 31) lived in families with less than 5 members, as illustrated in Figure 4.6 above.

Table 0.12 Association of family size with pneumonia readmission

		Pneumonia readmissions			Chi-sq. p value (95% CI)
		2 times [N = 68]	> 2 times [N = 57]	Total	
Family size	< 5 members	19	12	**31**	
	≥ 5 members	49	45	**94**	0.030

Further, the results indicated that there was a statistically significant association between large family sizes and pneumonia readmission ($X^2 = 4.739$, df = 1, p = 0.030) as shown in Table 4.12 above. This implied that having a large family size was a major determinant of readmission for pneumonia among the under five children admitted in the hospital.

4.6.2 Place where Cooking was Done and Association with Pneumonia Readmission

Figure 4.7 contains the findings relating to place where cooking was done.

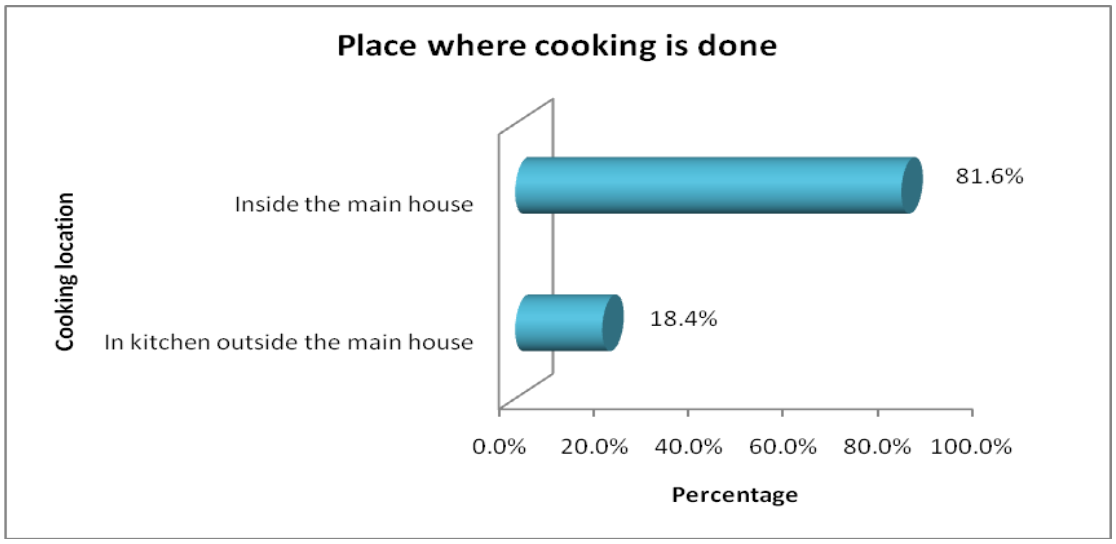

Figure 0.7 Place where cooking was done

Most (81.6%, n = 102) of the families of the under-five children readmitted with pneumonia in KNH's Paediatric Unit did their cooking inside the main house while 18.4% (n = 23) did their cooking in a kitchen outside the main house, as shown in Figure 4.7 above.

Table 0.13 Association of cooking location with pneumonia readmission

		Pneumonia readmissions			Chi-sq. p value (95% CI)
		2 times [N = 68]	> 2 times [N = 57]	Total	
Is cooking done inside the main house	Yes	54	48	**102**	
	No	14	9	**23**	0.041

It was further established that a statistically significant association existed between cooking being done inside the main house and pneumonia readmission ($X^2 = 4.174$, df = 2, p = 0.041) as captured in Table 4.13 above. This implied that cooking being done inside the main house was a significant determinant of readmission for pneumonia among the under five children admitted in the hospital.

4.6.3 Cooking Fuel and Association with Pneumonia Readmission

The results, on the kinds of cooking fuel used, were as shown in Figure 4.8.

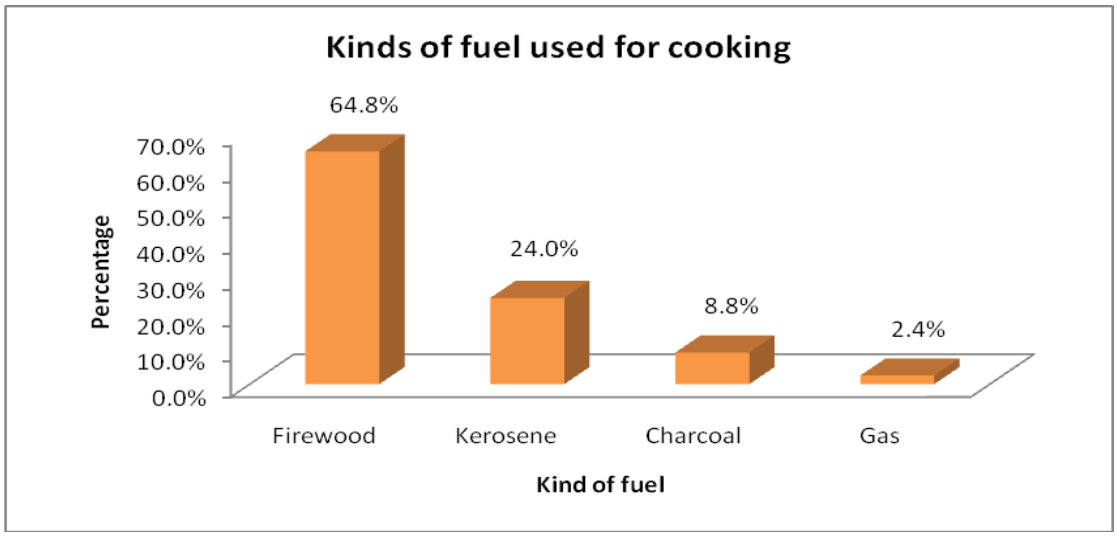

Figure 0.8 Kinds of fuel used for cooking in the respondents' homes

The results indicated that firewood (64.8%, n = 81) followed by kerosene (24%, n = 30) were the main kinds of fuel that were used for cooking in most of the homes of the under-five children readmitted with pneumonia in KNH's Paediatric Unit.

The findings on the association between the kind of fuel used for cooking and pneumonia readmission were as captured in Table 4.14.

Table 0.14 Association of kind of fuel used for cooking with pneumonia readmission

		Pneumonia readmissions			Chi-sq. p value (95% CI)
		2 times [N = 68]	> 2 times [N = 57]	Total	
Kind of fuel used for cooking	Firewood	40	41	**81**	
	Kerosene	22	8	**30**	
	Charcoal	3	8	**11**	
	Gas	3	0	**3**	0.013

In addition, the study established that there was a statistically significant association between use of firewood, kerosene and charcoal as the main kinds of fuel for cooking and pneumonia readmission (X^2 = 6.169, df = 3, p = 0.013) as shown in Table 4.14 above. This implied that the use of firewood, kerosene and charcoal as the main kinds of fuel for cooking was a significant determinant of readmission for pneumonia among the under five children admitted in the hospital.

4.6.4 Type of House Lived in and Association with Pneumonia Readmission

The finding, as to the type of house lived in, was as depicted in Figure 4.9.

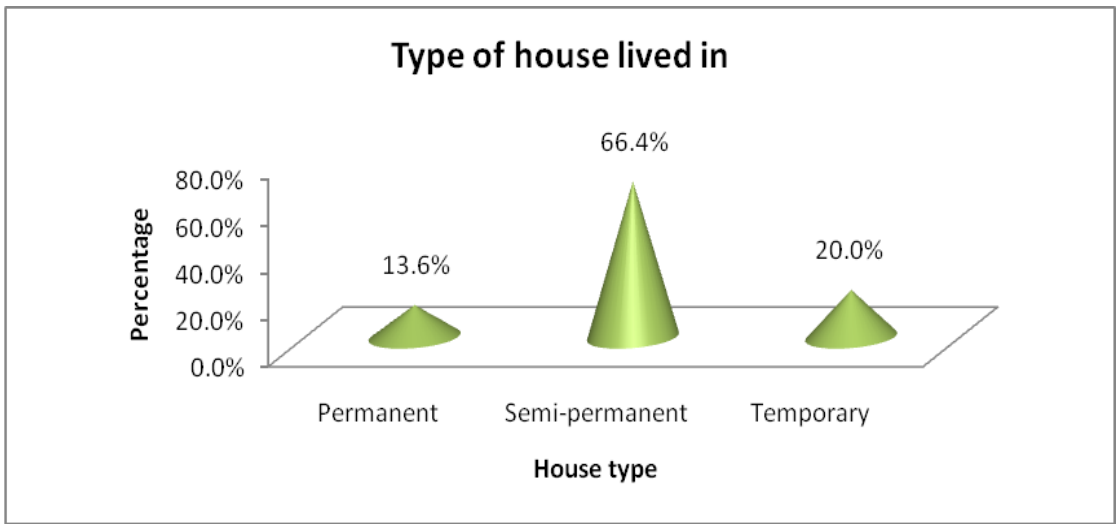

Figure 0.9 Type of house lived in by the respondents' families

Most (66.4%, n = 83) of the families of the under-five children readmitted with pneumonia in KNH's Paediatric Unit lived in semi-permanent houses while 20% (n = 25) lived in temporary houses, as shown in Figure 4.9 above.

Table 0.15 Association of type of house lived in with pneumonia readmission

		Pneumonia readmissions			Chi-sq. p value (95% CI)
		2 times [N = 68]	> 2 times [N = 57]	Total	
Type of house lived in	Permanent	14	3	**17**	
	Semi-permanent	48	35	**83**	
	Temporary	6	19	**25**	0.037

In addition, a statistically significant association was established between living in semi-permanent or temporary houses and pneumonia readmission ($X^2 = 4.235$, df = 2, p = 0.037), as depicted in Table 4.15 above. This implied that the type of house lived in was a significant determinant of readmission for pneumonia among the under five children admitted in the hospital.

4.6.5 House Ventilation and Association with Pneumonia Readmission

The findings on house ventilation aspects were as illustrated in Table 4.16.

Table 0.16 Whether the house lived in had windows and if so how many

		Frequency	Percent
Does the house you live in have window(s)?	Yes	116	92.8
	No	9	7.2
	Total	**165**	**100.0**
If Yes, how many? [Answered only by those who said Yes]	One	78	67.2
	Two	26	22.4
	Three	10	8.6
	More than three	2	1.7
	Total	**116**	**100.0**
Is your house's ventilation adequate?	Yes	19	15.2
	No	106	84.8

Total	**125**	**100.0**

The findings indicated that majority (92.8%, n = 116) of the families of the under-five children readmitted with pneumonia in KNH's Paediatric Unit lived in houses with a window (or windows) while only 7.2% (n = 9) lived in houses without a single window.

Of those who lived in houses with a window (or windows), most 67.2% (n = 78) said their house had one window while 22.4% (n = 26) said it had two windows.

However, only 15.2% (n = 19) considered their houses' ventilation as being adequate with most 84.8% (n = 106) viewing it as being inadequate.

Table 0.17 Association of house ventilation with pneumonia readmission

		Pneumonia readmissions			**Chi-sq. p value (95% CI)**
		2 times [N = 68]	**> 2 times [N = 57]**	**Total**	
Ventilation status	Inadequate	59	47	**106**	
	Adequate	9	10	**19**	0.014

Further, a statistically significant association was identified between inadequate house ventilation and pneumonia readmission ($X^2 = 6.148$, df = 1, p = 0.014) as illustrated in Table 4.17 above. This implied that inadequate house ventilation was a significant determinant of readmission for pneumonia among the under five children admitted in the hospital.

4.6.6 Living with Domestic Animals and Association with Pneumonia Readmission

The study sought to establish whether the caregivers lived with domestic animals in their main houses and if so, which and how many. The findings were as shown in Table 4.18.

Table 0.18 Whether they lived with domestic animals and if so which and how many

		Frequency	Percent
Do you live with domestic animals in your main house?	Yes	95	76.0
	No	30	24.0
	Total	**125**	**100.0**
If Yes, which animals? [Answered only by those who said Yes]	Cows and goats	54	56.8
	Pigs and sheep	7	7.4
	Poultry	23	24.2
	Dogs and cats	11	11.6
	Total	**95**	**100.0**
If Yes, how many? [Answered only by those who said Yes]	1 – 3	9	9.5
	4 – 6	58	61.1
	More than six	28	29.5
	Total	**95**	**100.0**

Most (76%, n = 95) of the families of the under-five children readmitted with pneumonia in KNH's Paediatric Unit lived with domestic animals in their main houses while 24% (n = 30) indicated that they did not live with domestic animals in their main houses.

The domestic animals with which the respondents lived with in their houses included cows and goats (56.8%, n = 54), poultry (24.2%, n = 23), dogs and cats (11.6%, n = 11) and pigs and sheep as reported by 7.4% (n = 7) of the respondents.

The findings also indicated that, most (61.1%, n = 58) lived with animals totaling 4 - 6 while 29.5% (n = 28) said they lived with animals totaling more than 6.

This showed that most of the families of the under-five children readmitted with pneumonia in KNH's Paediatric Unit did live with multiple domestic animals in their houses.

Table 4.19 below summarizes the findings on the association between living with domestic animals and pneumonia readmission

Table 0.19 Association of living with domestic animals with pneumonia readmission

		Pneumonia readmissions			Chi-sq. p value (95% CI)
		2 times [N = 68]	> 2 times [N = 57]	Total	
Living with domestic animals	Yes	51	44	**95**	
	No	17	13	**30**	
					0.017

Further, a statistically significant association was identified between living with domestic animals in the same house and pneumonia readmission ($X^2 = 5.749$, df = 1, p = 0.017) as depicted in Table 4.19 above. This implied that living with domestic animals in the same house was a significant determinant of readmission for pneumonia among the under five children admitted in the hospital.

In light of the findings described in sub-sections 4.6.1 to 4.6.6, the researcher rejects the null hypothesis that environmental related determinants had no significant association with pneumonia readmissions among children aged under five admitted at Kenyatta National Hospital. Consequently, the study holds that environmental related determinants had a significant association with pneumonia readmissions among children aged under five admitted at Kenyatta National Hospital.

4.7 Health System Related Determinants of Pneumonia Associated Readmissions in Under Five Children

The study sought to determine the health system related determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital. The health system related factors considered included adequacy of the health care giver to patient ratio in the hospital, congestion in wards, health status of the child during the previous discharge, whether the child got treatment from elsewhere prior to the current admission at KNH, whether the caregivers understood issued instructions on caring for the sick child, whether the child had been admitted in

ICU in their immediate previous hospitalization and quality of care offered. The findings were as described in the subsequent subsections.

4.7.1 Respondents' view as to adequacy of the health care giver to patient ratio in the hospital

The respondents were asked to indicate whether in their opinion they felt the health care giver to patient ratio in the hospital was adequate. Figure 4.10 illustrates the findings.

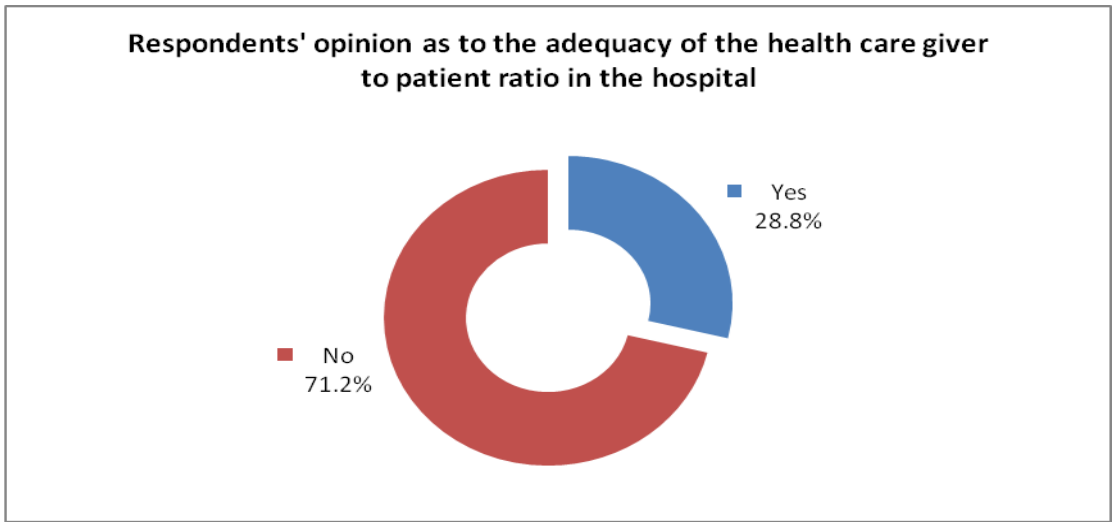

Figure 0.10 Caregiver's view as to the adequacy of the health care giver to patient ratio in the hospital

Most (71.2%, n = 89) of the caregivers of the under-five children readmitted with pneumonia in KNH's Paediatric Unit were of the view that the health care giver to patient ratio in the hospital was inadequate, as depicted in Figure 4.10 above.

Table 0.20 Association of inadequacy of health care giver - patient ratio with pneumonia readmission

In your view, is the health care giver to patient ratio in this hospital adequate?	Pneumonia readmissions			Chi-sq. p value (95% CI)
	2 times [N = 68]	> 2 times [N = 57]	Total	

Yes	29	7	**36**	
No	39	50	**89**	0.043

Further, a statistically significant association was identified between inadequacy of health care giver to patient ratio in the hospital and pneumonia readmission (X^2 = 4.012, df = 1, p = 0.043) as depicted in Table 4.20 above. This implied that inadequacy of health care giver to patient ratio in a hospital was a major determinant of readmission for pneumonia among the under five children admitted in the hospital.

4.7.2 Congestion in Wards and Association with Pneumonia Readmission

Figure 4.11 illustrates findings regarding congestion in pediatric wards at KNH.

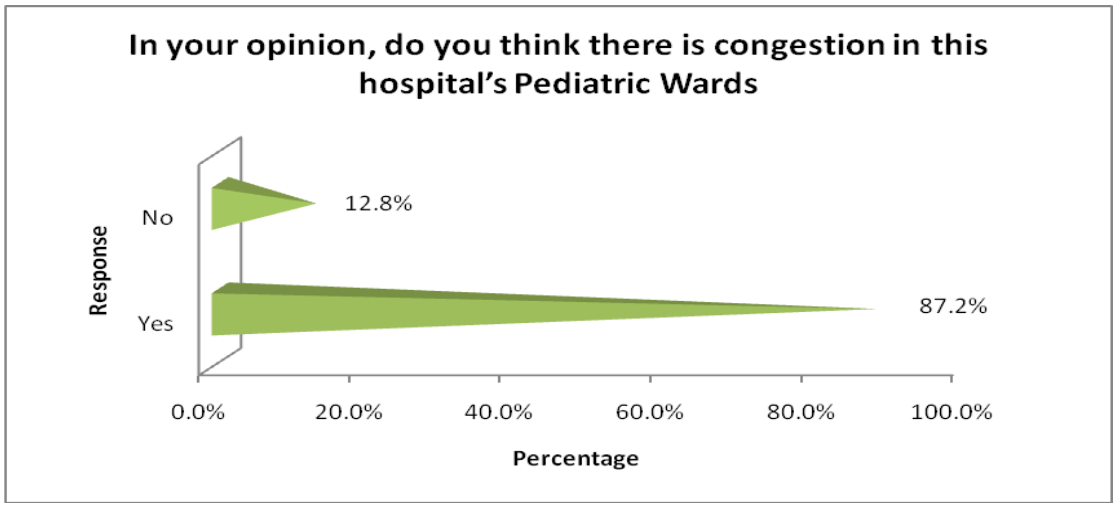

Figure 0.11 Caregivers' view regarding congestion in the Pediatric Wards

From the findings, most (87.2%, n = 109) of the caregivers of the under-five children readmitted with pneumonia in KNH's Paediatric Unit shared the view that the hospital's Pediatric Wards were congested, as shown in Figure 4.11 above.

Table 0.21 Association of congestion in hospital's children wards with pneumonia readmission

	Pneumonia readmission	**Total**	**Chi-sq. p value**

		2 times [N = 68]	> 2 times [N = 57]		(95% CI)
Are the Pediatric Wards in	Yes	61	48	**109**	
this hospital congested?	No	7	9	**16**	0.025

It was further established that a statistically significant association existed between congestion in the hospital's pediatric wards and pneumonia readmission ($X^2 = 5.074$, df = 1, p = 0.025), as depicted in Table 4.21 above. This implied that congestion in hospital's children wards was a significant determinant of readmission for pneumonia among the under five children admitted in the hospital.

4.7.3 Health Status of the Child during the Previous Discharge and Association with Pneumonia Readmission

The study sought to establish whether the caregivers were satisfied with the health of their child during the previous discharge. The results were as shown in Figure 4.12.

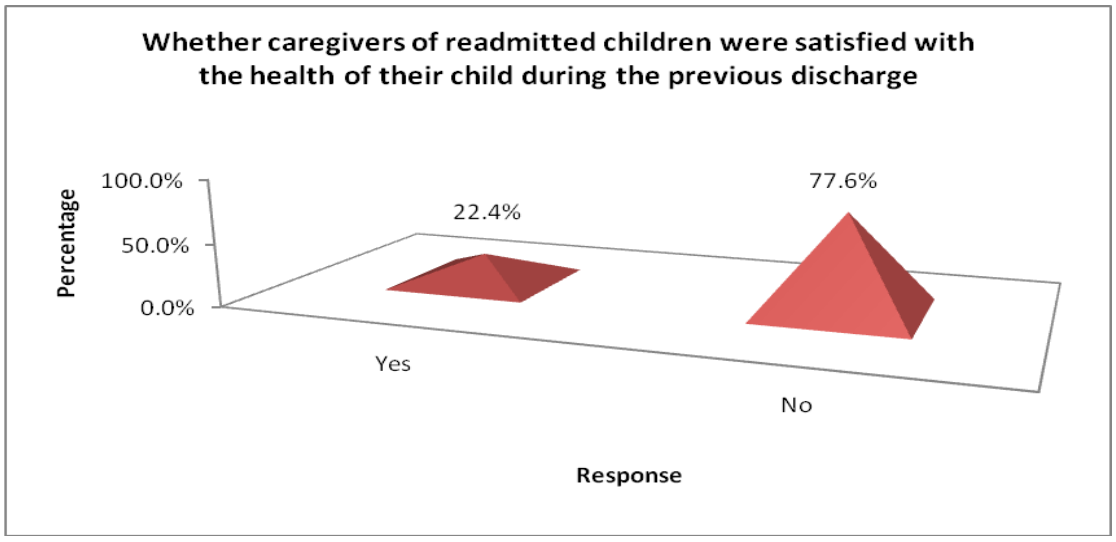

Figure 0.12 Whether the caregivers of the readmitted children were satisfied with the health of their child during the previous discharge

Most 77.6% (n = 97) of the caregivers of the under-five children readmitted with pneumonia in KNH's Paediatric Unit indicated that they were not satisfied with the health of their children during the previous discharge. However, 22.4% (n = 28)

indicated being satisfied with the health of their children during the previous discharge, as depicted in Figure 4.12 above.

The main reason cited by those that were not satisfied with the health status of their child during the previous discharge was that the child was discharged before full recovery while others said they felt that the child was not getting the right treatment. Others cited frequent resurgence of the illness as an indicator that the child was not properly treated in their previous point of treatment.

Table 0.22 Association of the health status of the child during the previous discharge with pneumonia readmission

		Pneumonia readmissions			Chi-sq. p value
		2 times [N = 68]	> 2 times [N = 57]	Total	(95% CI)
Child's health satisfactory at previous discharge	Yes	17	11	**28**	
	No	51	46	**97**	0.009

In addition, the study established that there was a statistically significant association between unsatisfactory health status of the child during the previous discharge and pneumonia readmission (X^2 = 6.618, df = 1, p = 0.009), as shown in Table 4.22 above. This implied that unsatisfactory health status of the child during the previous discharge was a significant determinant of readmission for pneumonia among the under five children admitted in the hospital.

4.7.4 Whether the Child Got Treatment from Elsewhere before Current Admission at KNH

The caregivers were requested to indicate whether they had sought medication/treatment elsewhere before their current readmission at KNH, with Table 4.23 illustrating the findings.

Table 0.23 Whether the child had been treated elsewhere before current admission and if so where

		Frequency	Percent
Did you seek treatment elsewhere prior to your child's admission at KNH?	Yes	125	100.0
	No	0	0.0
	Total	**125**	**100.0**
If Yes, where?	Local pharmacies	5	4.0
	Regional public hospital	90	72.0
	Private health care centres	19	15.2
	Local public health care centres	11	8.8
	Total	**165**	**100.0**

Results indicated that all (100%, n = 165) of the caregivers of the under-five children readmitted with pneumonia in KNH's Paediatric Unit had sought medication/treatment for their child elsewhere before their current readmission at KNH.

According to the results, most 72% (n = 90) had sought medication/treatment for their child from regional public hospitals while 15.2% (n = 19) said from private health care centres. This implied that most of the under-five children readmitted with pneumonia at KNH were in the hospital largely on a referral basis.

4.7.5 Understanding of Care Giving Instructions and Association with Pneumonia Readmission

The study sought to establish whether the caregivers understood issued instructions on caring for the sick child. Figure 4.13 indicates the findings.

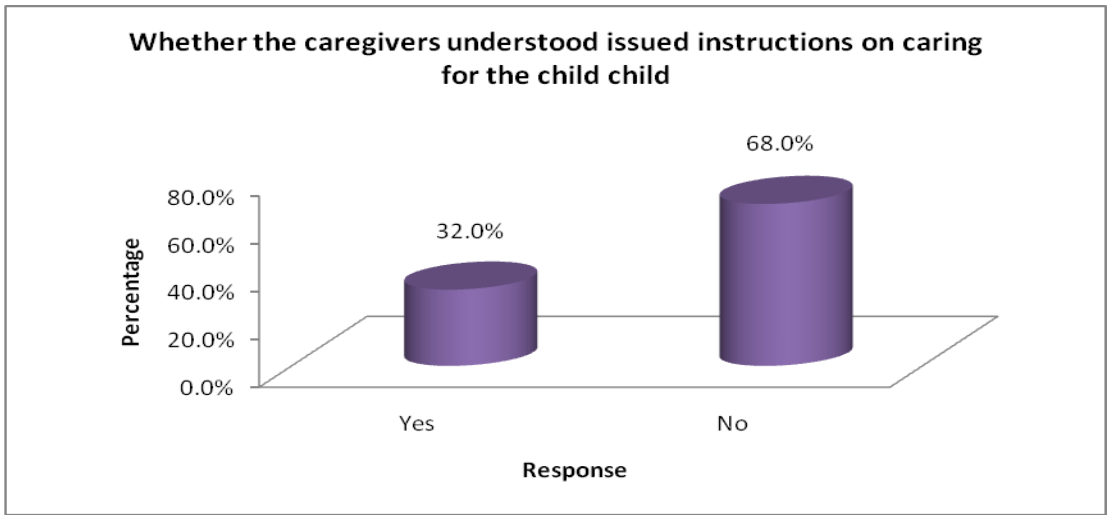

Figure 0.13 Whether the caregivers understood issued instructions on caring for the sick child

Most (68%, n = 85) of the caregivers of the under-five children readmitted with pneumonia in KNH's Paediatric Unit did not understand health care workers' issued instructions on how to care for the sick child, as depicted in Figure 4.13 above.

The association between the caregivers' understanding of issued instructions relating to caring for the sick child and pneumonia readmission was as shown in Table 4.24.

Table 0.24 Association of caregivers' understanding of issued instructions relating to caring for the sick child with pneumonia readmission

		Pneumonia readmissions			Chi-sq. p value (95% CI)
		2 times [N = 68]	> 2 times [N = 57]	Total	
Do you understand issued instructions on caring for the sick child?	Yes	12	28	**40**	
	No	56	29	**85**	
					0.022

A statistically significant association was also found between caregivers' low or lack of understanding of instructions given regarding caring for the sick child and pneumonia readmission (X^2 = 5.129, df = 1, p = 0.022) as depicted in Table 4.24 above. This implied that caregivers' lack of or low understanding of instructions

given regarding caring for the sick child was a significant determinant of readmission for pneumonia among the under five children admitted in the hospital.

4.7.6 Admission in ICU and Association with Pneumonia Readmission

The caregivers were requested to indicate whether the child had been admitted in ICU in their immediate previous hospitalization. The findings were as depicted in Table 4.25.

Table 0.25 Child's admission in ICU in earlier hospitalization

		Frequency	Percent
Was the child admitted in ICU in the immediate previous admission	Yes	15	12.0
	No	110	88.0
	Total	**125**	**100.0**

The results indicated that most (88%, n = 110) of the under-five children readmitted with pneumonia in KNH's Paediatric Unit had not been admitted in ICU in earlier hospitalization. Only 12% (n = 15) of the caregivers said that their children had been admitted in ICU in the immediate previous hospitalization, as shown in Table 4.25 above.

Table 0.26 Association of past admission in ICU with pneumonia readmission

		Pneumonia readmission			Chi-sq. p value (95% CI)
		2 times [N = 68]	> 2 times [N = 57]	Total	
Child admitted in ICU in the immediate previous admission	Yes	4	11	**15**	
	No	64	46	**110**	0.027

Further, a statistically significant association was established between child's admission in ICU in the immediate past hospitalization and pneumonia readmission ($X^2 = 4.778$, df = 1, p = 0.027) as illustrated in Table 4.26 above. This implied that a child's admission in ICU during previous hospitalization was a significant

determinant of readmission for pneumonia among the under five children admitted in the hospital.

4.7.7 Quality of Care Offered and Association with Pneumonia Readmission

The study sought to find out whether the caregivers of the under-five children readmitted with pneumonia in KNH's Paediatric Unit were satisfied with the quality of care being offered to their sick child. The findings were as shown in Figure 4.14.

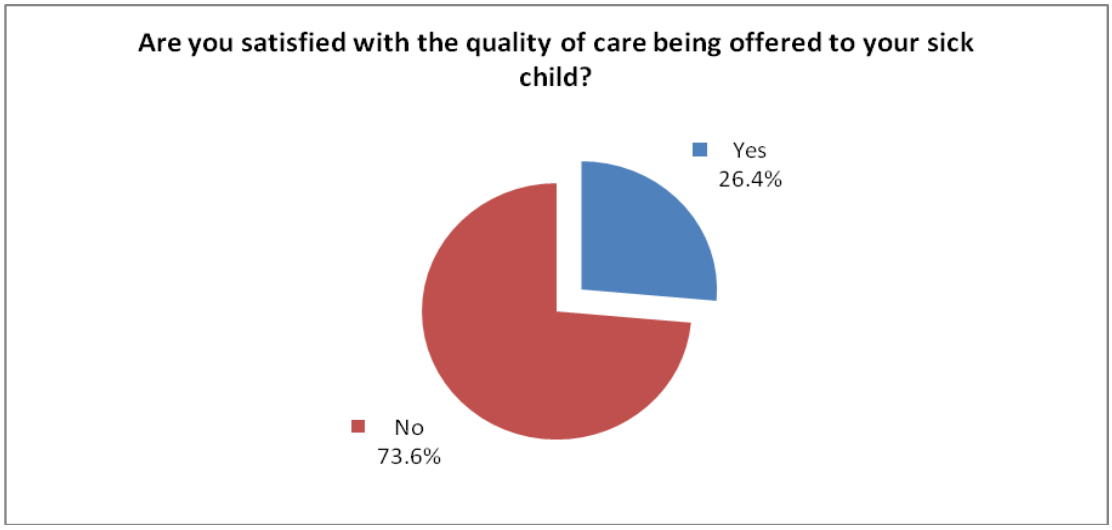

Figure 0.14 Caregivers' satisfaction with quality of care offered to their children

Most (73.6%, n = 92) of the caregivers of the under-five children readmitted with pneumonia in KNH's Paediatric Unit were not satisfied with the quality of care being offered to their sick child, as depicted in Figure 4.14 above.

Table 0.27 Association of quality of care offered with pneumonia readmission

		Pneumonia readmissions			
		2 times [N = 68]	> 2 times [N = 57]	Total	Chi-sq. p value (95% CI)
Are you satisfied with the	Yes	25	8	**33**	
quality of care being offered	No	43	49	**92**	0.012

to your sick child

Further, a statistically significant association was established between low/poor quality of quality of care offered and pneumonia readmission ($X^2 = 6.359$, df = 1, p = 0.012), as depicted in Table 4.27 above. This implied that low/poor quality of care offered to pediatric pneumonia patients was a significant determinant of readmission for pneumonia among the under five children admitted in the hospital.

In light of the findings described in sub-sections 4.7.1 to 4.7.7, the researcher rejects the null hypothesis that health system related determinants had no significant association with pneumonia readmissions among children aged under five admitted at Kenyatta National Hospital. Consequently, the study holds that health system related determinants had a significant association with pneumonia readmissions among children aged under five admitted at Kenyatta National Hospital.

CHAPTER FIVE: DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents discussion of findings, conclusions and recommendations of the study in line with the study objectives. The study sought to assess determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital.

5.2 Discussion of Findings

5.2.1 Patient Related Determinants of Pneumonia Associated Readmissions in Under Five Children

According to this study, the patient related determinants found to be statistically associated with pneumonia readmissions among the under five children admitted in the Peadiatric Unit of Kenyatta National Hospital were child's younger age (of 2 years and below), the child's gestation at birth, low birth weight, the child's inadequate nutritional status, the child having not been exclusively breastfed in the first six months, the child's incomplete immunization status for age and the child having other pre-existing illnesses apart from pneumonia. However, no significant association was established between the child's gender and readmission for pneumonia in the hospital. Based on these findings, the study rejected the null hypothesis and held that patient related determinants had a significant association with pneumonia readmissions among children aged under five admitted at Kenyatta National Hospital. This implied that a wide range of patient related factors such as their age, gestation at birth, birth weight, nutritional status, exclusive breastfeeding in the first 6 months, immunization status and other comorbidities were significant associations of pneumonia readmission among under five children admitted at KNH.

Similar findings were reported by Hong et al. (2017) in South Korea who identified younger age, low birth weight, malnutrition and having not been exclusively breastfed as significant risk factors for pediatric pneumonia readmissions. Similar observations

were made by Ramezani et al. (2015) who in an investigation of factors affecting the rate of pediatric pneumonia and associated hospital readmissions in the developing countries identified low birth weight, malnutrition, not being breast fed, not being immunized and young age of 2 years and below as the most important risk factors that affected the rate of pneumonia in children and its associated hospital readmissions in the developing countries.

Similarly, Leung *et al*. (2016) identified birth weight, lack of exclusive breastfeeding for the first 4-6 months, under-nutrition, children with compromised immune systems and young age as leading risk factors for pneumonia readmissions in low- and middle-income countries. On their part, Neuman *et al*. (2014) opined that being born prematurely, having a low birth weight, malnutrition and poor immunization status were strongly associated with increased incidence of pneumonia hospitalization and possible readmission. On their part, Lin *et al*. (2019) established that nasogastric tube use and having pre-exiting comorbidities such as chronic respiratory disease significantly increased the risk of rehospitalization for pediatric pneumonia patients.

5.2.2 Caregiver Related Determinants of Pneumonia Associated Readmissions in Under Five Children

According to this study, the caregiver related determinants found to be statistically associated with pneumonia readmissions among the under five children admitted in the Peadiatric Unit of Kenyatta National Hospital were the caregiver's low education level; low household monthly income level; rural residence; living with a person who smoked cigarettes; lack of training on handling domestic/indoor smoking; failure to regularly observe proper hand washing practice; lack of awareness about the signs and symptoms of pneumonia in children prior to the current admission and delays in seeking treatment for the sick child. However, no significant association was established between the caregiver's relationship with the child and readmission for pneumonia in the hospital. Based on these findings, the study rejected the null hypothesis and held that caregiver related determinants had a significant association with pneumonia readmissions among children aged under five admitted at Kenyatta National Hospital.

These findings concur with those of Markos et al. (2019) who in a study carried out in Ethiopia observed that increased odds of pneumonia hospital readmissions were associated with children whose fathers engaged in smoking cigarettes, children of mothers who had not heard about how to handle domestic smoking and children of mothers who did not follow proper hand washing practice. Hence, parental cigarette smoking, not knowing how to handle domestic smoking, and poor compliance with proper hand washing practice were identified as determinants of under-five pneumonia hospital readmissions. According to a study by Gritly *et al*. (2018) carried out in Sudan, the factors found to be associated with pneumonia related hospital readmissions included low socio-economic status and low educational level of the mothers, parental smoking, Poor child feeding practices, poor hand hygiene practices and poor knowledge related to signs and symptoms of pneumonia amongst the mothers.

Similarly, Ramezani et al. (2015) reported that parental smoking, low economic status occasioning undernourishment and maternal education were significant predictors of the rate of pneumonia in children and its associated hospital readmissions in most of the developing countries. According to a study done in Pakistan, the most significant risk factors associated with pneumonia related hospital readmissions were maternal and father education, maternal and father occupation, living in rural areas, bottle feeding of the infants by their caregivers, failure by parents to get their infants vaccinated and infants whose parents engaged in tobacco smoking (Aftab *et al*., 2017).

5.2.3 Environment Related Determinants of Pneumonia Associated Readmissions in Under Five Children

According to this study, the environment related determinants found to be statistically associated with pneumonia readmissions among the under five children admitted in the Peadiatric Unit of KNH were having a large family size (of 5 or more members); cooking being done within the main house; use of firewood, kerosene and charcoal as the main kinds of fuel for cooking; living in semi-permanent and temporary houses; inadequate house ventilation and living with domestic animals in the house. Based on

these findings, the study rejected the null hypothesis and held that environment related determinants had a significant association with pneumonia readmissions among children aged under five admitted at KNH. This implied that a wide range of environment related factors, particularly those relating to size of the family, place where cooking was done and kinds of fuel used for cooking, type of house lived in, adequacy of house ventilation as well as living together with domestic animals in the same house were significant determinants of pneumonia readmission among under five children admitted at KNH.

These findings corroborated with those of Zheng *et al*. (2013) who in a study done in China identified poor ventilation, use of charcoal as cooking fuel, dampness and overcrowding in living areas as factors that significantly related with pneumonia incidences and their associated rehospitalizations. A study by Loeb *et al*. (2009) did also establish regular exposure to secondhand smoke; history of regular exposure to gases, fumes, paints, gasoline or chemicals at home or at work and living in crowded homes as environmental risk factors for pneumonia related rehospitalization. Similarly, in a review of environmental determinants of pneumonia associated rehospitalizations, Almirall *et al*. (2017) identified exposure to smokes or fumes both at home and at work, exposure to toxic chemicals and other toxic environmental pollutants, exposure to animals and residing or working in crowded places with poor ventilation as the definitive environmental risk factors for CAP.

Similarly, in a study on the impact of social factors on risk of readmission or mortality in pneumonia, Calvillo-King *et al*. (2013) noted exposure to household air-pollution as a consequence of domestic combustion of biomass fuels for heating, lighting and cooking as a major risk factor of hospital readmission among children diagnosed with pneumonia. They also argued that poor ventilation and household crowding may further contribute to the burden of pneumonia and its associated hospital readmissions. Similarly, Leung *et al*. (2016) identified household crowding, exposure to animals and indoor air pollution from use of solid or biomass fuels as leading risk factors for pneumonia readmissions in low- and middle-income countries. These sentiments are also espoused by the WHO which also indicate that the risk for

pneumonia may increase if one has been exposed to certain chemicals, pollutants, or toxic fumes as well as through exposure to animals (WHO, 2019).

5.2.4 Health System Related Determinants of Pneumonia Associated Readmissions in Under Five Children

According to this study, the health system related determinants found to be statistically associated with pneumonia readmissions among the under five children admitted in the Peadiatric Unit of KNH were inadequate health care giver - patient ratio in the hospital; congestion in the paediatric wards; unsatisfactory health status of the child during the previous discharge; caregivers' low or lack of understanding of instructions given regarding caring for the sick child; a child's admission in ICU during previous hospitalization and low/poor quality of care offered to pediatric pneumonia patients. Based on these findings, the study rejected the null hypothesis and held that health system related determinants had a significant association with pneumonia readmissions among children aged under five admitted at KNH. This implied that a wide range of health system related factors that related to adequacy of health care giver to patient ratio in the hospital, congestion in the wards, child's health status stability at discharge, timeliness in seeking treatment, understanding of issued care giving instructions by the caregivers, ICU admissions and quality of care offered were significant determinants of pneumonia readmission among under five children admitted at KNH.

Similar results were reported by De Alba and Amin (2014) who asserted that most of pneumonia readmissions were attributable to modifiable health system-related factors which included fragmentation of healthcare, variation in practice style, bed availability and quality of pneumonia care offered. Other health system related factors contributing to pneumonia readmissions were pneumonia illness severity, hospital complications and stability on discharge. According to a study by Zuckerman *et al*. (2016) approximately 10% of patients who required mechanical ventilation developed ventilator associated pneumonia, and those patients with gastric feeding tube had an increased risk of developing aspiration pneumonia which in turn increased their chances of readmission.

On their part, Onyango *et al*. (2012) identified co-morbidities; delays in seeking treatment for three days or more and contact with upper respiratory tract infection as independent risk factors for frequent pneumonia readmissions. Similarly, in a study on risk factors of acute respiratory infection in under-fives in a rural hospital in India, Taksande and Yeole (2015) identified a history of lung and respiratory conditions, such as chronic obstructive pulmonary disease (COPD), cystic fibrosis, heart disease and asthma; severity of the pneumonia infection; having not been vaccinated against pneumonia, having been hospitalized in the ICU and early hospital discharges as significant predictors for the higher rehospitalization rates among under-five pneumonia patients.

5.3 Conclusions

Based on the findings of the study, the researcher drew the following conclusions:

Child's younger age (of 2 years and below), the child's gestation at birth, low birth weight, the child's inadequate nutritional status, the child having not been exclusively breastfed in the first six months, the child's incomplete immunization status for age and the child having other pre-existing illnesses apart from pneumonia were the patient related determinants associated with pneumonia readmissions among children aged under five admitted at KNH.

Caregiver's low education level; low household monthly income level; rural residence; living with a person who smoked cigarettes; lack of training on handling domestic/indoor smoking; failure to regularly observe proper hand washing practice; lack of awareness about the signs and symptoms of pneumonia in children prior to the current admission and delays in seeking treatment for the sick child were the caregiver related determinants associated with pneumonia readmissions among children aged under five admitted at KNH.

Having a large family size (of 5 or more members); cooking being done within the main house; use of firewood, kerosene and charcoal as the main kinds of fuel for cooking; living in semi-permanent and temporary houses; inadequate house ventilation and living with domestic animals in the house were the environmental

related determinants associated with pneumonia readmissions among children aged under five admitted at KNH.

Inadequacy of health care giver to patient ratio in the hospital; congestion in hospital's children wards; unsatisfactory health status of the child during the previous discharge; caregivers' low or lack of understanding of instructions given regarding caring for the sick child; a child's admission in ICU during previous hospitalization and low/poor quality of care offered to pediatric pneumonia patients were the health system related determinants associated with pneumonia readmissions among children aged under five admitted at KNH.

5.4 Recommendations

5.4.1 Action Recommendations

Most of the patient related determinants associated with pneumonia readmissions among children aged under-five can be addressed through their caregivers' attendance of prescribed antenatal and postnatal care services where they can be trained on important subjects such as observing personal hygiene and good nutrition prior to, during and after birth, which may enhance pediatric pneumonia prevention efforts.

To enhance the caregivers' capacity to care for their sick children, a program should be created at KNH to train them on basic proper hand washing practice and on the signs and symptoms of pneumonia in children. Awareness should also be created, among the caregivers, on the dangers of domestic/indoor smoking and living with persons who smoked cigarettes. The caregivers should be encouraged to separate cooking areas, smoking outside the houses and animal sleeping areas from their main houses/main living area. In addition, the government and its development partners should intensify efforts to improve the socio-economic status of the caregivers and their households.

There should be creation of awareness programs, at hospital and community levels, to enlighten caregivers and their households in particular and community in general on

environmental related aspects that contributed to pediatric pneumonia incidences and possible ways of mitigating them.

Policy makers should institute necessary local and national policy to decongest pediatric wards in the country.

5.4.2 Recommendations for Further Studies

Since the current study explored the determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital; a wider study involving other Level 5 and Level 4 hospitals in the country is hereby recommended. This will facilitate a broader comparison and generalization of the study findings. Further, in light of the prevailing Covid 19 pandemic, a study to investigate the influence of contracting Covid 19 on pediatric pneumonia readmissions is hereby recommended.

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APPENDICES

Appendix I: Participants' Information Document

Title of Study: Determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital

Principal Investigator\and institutional affiliation: Josephine Beatrice Okumu, University of Nairobi

Supervisors: Dr. Eunice Omondi & Dr. Emmah Matheka, University of Nairobi

Introduction

My name is Josephine Beatrice Okumu a student at the University of Nairobi pursuing a Master of Science Degree in Nursing (Pediatric). I am undertaking a thesis study on 'determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital'.

Purpose of the study

The aim of the study is to assess determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital. I am requesting for your participation in this study by giving me your views and opinions regarding the study subject. If you choose to participate, the researcher will ask you a series of questions that seek to gather information relating to the patient, caregiver, environmental and health system related determinants of pneumonia associated readmissions among children aged under five. Our discussion will take about 15 minutes.

Confidentiality

All the information provided will be treated in utmost confidentiality. In addition, all the information given herein will only be used for research purposes. Your name or anything else that may identify you will not appear anywhere in the study as the study will use statistics.

Voluntary participation

Your participation in this study is voluntary. There will be no penalties for any decline and you can withdraw at any stage of data collection with no penalties. However, I will greatly appreciate your participation because your views are very important for the success of this study.

Benefit

This research work is for academic purposes only and if you agree to participate, the information that you will provide will be of great importance to various stakeholders in improving the quality of care for pediatric patients admitted with pneumonia in the country particularly with respect to reduction or elimination of unplanned readmissions attributable to pediatric pneumonia. However, there will be no monetary gains or any other form of payment for participating.

Risks

There will be no any harm to you, your family or the child as a result of your participation in this study.

Contacts

For any queries regarding this study, kindly contact;

Principal researcher: Josephine Beatrice Okumu, Cell: 0721 546 432

OR

Secretary, Ethics and Research Committee of KNH/UON, Telephone: 020-2726300 Ext 44355

[*Please ensure that you have read the following, or that the following has been read to you, and that you fully understand what is involved in participating in this study and that your role as respondent has been fully explained to you*.]

Appendix II: Consent Form

Respondent's Declaration

I have been fully informed about the nature of the study, I know the benefits, and understand that there are no risks involved. I hereby give my consent to participate in this study.

Signature of participant ……. Date …….

Researcher's Declaration

I have fully disclosed all the relevant information concerning this study to the study respondent.

Signature of researcher ……. Date ……

Appendix III: Questionnaire

Section A: Demographic information of the caregivers

1. What is your age in years? ……

2. What is your marital status?

Single ( ) Married ( ) Separated ( ) Divorced ( ) Widowed ( )

3. What is your religion?

Christian ( ) Muslim ( ) Traditionalist ( ) No religion ( )

Section B: Nature of admission

4. a) Is this the child's first admission? Yes ( ) No ( )

b) If it is not the child's first admission (within the last 30 days), it is the:

Second	( )	Third	( )
Fourth	( )	More than fourth	( )

Section C: Patient related determinants

5. The child's gender:	Male	( )	Female	( )
6. The child's age in years:	≤ 2 years	( )	2-5 years	( )
7. Child born at:	Term	( )	Prematurely	( )
8. The child's birth weight:	<2500g	( )	2500g-3500g	( )
	>3500g	( )		

9. The child's current nutritional status:

Adequately nourished ( )

Moderately malnourished ( )

Severely malnourished ( )

10. Was the child exclusively breastfed in the first six months: Yes ( ) No ( )

11. The child's immunization status for age:

Partially immunized ( )

Fully immunized ( )

Not immunized at all ( )

12. Does the child has any other pre-existing illnesses other than pneumonia

Yes ( ) No ( )

13. If so, which other illness(es) does the child have?

Chronic Obstructive Pulmonary Disease (COPD) ( )

Congenital heart diseases ( )

HIV ( )

Cancers ( )

Others …… (specify)

Section D: Caregiver related determinants

14. What is your relationship with the child?

Mother ( ) Father ( )

Brother ( ) Sister ( )

Relative ( ) Others (specify) ……..

15. What is your education level?

No formal education ( ) Primary education ( )

Secondary education ( ) Tertiary education ( )

16. What is your occupation?

Not employed ( ) Self-employed ( )

In informal employment ( ) In formal employment ( )

17. What is your household's monthly income level?

Below Kshs. 5,000 ( ) Kshs. 5,000 – Kshs. 10,000 ( )

Kshs. 10,001 - Kshs. 20,000 ( ) Above Kshs. 20,000 ( )

18. Where do you live?

Rural ( ) Urban ( )

19. Is there a person who smokes cigarettes in your family?

Yes ( ) No ( )

If Yes, who? ……

20. Have you ever heard or been trained on how to handle domestic/indoor smoking?

Yes ( ) No ( )

21. Do you regularly observe proper hand washing practice?

Yes ( ) No ( )

22. Were you aware of the signs and symptoms of pneumonia in children prior to this hospitalization?

Yes ( ) No ( )

Section E: Environmental related determinants

23. What is your family size? < 5 ( ) ≥ 5 ( )

24. Where do you do your cooking?

In kitchen outside the main house ( ) Inside the main house ( )

25. Which kind of fuel do you use for cooking?

Firewood ( ) Charcoal ( ) Kerosene ( )

Gas ( ) Electricity ( )

26. Type of house in which your family lives in:

Permanent ( ) Semi-permanent ( ) Temporary ( )

27. Does the house you live in have window(s)?

Yes ( ) No ( )

If Yes, how many? ……

28. Do you live with domestic animals in your main house?

Yes ( ) No ( )

If Yes, which animals and how many? ……

Section F: Health system related determinants

29. In your opinion, do you think the health care giver to patient ratio in this hospital is adequate?

Yes ( ) No ( )

30. In your opinion, do you think there is congestion in this hospital's Pediatric Wards? Yes ( ) No ( )

31. In your opinion, were you satisfied with the health of your child during the previous discharge?

Yes ( ) No ( )

If No, why? ……

……

32. Did you seek medication else where before the child's admission at KNH?

Yes ( ) No ( )

If Yes, where ……

If No, why? ……

……

33. How many days did you spend with the sick child at home before seeking medical attention at the hospital?

None ( ) 1-3 day ( ) More than 3 days ( )

34. Do you understand caregiver's instructions on caring for the sick child?

Yes ( ) No ( )

35. Was your child admitted in ICU in your immediate previous hospitalization?

Yes ( ) No ( )

36. Are you satisfied with the quality of care being offered to your sick child?

Yes ( ) No ( )

If No, why? ……

Thank you for your participation

Appendix IV: Letter to Ethical and Research Committee

Josephine Beatrice Okumu,

Reg. No. H56/11439/2018,

School of Nursing Sciences,

College of Health Sciences,

University of Nairobi.

The Secretary,

KNH/UoN - Ethics and Research Committee,

P.O. Box 20723-00202,

Nairobi.

Dear Sir/Madam,

RE: <u>Approval To Conduct A Research Study</u>

My name is Josephine Beatrice Okumu a student at the University of Nairobi, School of Nursing Sciences undertaking a Masters of Science Degree in Nursing (Peadiatrics). I am hereby requesting for your approval to carry out a research study on "determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital", as a requirement in partial fulfillment for the award of the said degree.

Thank you in advance.

Yours faithfully,

Josephine Beatrice Okumu.

Appendix V: Letter to the Head of Department – Paediatric Unit of KNH

Josephine Beatrice Okumu,
Reg. No. H56/11439/2018,
School of Nursing Sciences,
College of Health Sciences,
University of Nairobi.

The Head of Department,
Paediatric Unit – KNH,
Nairobi.

Dear Sir/Madam,

RE: <u>Authority To Carry Out A Research Study at KNH</u>

My name is Josephine Beatrice Okumu a student at the University of Nairobi, School of Nursing Sciences undertaking a Masters of Science Degree in Nursing (Peadiatrics). I am undertaking a research study on "determinants of pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital", as a requirement in partial fulfillment for the award of the said degree.

I am therefore hereby requesting for your authorization to conduct data collection within the Peadiatric Unit of KNH among caregivers of children aged under five admitted with pneumonia.

Yours faithfully,

Josephine Beatrice Okumu.

Appendix VI: Approval Letter from KNH-UON ERC

UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
Tel:(254-020) 2726300 Ext 44355

KNH-UON ERC
Email: uonknh_erc@uonbi.ac.ke
Website: http://www.erc.uonbi.ac.ke
Facebook: https://www.facebook.com/uonknh.erc
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC

KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/131

27th April 2020

Josephine Beatrice Okumu
Reg. No.H56/11439/2018
School of Nursing Sciences
College of Health Sciences
University of Nairobi

Dear Josephine

RESEARCH PROPOSAL – DETERMINANTS OF PNEUMONIA ASSOCIATED READMISSIONS AMONG CHILDREN AGED UNDER FIVE ADMITTED AT KENYATTA NATIONAL HOSPITAL (P80/02/2020)

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above research proposal. The approval period is 27th April 2020 – 26th April 2021.

This approval is subject to compliance with the following requirements:

a. Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
b. All changes (amendments, deviations, violations etc.) are submitted for review and approval by KNH-UoN ERC before implementation.
c. Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
d. Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
e. Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.
f. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
g. Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

For more details consult the KNH- UoN ERC website**http://www.erc.uonbi.ac.ke**

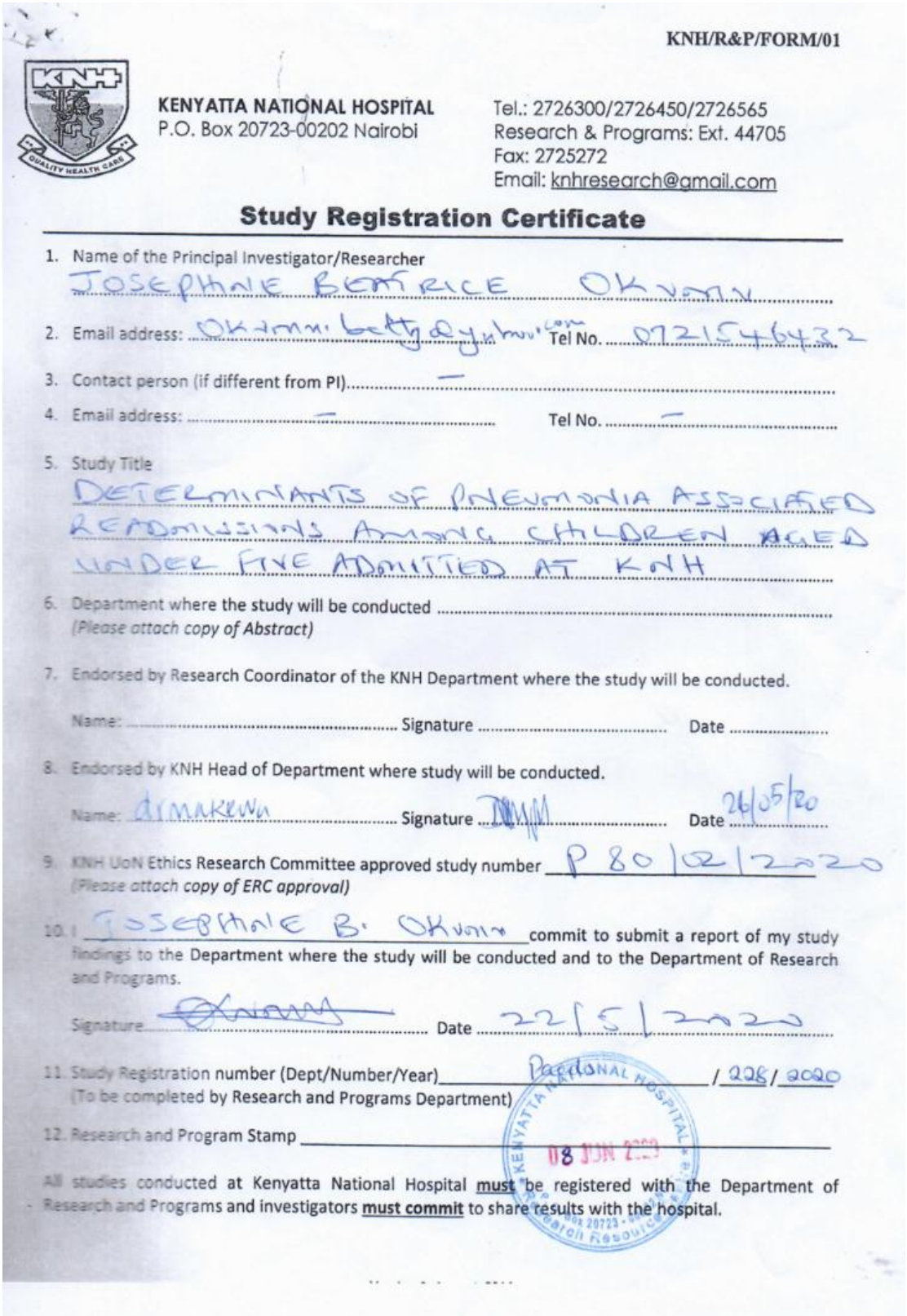
Protect to discover

Yours sincerely,

PROF. M. L. CHINDIA
SECRETARY, KNH-UoN ERC

c.c. The Principal, College of Health Sciences, UoN
The Director, CS, KNH
The Chairperson, KNH- UoN ERC
The Assistant Director, Health Information, KNH
The Director, School of Nursing Sciences, UoN
Supervisors: Dr. Eunice A. Omondi, School of Nursing Sciences, UoN
Dr. Emmah K. Matheka, School of Nursing Sciences, UoN

Appendix VII: Approval Letter from Kenyatta National Hospital



KNH/R&P/FORM/01

KENYATTA NATIONAL HOSPITAL
P.O. Box 20723-00202 Nairobi

Tel.: 2726300/2726450/2726565
Research & Programs: Ext. 44705
Fax: 2725272
Email: knhresearch@gmail.com

Study Registration Certificate

1. Name of the Principal Investigator/Researcher
JOSEPHINE BEATRICE OKWANY
2. Email address: OKwanybetty@yahoo.com Tel No. 0721546432
3. Contact person (if different from PI) —
4. Email address: — Tel No. —
5. Study Title
DETERMINANTS OF PNEUMONIA ASSOCIATED READMISSIONS AMONG CHILDREN AGED UNDER FIVE ADMITTED AT KNH
6. Department where the study will be conducted .....
(Please attach copy of Abstract)
7. Endorsed by Research Coordinator of the KNH Department where the study will be conducted.
Name: ..... Signature ..... Date .....
8. Endorsed by KNH Head of Department where study will be conducted.
Name: DR MAKENA Signature ..... Date 26/05/20
9. KNH UoN Ethics Research Committee approved study number P 80/02/2020
(Please attach copy of ERC approval)
10. I JOSEPHINE B. OKWANY commit to submit a report of my study findings to the Department where the study will be conducted and to the Department of Research and Programs.
Signature ..... Date 22/5/2020
11. Study Registration number (Dept/Number/Year) PAEDIATRIC/228/2020
(To be completed by Research and Programs Department)
12. Research and Program Stamp
08 JUN 2020

All studies conducted at Kenyatta National Hospital **must** be registered with the Department of Research and Programs and investigators **must commit** to share results with the hospital.

Appendix VIII: Approval Letter from Head of Department, Paediatrics – KNH

KENYATTA NATIONAL HOSPITAL
P.O. BOX 20723, 00202 Nairobi

Tel.: 2726300/2726450/2726550
Fax: 2725272
Email: knhadmin@knh.or.ke

Ref: KNH/PAEDS-HOD/48 Vol.II

Date: 2nd June 2020

Josephine Beatrice Okumu
School of Nursing Services
College of Health Sciences
University of Nairobi

Dear Josephine

RE: AUTHORITY TO COLLECT DATA IN PAEDIATRICS DEPARTMENT

Following approval by the KNH/UON-Ethics & Research Committee for your Research Proposal and subsequent filing of the Study Registration Certificate, this is to inform you that authority has been granted to collect data in ***Paediatrics Department***, on your study titled ***"Determinants of Pneumonia associated readmissions among children aged under five admitted at Kenyatta National Hospital"***.

Kindly liaise with the Senior Assistant Chief Nurse, Paediatrics for facilitation.

You will also be required to submit a report of your study findings to the Department of Paediatrics after completion of your study.

Dr. Douglas Makewa
HEAD OF DEPARTMENT, PAEDIATRICS

Cc. Senior Assistant Chief Nurse, Paediatrics

Appendix IX: Research Authorization from Nairobi City County - County Health Services

NAIROBI CITY COUNTY

Telephone 020 344194

web: www.nairobi.go.ke

City Hall,
P. O. Box 30075-00100,
Nairobi,
KENYA.

COUNTY HEALTH SERVICES

REF: CHS/1/13/ (25) - 020

UNIVERSITY OF NAIROBI
P.O BOX 1967 - 00200
NAIROBI

DATE: 11TH MAY, 2020

RE: RESEARCH AUTHORIZATION – JOSEPHINE BEATRICE OKUMU

Reference is made to a letter from the Director Human Resource Management

Ref. NCC/HRD/HRM/10/478/SWM/2020 dated 11th May, 2020.

Authority is hereby granted to you to carry a research on **"Determinants of Pneumonia Associated Readmissions Among Children Aged Under Five (5No.) Admitted at Kenyatta National Hospital"**.

Please note that your research runs for Three (3No.) days between 27th April, 2020 to 27th April, 2021.

During the course of your research, you will be expected to adhere to the rules and regulations governing the Nairobi City County.

During your study there will be no costs devolving on the County.

That you undertake to indemnify the County against any claims that may arise from your research.

By a copy of this letter, the Medical Superintendent, Mbagathi Hospital is requested to accord you necessary assistance.

CHS HEALTH SERVICES
Nairobi City County Government
Received.....Date.....

LILIAN SHIKANDA
FOR: CHIEF ADMINISTRATIVE OFFICER – (CHS)

Cc: -: - Medical Superintendent - Mbagathi
- HAO – Mbagathi

Appendix X: Approval Letter from Mbagathi Hospital

THE PRESIDENCY
EXECUTIVE OFFICE OF THE PRESIDENT
NAIROBI METROPOLITAN SERVICE

Telephone: 0721 311 808, 2724712, 2725791

E-mail: mbagathihosp@gmail.com

Mbagathi Hospital
P.O.Box 20725-00202
NAIROBI

3rd June 2020

Josephine Beatrice Okumu
UON

RE: RESESEARCH AUTHORIZATION

This is in reference to your application for authority to carry out a research on ***"Determinants of Pneumonia Associated Readmissions Among Children Aged under Five admitted at Kenyatta National Hospital."***

I am pleased to inform you that your request to undertake research in the hospital has been granted.

On completion of the research you are expected to submit one hard copy and one soft copy of the research report/ thesis to this office.

Dr. David Kimutai
Chairman – Research Committee
Mbagathi Hospital.

Appendix XI: Work Plan

Activity	2020								
	Mar	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**
Development of the concept									
Proposal writing and presentation									
Submission of proposal to Ethics Board									
Pretesting the instrument									
Data collection and analysis									
Report writing and corrections									
Presentation of the project									
Project results dissemination									

Appendix XII: Budget

Item	**Quantity**	**Unit Cost**	**Total Cost**
HB pencils	20	@ Ksh.35.00x20	Ksh. 700
Pens	10	@ Ksh.20.00x10	Ksh.200
Foolscaps	1 ream	@ Ksh.500.00	Ksh. 500
Printing papers	2 reams	@ Ksh.1,000.00x2	Ksh. 2,000
Note books	10	@ Ksh.500.00x4	Ksh. 2,000
Proposal writing			
Fair copies printing	3 copies, 100 pgs	@Ksh.(5per page x 100)3	Ksh. 1500
Final copy printing	2 copies, 100 pgs	@ Ksh.(5 per page x100)2	Ksh. 1,000
Final copies photocopy	4 copies, 100 pgs	@Ksh.(5 per page x100)4	Ksh.2000
Binding	6 copies	@ ksh. (1,000 per copy)6	Ksh. 6000
Project Writing			
Data analysis statistician	1	@Ksh 100,000	Ksh.100,000
Fair copies printing	2 copies, 100 pgs	@ Ksh.(5 per page x100)2	Ksh. 1,000
Final copy printing	4 copies, 100 pgs	@Ksh.(5 per page x100)4	Ksh.2000
Binding	3 copies	@ ksh. (1000 per copy)3	Ksh. 3,000
Transport cost	1 person for 21 days	@ Ksh 500 x 21 days	Ksh. 10,500
Meals	@1000 per day	@1000 x 21 days	Ksh. 21,000
Tape Recorder		@Ksh. 10,000	Ksh. 10,000
Project results dissemination			

Publication in a peer reviewed journal		@Ksh. 40,000	Ksh. 40,000
		Sub-total	**Ksh. 203,400**
Contingencies	10%		20,340
		Grand Total	**Ksh. 223,740**

DETERMINANTS OF PNEUMONIA ASSOCIATED READMISSIONS AMONG CHILDREN AGED UNDER FIVE ADMITTED AT KENYATTA NATIONAL HOSPITAL

ORIGINALITY REPORT

8%	7%	4%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.hindawi.com Internet Source	1%
2	erepository.uonbi.ac.ke Internet Source	1%
3	Submitted to Brookhouse School Student Paper	<1%
4	worldwidescience.org Internet Source	<1%
5	Awoke Keleb, Tadesse Sisay, Kassahun Alemu, Ayechew Ademas et al. "Pneumonia remains a leading public health problem among under-five children in peri-urban areas of north-eastern Ethiopia", PLOS ONE, 2020 Publication	<1%
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7	www.researchsquare.com	

Dr Eunice Ommeti

6/12/2020