UNIVERSITY OF NAIROBI

PREVALENCE AND FACTORS ASSOCIATED WITH PERSISTING RESPIRATORY SYMPTOMS AND SIGNS FOUR WEEKS AFTER DISCHARGE FROM HOSPITAL FOLLOWING TREATMENT FOR SEVERE ACUTE PNEUMONIA IN CHILDREN AGED 2 – 59 MONTHS.

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DECLARATION

I hereby confirm that this dissertation is my original work and has not been presented elsewhere for examination.

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LIST OF ABBREVIATIONS

CAP - Community-Acquired Pneumonia

CXR - Chest X-Ray

HRCT - High-resolution Computed Tomography

KNH - Kenyatta National Hospital

MRC - Medical Research Council

POPC - Paediatric Out-Patient Clinic

SPSS - Statistical Package for the Social Sciences

UON - University of Nairobi

WHO - World Health Organization

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ABSTRACT

Background: Pneumonia is the single largest infectious cause of death in children worldwide. With advances in treatment, many children survive severe pneumonia with risk of residual disease. Our study sought to describe the prevalence and factors associated with persisting respiratory symptoms and signs after discharge from the hospital following treatment for severe acute pneumonia in children aged 2 – 59 months.

Method: Observational prospective cohort study conducted in KNH general paediatric wards between December 2022- March 2023. Ninety-four children aged between 2-59 months were involved in the study. The eligibility for inclusion was patients with severe acute pneumonia at admission with subsequent persisting respiratory symptoms and signs for four weeks after discharge from the hospital.

Data Analysis Plan: Data was entered into pre-coded questionnaires, reviewed, cleaned, entered into a customized Microsoft Excel database, then analysed. Results were summarized using medians and interquartile ranges, and frequencies and proportions. Risk factors were analysed using logistic regression and results were presented as risk ratios and p-values.

Results: Out of 94 children, 35 had persisting symptoms and signs of pneumonia, a prevalence of 37% (95% CI 28%, 48%). The residual symptoms and signs at 4 weeks post discharge included 15 (16%) children with cough, 10 (10.6%) with difficulty breathing and 9 (9.6%) with congested chests, 19 (20.2%) had hypoxia, 7 (7.4%) had tachypnoea and 18 (19.1%) used accessory muscles of respiration. Abnormal chest X-ray findings were significantly associated with the persistence of symptoms and signs of pneumonia with a p value <0.05.

Conclusion: Persistence of respiratory symptoms and signs after treatment of severe pneumonia among children at KNH was common. It is important recognise those at risk and follow up and manage these patients appropriately after discharge.

CHAPTER ONE: INTRODUCTION

Pneumonia is an acute respiratory infection of the lungs and is the single largest infectious cause of death in children worldwide. WHO defines "pneumonia" in children as the presence of cough or difficulty in breathing associated with fast breathing or chest in drawing in children 2–59 months of age, and "severe pneumonia" is defined as pneumonia plus the inability to drink, persistent vomiting, convulsions, lethargy, stridor, or severe malnutrition (1).

There are approximately 150 million new cases of paediatric pneumonia annually, with about 10-20% of this number severely ill and requiring hospitalisation (2). In 2015 the WHO Africa region had the highest mortality burden due to severe pneumonia (3). Due to advances in treatment, improved access to healthcare, and training of healthcare workers, there has been an improvement in outcomes and a reduction in mortality. However, this also translates to a high number of patients who survive pneumonia.

During the first 3-4 years of postnatal life, lung growth is very rapid. The developing lungs are susceptible to injury from infection, which predisposes the child to the long-term effects of pneumonia (4). Some of the predictors of prolonged hospital stay and poor response to treatment include head nodding, malnutrition with oedema, severe wasting, those who present with hypoxemia, radiological evidence of pneumonia, and the presence of the danger signs as described by WHO (5).

In the case of bacterial pneumonia, clinical response to antibiotics is within 48-72 hours. Patients on management for severe pneumonia whose symptoms do not resolve within this time frame require further evaluation for complications and comorbidities. Also, they warrant further investigation, including a chest X-ray (6).

Metley et al. (7) 1998 established that the median time for symptoms to resolve was 3 days for the fever to 14 days for cough and fatigue, and about 35% of patients had at least one symptom persisting at the end of the 28-day study period.

Long-term respiratory sequelae have been studied in paediatric patients with pre-existing risk factors. Still, there is a poor understanding of the same in patients without any pre-existing risk factors and in those who do not have infections with highly virulent pathogens (8).

Major sequelae researched include restrictive lung disease, obstructive lung disease, and bronchiectasis. The others include chronic bronchitis, asthma, and other derangements in pulmonary function. However, some of these studies have been limited by poor/lack of follow-up, misclassification of disease, and other possible confounders such as nutritional status, socioeconomics, and pre-existing respiratory illnesses (9).

CHAPTER TWO: REVIEW OF LITERATURE

2.1 Epidemiology of Pneumonia in Young Children

2.1.1 Prevalence

Pneumonia is considered one of the most significant causes of death among children aged under five years globally. WHO statistics indicate that in 2019, pneumonia resulted in more than 700,000 deaths of children under five years, accounting for about 14% of all deaths of children within the age bracket (10). There are approximately 150 million new cases of pneumonia among children annually, and about 20% of the reported cases often require immediate medication and hospitalisation. According to WHO (11), the prevalence of pneumonia among children below five years includes 1 case per 71 children annually.

Among all these cases, about 10% are often associated with severe pneumonia, which increases the fatality rate. The prevalence of severe pneumonia is even higher in Africa than in the rest of the world, with about half of the global death cases reported in Africa (9). In Kenya, severe pneumonia is considered the second leading cause of paediatric death among those under 5 and causes 16% of deaths in this particular age group (12).

2.1.2 Modes of Infection

Pneumonia can be spread in several ways depending on the infectious organisms involved. Bacteria and viruses often existing in a child's nasal, or throat cavity can contaminate the lungs if inhaled. Coughs and sneezes can disseminate through droplets in the air. Pneumonia can also be transmitted through the blood, frequently during or right after birth (10). The different changing microorganisms that cause Pneumonia and the mechanisms in which they are spread require extensive research since this is a vital position for therapy and prevention. A weakened immune system increases the risk of developing pneumonia infection in the paediatric age group. Malnutrition or undernourishment can decrease a child's immune functionality (11). Also, already existing disorders, such as measles and indicative HIV infections, predispose children to pneumonia.

2.1.3 Risk Factors

Risk factors that predispose children under 5 to develop pneumonia vary since most immunocompetent children often can mount an appropriate immune response to disease-causing pathogens and fight off the disease. However, among children whose immunity is compromised, the risk of developing pneumonia is higher (8). Living in a crowded environment increases susceptibility to pneumonia as transmission becomes even more effective once an infected individual releases the causative organisms into the atmosphere. Additionally, air pollution is another risk factor that, over time, adversely affects the developing lungs reducing the ability to withstand respiratory infections such as pneumonia. A weakened immune system due to lack of exclusive breastfeeding for the first six months of life is a risk factor that puts children at a higher risk of contracting pneumonia. Children who have been exclusively breastfed for the first six months of life are better protected against respiratory tract infections as they acquire passive immunity from the mother (8).

2.1.4 Aetiology

According to a review of the PERCH study by Dr Mary E Wilson, more than 60% of pneumonia in Paediatrics was caused by viruses and bacteria accounted for about 27%, with *Mycobacterium tuberculosis* causing almost 6% of cases of pneumonia. *Streptococcus pneumoniae* accounted for over 60% of the bacterial causes, accounting for more than a third of severe pneumonia cases. Among all causative agents, respiratory syncytial virus (RSV) accounted for about 31% of all cases. Of note, the prevalence of pneumonia, severity, and pathogenesis varied due to factors such as age and geographical location. Ten pathogens together accounted for about 80% of the cases. Of the cases of pathogens, vaccines exist for 14% (13).

2.2 Survival Rates from Pneumonia in Children Under 5

Different scholars have conducted several research studies to establish the survival rates from pneumonia and the existing risk factors that affect the mortality rates. Among 150 million cases of pneumonia reported in children annually, about 20% have severe forms of the disease, increasing the risk of morbidity and mortality (9). The survival and mortality rates often depend on factors such as the presence of risk factors and the provision of appropriate treatment. Providing care early in the

infection significantly increases survival rates and reduces mortality rates (14). Additionally, reducing risk factors by either providing exclusive breastfeeding or immunization often improves survival rates and reduces mortality rates. Among those who survive the infection, a significant percentage develop residual morbidity, including conditions associated with respiratory infections.

2.3 Respiratory Sequelae among Children Surviving Severe Pneumonia

2.3.1 Short Term Sequelae

Different research studies have identified several respiratory sequelae that often develop in the short term, including while the children are still undergoing treatment for severe acute pneumonia. One identified short-term impact is asthma, which develops due to various causative factors. Some of the predictors of asthma include parental atopy and CAP (15).. It is more prevalent among hospital patients receiving pneumonia treatment without additional pathogen infections (16).

2.3.2 Long-term Sequelae

Restrictive lung disease is considered one of the most common types of sequelae, according to Edmond et al. (8). It involves a series of conditions that affect the normal functioning of the lungs, inhibiting their ability to expand with air when breathing. In this case, the interstitial lung parenchyma suffers damage from the pneumonia pathogens, which often results in acute lung consolidation.
Additionally, obstructive lung disease is another respiratory sequela most prevalent among paediatric patients hospitalized receiving pneumonia treatment. About 9.7% of the patients develop the condition, often facilitated by predictor factors such as living in a crowded environment, which may be associated with crowded hospital rooms and halls (8). This disease involves various other conditions, including emphysema and chronic bronchitis which impairs respiratory function due to bronchiolar dilation and impaired elimination of secretions
Bronchiectasis, which is a permanent and abnormal widening of the bronchi due to chronic infection and inflammation of the airway negatively affects their functionality. According to Chang et al. (16), these adverse outcomes result in the need to change the administered antibiotics to the patients. Bronchiectasis is more prevalent among children hospitalized receiving treatment for severe pneumonia

since they are prone to hospital-acquired infections. Chronic bronchitis is another sequelae characterized by chronic cough and is often common within the period of four weeks to 24 months post-hospitalisation for pneumonia (16).

2.4 Factors Associated with Respiratory Sequelae

Even after recovering from severe pneumonia, paediatric patients aged 2-59 months have a significant possibility of developing respiratory sequelae. This is often determined based on the existing predictors. For instance, according to Sly et al. (17), in a case-control study carried out in Australia between 1960 to 1978, 20 children who were admitted with Adenovirus type 7 pneumonia were compared to 20 control and it was noted that infection of pneumonia at a younger age was associated with increased cases of respiratory sequelae.

In a prospective observational study, which involved 200 children between 2-60 months hospitalized with severe pneumonia as defined by WHO, Tiewsoh et al (18) focused on the children who required a change of antibiotics, a need for mechanical ventilation, had a prolonged hospital stay and those who succumbed to the illness. In this study, it was established that other predictors facilitating the development of adverse respiratory health outcomes among children after suffering from severe pneumonia included lack of exclusive breastfeeding [RR (95%CI) 2.63 (2.16–2.86)], overcrowding [RR (95%CI) 1.94 (1.35–2.38)] and an abnormal chest x-ray [RR (95%CI) 2.29(1.22–3.44)]. These were associated with the need for a change of antibiotics (18).

In a controlled follow-up study by Eastham et al. (15) in the UK, involving 159 children aged 5-16 years, who at the time of follow-up were admitted to Newcastle General Hospital from 1995 to 1998, community-acquired pneumonia (CAP) was identified as another predictor of respiratory sequelae. Eastham et al. (15) speculated that the respiratory conditions that result from CAP primarily affect children up to 2 years of their lives and, in some cases, up to 10 years of age.

Table 1: Different studies on the prevalence of factors associated with respiratory symptoms and signs among children for severe acute pneumonia

Country, Author, Journal, Year	Title	Design, Study Population	Key Findings
Multi-country Edmond et al., PLoS One 2012.	Long Term Sequelae from Childhood Pneumonia; Systematic Review and Meta-Analysis.	Systematic Review and Meta-Analysis. -13 studies were considered.	-A 5.5 % and 13.6% risk of at least one significant sequela in non-hospitalized and hospitalized children, respectively. -The highest sequelae risk, 54.8%, was associated with Adenovirus pneumonia. -Children hospitalized with no pathogen isolated had a risk of 17.6%. -Restrictive lung disease was the most common type of significant sequela.
Melbourne, Australia Sly et al., Archives of Disease in Childhood. 1984	Factors predisposing to abnormal pulmonary function after adenovirus type 7 pneumonia. Archives of disease in childhood.	-Case-Control -40 participants (20 Cases 20 Controls)	- Sixty-five percent of the pneumonia group had developed airways obstruction compared with 10% of controls. -Young age at the time of pneumonia and a 'measles-like' illness before its onset increase the chance of developing long-term pulmonary function abnormalities.
The Gambia Puchalski Ritchie et al., The international journal of tuberculosis and lung disease. 2009.	Long-term morbidity from severe pneumonia in early childhood in The Gambia, West Africa: a follow-up.	-Observational cohort study -83 children	-13% of cases and 4% of controls had lung disease clinically or on spirometry. -Additional 13% of participants had abnormal spirometry but did not meet the American Thoracic Society technical criteria (formally 'inconclusive'). -The odds of long-term lung disease post severe pneumonia are 2.93 times that of matched controls.

Multi-country Grimwood and Chang, Pneumonia (Nathan). 2015.	Long-term effects of pneumonia in young children.	-Systematic Review	-The risk of major sequelae was reported as 10.4 % (restrictive lung disease, obstructive lung disease, and bronchiectasis. -There was a higher risk in those hospitalized (13.6%) than in those not hospitalized (5.5%) -Children < 2 years had a non-statistically significantly higher risk of sequelae than those aged 2-5 years at diagnosis.
New Delhi, India Tiewsoh et al., BMC paediatrics. 2009	Factors determining the outcome of children hospitalized with severe pneumonia.	-Prospective observational study -200 children aged 2-60 months were hospitalized with severe CAP.	-56.5% of the children needed a change in antibiotics -51% stayed for more than 5 days in the hospital -20.5% needed mechanical ventilation, and 10.5% died.
Newcastle upon Tyne, North Tyneside and Northumberland schools, England. Eastham et al., Archives of Disease in Childhood. 2008	A follow-up study of children hospitalized with community-acquired pneumonia.	-A controlled follow-up study -103 cases of radiologically confirmed CAP, with a median of 5.6 years.	-Cases were 2.9 times more likely than controls to have a persistent cough and 5.5 times more likely to have an abnormal chest shape. -Cases of an atopic parent had a 7.0% deficit in FEV1, and a 4.4% deficit in FVC % predicted but were not at increased risk of subsequent asthma. Cases of a non-atopic parent were at increased risk of subsequent asthma but not of deficit in lung function.

2.6 Study Justification

There is a significant burden of severe pneumonia with a paucity of data on respiratory sequelae globally, making this event a health issue in society. It is important to generate much-needed information on the proportion of patients who recovered from severe pneumonia and have persisting abnormal respiratory symptoms at KNH. There is also a need to increase knowledge of risk factors or

predictors of respiratory sequelae after recovery from severe pneumonia. This will provide healthcare workers with information that could potentially create a better discharge and follow-up plan for patients cured of severe pneumonia.

2.6.1 The Importance of the Generated Information

Conducting ethical research, especially in the healthcare field, is essential since it facilitates the acquisition of evidence-based practices with higher accuracy and the ability to improve positive health outcomes. The generated information from the study is expected to significantly impact the understanding of the magnitude of pneumonia among children. The generated information will offer new perspectives and specific knowledge of approaching the treatment of pneumonia and the associated causative factors (4).

The generated information will also explain why some severe pneumonia survivors develop respiratory sequelae and the available effective interventions to address the problem. The information will guide the development of governing policies when treating pneumonia among children aged five years and below, for instance, the consideration of extensive antibiotics administration during treatment (19). Lastly, the new information will facilitate the development of a defined and systematic procedure for identifying the sequelae.

2.7 STUDY QUESTION AND OBJECTIVES

2.7.1 Research Questions

1. What proportion of children have respiratory symptoms and signs that persist after discharge from the hospital among children who survive severe pneumonia, and what are the risk factors?
2. What is the clinical spectrum of persisting respiratory symptoms and signs among these children?

2.7.2 Primary Objectives

1. To determine the proportion of children with respiratory symptoms and signs that persist up to four weeks after discharge from the hospital following treatment for severe pneumonia.
2. To describe the clinical spectrum of persisting respiratory symptoms and signs among these children who survive severe pneumonia.

2.8 Secondary Objective

To determine among children who survive severe pneumonia the risk factors for persisting respiratory symptoms and signs following discharge from the hospital

CHAPTER THREE: METHODS

3.1 Study Design

This was a Prospective cohort study.

3.2 Study Setting

The study was conducted in Kenyatta National Hospital based on two evaluations: The initial evaluation of the study was conducted in the paediatric wards. Kenyatta National Hospital is the largest National Referral Hospital located on Hospital Road, Nairobi. There are three General Paediatric wards with approximately 60 beds in each ward. About 14000 paediatric patients are usually admitted to the wards annually (20).

The second evaluation was conducted in the Paediatric Outpatient Clinic (POPC) and the Paediatric Pulmonology clinic. This evaluation primarily focused on conducting a follow-up on the patients and conducting a thorough but focused examination and history taking to assess for persistence of symptoms and signs

3.3 Study Population

3.3.1 Inclusion Criteria

- Age group 2-59 months
- Have severe acute pneumonia at admission.
- Hospitalized at KNH for more than five days.
- Required oxygen supplementation for more than 48 hours.

3.3.2 Exclusion Criteria

- Documented chronic lung disease before admission.
- Known congenital heart disease
- Nosocomial pneumonia

3.4 Case Definitions

3.4.1 Severe Acute Pneumonia

Clinician diagnosis as per WHO, including a history of cough or difficulty in breathing with one of the following danger signs; Oxygen saturation<90%, cyanosis, inability to drink or breastfeed, altered level of consciousness, or grunting.

3.4.2 Persisting Respiratory Symptoms

Respiratory symptoms that persisted from onset of symptoms through discharge from the hospital for four weeks or longer. These include cough, difficulty breathing, wheezing, chest congestion and breathlessness.

3.4.3 Persisting Respiratory Signs

The presence of one or more abnormal respiratory signs during physical examination four weeks or longer after discharge from the hospital. These include observed cough, tachypnoea at rest (above 90th centile for age), use of accessory muscles of respiration, audible wheeze or stridor, abnormal chest exam, moderate hypoxia which is oxygen saturation equal to or less than 92% (normal SpO2 > = 94% at rest, mild to moderate hypoxia 90-93% and severe hypoxia less than 90%) (21)

3.5 Sample Size Calculation

This was based on the primary objective to determine the proportion with the outcome of interest, persisting respiratory symptoms, or signs. We, therefore, estimate the required sample size using the Fishers formula of prevalence study (22)

$$N = \frac{Z^2 P (1 - P)}{D^2}$$

Whereby:

Z = Critical value at 95% confidence level. In this case Z=1.96

P = Proportion of the population with persistent respiratory symptoms and signs is set at 0.50 as it is unknown; no study was found in a similar setting to provide an estimate.

D^2 = Degree of precision will be taken as 10% (0.10)

Therefore, the minimum required sample size will be:

$$N = \frac{(1.96 \times 1.96) \times 0.5(1-0.5)}{0.1 \times 0.1}$$

N = 96

3.6 Factors of Interest

- Socio-demographic factors included age, sex, economic, parental, and home environmental factors.
- Nutritional status - poor weight gain since discharge, persisting low WAZ or WHZ score, and persisting poor feeding.
- The severity of illness within the first 48 hours. The severity of hypoxia, tachypnoea, tachycardia, and oxygen support requirement (FiO2).
- Oxygen support requirement –dose, mode of oxygen support required (non-invasive vs. invasive, mechanical).
- Antibiotics - change of antibiotics.
- The duration of hospitalisation. The time to discharge from the acute room and the time to discharge home.
- The comorbidities or complications present during the hospitalisation. These include HIV infection, rickets, malnutrition, and anaemia.

3.7 Sampling Methods

Eligible candidates were identified and recruited into the study using a consecutive sampling method from the general paediatric wards in KNH. This was done until the desired sample size was reached.

There are approximately 14000 admissions to the paediatric ward annually. These admissions are equally distributed among wards 3A, 3B, and 3C. However, Ward 3D is fully dedicated to oncology patients.

3.8 Study Tools

The specific tool that was used was paper Case Record Forms (CRFs). This captured sociodemographic data, relevant history, clinical examination and treatment, and comorbidities during hospitalisation. The CRFs captured information at enrolment, in-hospital follow-up, discharge, and four-week follow-up visits after discharge.

3.9 Study Procedures

3.9.1 Screening and Enrolment Procedures

The principal researcher and research assistant went around the general paediatric wards daily and identified patients eligible for participation in the study. The principal researcher also explained the study to the parents, sought informed consent, and enrolled them on day three of admission for clinical evaluation.

3.9.2 Clinical Evaluation at Enrolment and during hospital Stay

The researcher interviewed the parent or caregiver to collect clinical history and socio-demographic data. The researcher also examined each enrolled child to capture anthropometry, vital signs, and respiratory exam and review medical records for other relevant clinical information. A follow-up review was then done every week thereafter until discharge to capture the child's clinical status and key information on treatment, comorbidities, and chest x-ray or high-resolution chest CT scan if available. When the primary clinical team recommended the child's discharge, the researcher did the final clinical evaluation, especially to capture respiratory clinical information. The researcher then gave a follow-up appointment visit at KNH POPC four weeks post-discharge. Telephone reminders were made two days before the scheduled visit to enhance follow-up.

3.9.3 Four Week follow-up Visit Procedures

The children enrolled in the study were reviewed at the paediatric outpatient clinic and the paediatric pulmonology clinic at four weeks post discharge. The principal investigator conducted a clinical evaluation to assess respiratory function, including signs and symptoms, chest X-ray, and high-resolution chest computed tomography (HRCT) done while admitted in the ward. Some of the considered signs and symptoms included tachypnoea, grunting, hypoxemia defined as oxygen saturation of less than 92%, cough, difficulty in breathing, and wheezing. Patients who required follow-up and the provision of further interventions were directed as appropriate.

The four-week post-hospitalisation follow-up visit was not a separate follow-up appointment but a scheduled post-hospital discharge appointment saving the patient from incurring additional transport costs for the appointment.

If the patient had been scheduled for a follow-up visit at 2 weeks post-discharge by the primary clinical team, the principal investigator made an allowance for review of the the patient for any persisting signs and symptoms during that visit. If no persisting signs and symptoms were noted, then the patient was followed up at four weeks via a telephone call.

If there were any persisting signs and symptoms noted, then a visit at four weeks post-discharge was scheduled at the convenience of the patient.

If another study visit was scheduled, the principal investigator compensated the study participant for the cost of travel to the facility, and no extra consultation fee was charged to the study participant unless the primary clinical team required another clinic visit.

If a patient had a Chest x-ray and/or high-resolution chest computed tomography (HRCT) done while in the ward, these were reviewed with no need for a repeat of the same unless indicated by the child's clinical team.

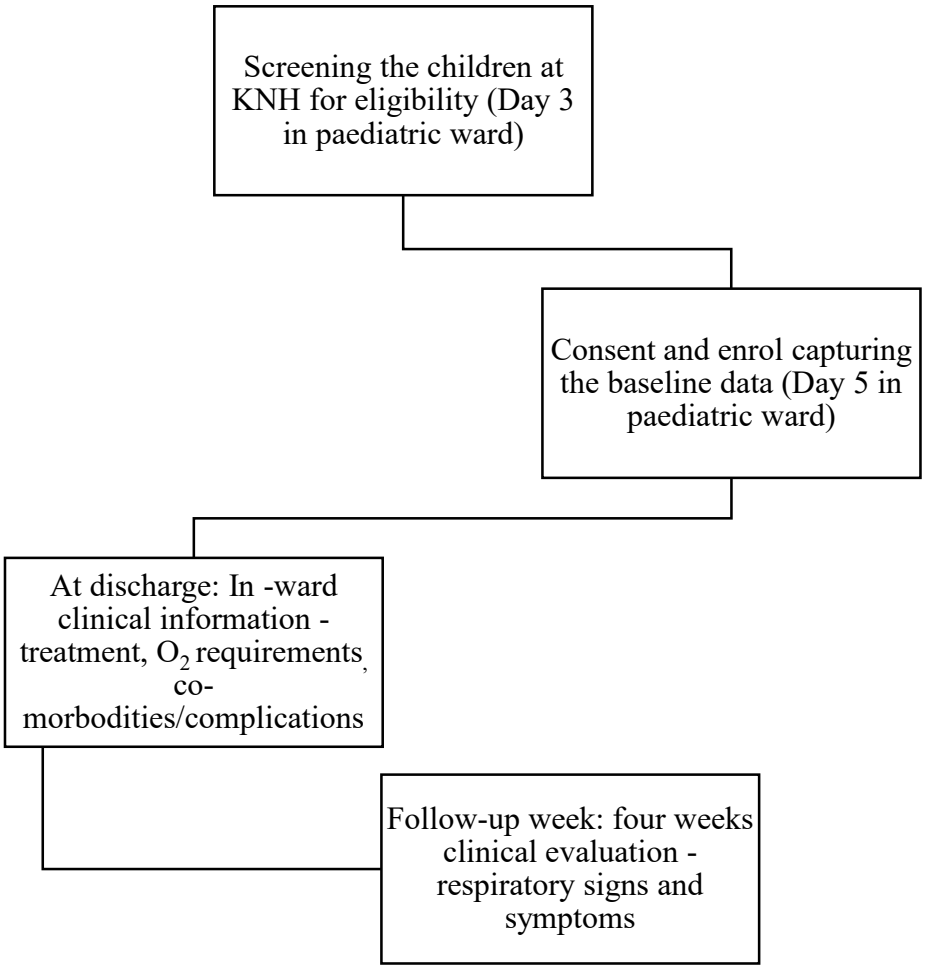

Figure 1: Study Screening, Enrolment, and Follow-up Flow Chart

3.10 Data management and analysis

Data was entered into pre-coded questionnaires, reviewed, cleaned, and keyed into a customized Microsoft Excel database. Then, it was analysed using the R software, version 4.1.2 Continuous variables were summarized using medians and interquartile ranges, categorical variables were summarized using frequencies and proportions. The proportion of children with persisting signs and symptoms was determined as the number of children with any of the signs and symptoms of interest, divided by the total number of children reviewed and expressed as a percentage. Descriptive analysis to determine the proportion of children presenting with each sign and symptom of interest was done and expressed as a percentage of the total number of study participants. Association of risk factors of interest with persisting signs and symptoms was then determined using binary logistic regression, chi square and Fisher's exact test, and presented as odds ratios with 95% confidence intervals.

Associated risk factors of interest include age, sex, exposure to cigarette smoke, chest X-ray findings, chest CT scan findings, antibiotics change, comorbidities, mode of oxygenation and duration of hospitalization.

The variables for the multivariable logistic regression model were selected using purposeful selection with p values <0.25 (23).

Tests were interpreted using p values, odds ratios, and confidence intervals at 5% significance level. Tests with p values <0.05 were considered significant

3.11 Ethical Considerations

Measures were carried out to ensure that the study abided by the ethical guidelines outlined when conducting the research. We acquired ethical approval from KNH-UON ERC. Additionally, detailed information was provided to the patient's parents to obtain informed consent. The parents were also informed that they could opt out of the study at will, allowing participation at their own will. The collected information was closely monitored to ensure that privacy and confidentiality were maintained throughout the study.

Patient-identifiable data was not included in the data collection tool. A unique study number was allocated to every patient recruited for identification.

Soft copy data was stored in a password-protected computer with restricted access. Hard copies of data were stored in a lockable cabinet

We ensured the participants' safety was maintained and they were not put at risk since the study aimed to be beneficial to the population. Since the study was carried out during the Covid-19 pandemic, there was limited contact during the study to ensure that the whole research team and participants were not at risk of contracting the coronavirus. These included:

a. Wearing of face mask was maintained by the principal investigator and research assistant.
b. Hand washing/sanitizing was done before examining and interviewing each patient.
c. The principal investigator ensured that the interview rooms were well-ventilated.

CHAPTER FOUR: STUDY RESULTS

4.1 Screening and Enrolment

We screened 104 children, out of whom 5 were potentially ineligible due to congenital heart disease and chronic lung disease. For the ninety-nine children included in the study, 4 died and 1 was lost to follow up. All 94 children were seen at four weeks after discharge at the outpatient clinic.

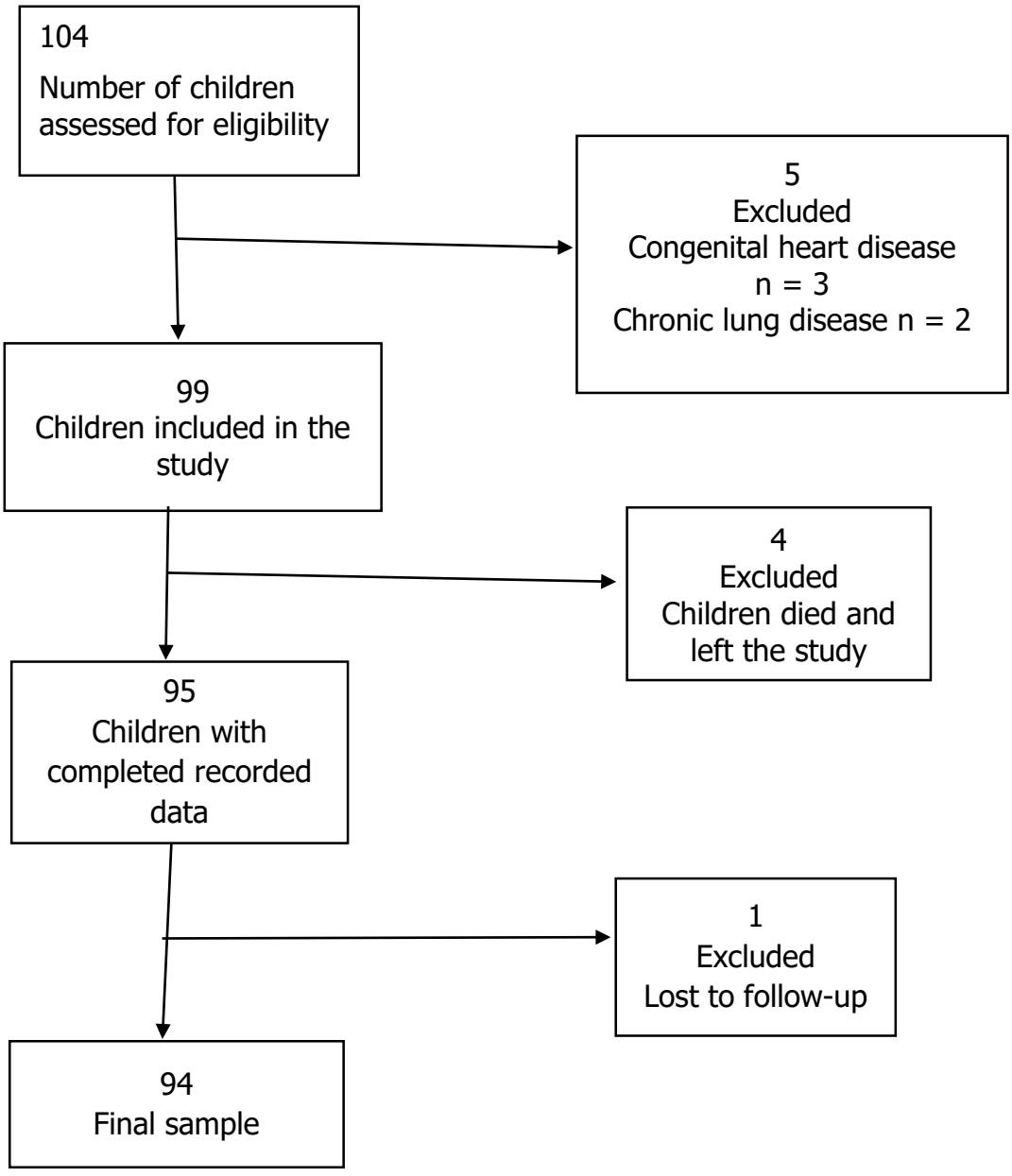

FIGURE 2: STUDY FLOW CHART

4.2 Descriptive Characteristics of the Study Population

4.2.1 Sociodemographic characteristics of the study participants

Table 2 below presents the demographic characteristics of the study participants, parents, and household characteristics.

Table 2: Socio-demographic characteristics of the study participants (N = 94)

Characteristic	Detail	Frequency	%
Children characteristics			
Sex	Female	37	39.6
	Male	57	60.6
Age in months	<6	26	27.6
	6-11	37	39.4
	12-23	15	16
	23-59	16	17
Parent/Guardian characteristics			
Age in years	<25	11	15.3
	≥25	61	84.7
	Median	32.0	27, 37
Relationship to the child	Mother	88	95.3
	Father	1	1.1
	Guardian	4	4.3
	Grandmother	1	1.1
Level of education	Primary	16	17
	Secondary	42	44.7
	Tertiary	32	34
	Not indicated	4	4.3
Family characteristics			
Household density	<4	25	27
	≥4	69	73
	Median (IQR)	4	3, 5
Number of rooms in the house	Median	3	1,4
	1	24	25.5
	2	22	23.4
	3+	48	51.1
Cooking fuel	Clean fuel	56	59.6
	Unclean fuel	38	40.4
Unclean source of cooking fuel	Charcoal	29	30.9
	Wood	13	13.8
	Kerosene	5	5.3
Smoking exposure	Yes	10	10.6

Of the 94 children, 37 (39.4%) were females and the rest were males. The majority 37 (37.4%) of the children were aged between 6 to 11 months old, 26 (27.6%) were

aged less than 6 months, 15 (16%) were between 12 to 23 months and the rest were aged 24 to 59 months.

Most of the caregivers 37 (84.7%) were aged 25 years and above. The median age of the parents/caregiver was 32 years (IQR 27, 37). The majority 88 (93.5%) of the caregivers were mothers to the children, 4 (4.3%) were guardians, and 1 (1.1%) was a father. In terms of the level of education, the majority 42 (44.7%) of the caregivers had a secondary school education, 32 (34%) had tertiary education and 16 (17%) had a primary education. The rest did not reveal their education level.

The median number of rooms in the household where the children came from was three rooms (IQR 1, 4). The majority 48 (51.1%) of the children came from households with three rooms and above, 24 (25.5%) came from a one-roomed houses and 22 (23.4%) came from a one-roomed house.

The majority 56 (59.6%) of the households used a clean source of cooking fuel. Twenty-nine (30.9%) of the households used charcoal, 13 (13.8%) used wood and 5 (5.3%) used kerosene. Ten (10.6%) of the children were exposed to cigarette smoke (Table 2).

4.2.2 Baseline clinical characteristics of children

i. Respiratory symptoms at admission

Six respiratory symptoms were reported at admission: cough, breathing difficulty, congested chest, chest pain, wheeze, and fast breathing. These are presented below

Table 3: Respiratory systems at admission (N=94)

Variable	Detail	Frequency	Percent
Cough	Yes	84	89.4
Breathing difficulty	Yes	91	96.8
Congested chest	Yes	49	52.1
Chest pain	Yes	22	23.4
Wheeze	Yes	14	14.9
Fast breathing	Yes	84	89.4

In terms of respiratory symptoms at admission, 84 (89.4%) of the children had a cough, 91 (96.8%) had difficulty breathing, and 49 (52.2%) had congested chests. There were 22 (23.4%) children with chest pain and 14 (14.9%) with a wheeze.

ii. Respiratory signs identified at admission

The majority 63 (67%) of the children had oxygen saturations of between 80-90%, 23 (24.5%) had saturations of between 70-79% and the rest had saturations of above 90%.

In terms of respiratory rate, 10 (10.6%) were tachypnoeic (RR≥99th centile for age). Forty-four (46.8%) had respirations of between 90th-<99th centile for age and 40 (42.6%) were between 50th-<90th centile for age.

A small number of the children had tachycardia 5 (5.3%) (HR≥99th centile for age). The majority 62 (66%) had had heart rates between 50th-<90th centile for age and 27 (28.7%) were between 90th-<99th centile for age.

Table 4: Respiratory signs identified at admission (N = 94)

Variable	Detail	Freq	%/IQR
WHO criteria for diagnosis of pneumonia (Respiratory)			
Oxygen saturations	>90%	8	8.5
	80-90%	63	67
	70-79%	23	24.5
	Median	84	80,87
Respirations (centile for age)	≥99th centile	10	10.6
	90th-<99th centile	44	46.8
	50th-<90th centile	40	42.6
Heart rate (centile for age)	≥99th centile	5	5.3
	90th-<99th centile	27	28.7
	50th-<90th centile	62	66
Grunting respirations	Yes	46	48.9
WHO criteria for diagnosis of pneumonia (Others)			

Inability to feed	Yes	34	36.2
Altered level of consciousness	Yes	3	3.2
Body temperature at admission	<36.8	28	
	36.8-37.2	18	
	>37.2	42	
	Median	37.1	36.7,37.8
Upper respiratory tract signs at admission			
Nasal congestion	Yes	38	40.4
Sneeze	Yes	19	20.2

Almost half 46 (48.9%) of the children had grunting respirations. Other features under WHO criteria for classification of severe pneumonia were; inability to feed 34 (36.2%) and altered level of consciousness 3 (3.2%). Some of the children had signs of upper respiratory tract infections; 38 (40.4%) had nasal congestion and 19 (20.2%) were sneezing (Table 4).

iii. Clinical respiratory diagnosis during hospitalisation

Table 5 below shows the diagnoses of the children during hospitalisation. Patients presented with symptoms of severe pneumonia, but some were also diagnosed to have other respiratory illnesses.

Table 5: Clinical respiratory diagnosis during hospitalisation (N = 94)

Diagnosis	**Frequency**	**Percent**
Severe pneumonia	80	85
Severe pneumonia with pleural effusion	4	4.3
Severe pneumonia with wheeze (bronchiolitis/asthma)	9	9.6
Severe pneumonia R/O PTB	1	1.1

The majority of the children 80 (85%) had a diagnosis of severe pneumonia, 9 (9.6%) had severe pneumonia with bronchiolitis/asthma and 4 (4.3%) had severe pneumonia with pleural effusion. The rest of the diagnoses are shown in Table 7.

Table 6: Other baseline characteristics at admission (N = 94)

Characteristic	**Detail**	**Freq**	**%**
General clinical Characteristics			
Nutritional status (weight for age z score)	Normal- mildly underweight (WAZ ≥ -2)	51	54.3
	Mod-severely underweight (WAZ < -2)	43	45.7
Malnutrition based on MUAC (mid upper arm circumference)	<11.0 cm (Severe)	26	27.7
	11.0 to 12.5 cm (Moderate)	8	8.5
	>12.5 cm to 13.5 cm (Mild)	8	8.5
	>13.5 cm (Healthy)	27	28.7
	Not indicated	25	26.6
Exclusive breastfeeding for children above 6 months	Yes	51	79.7
	No	13	20.3
Co-morbidity			
HIV status	Positive	3	3.2
Rickets	Yes	18	19.1
Cerebral palsy	Yes	7	7.4
GERD	Yes	9	9.6
Others		10	10.6
Recurrent respiratory illnesses	Adenoid hypertrophy	8	8.5
	Asthma	2	2.1
	URTI	12	12.8
Previous hospitalisation due to pneumonia/ LRTI	Yes	42	44.7
Number of hospitalizations	Two and below	26	61.9
	More than two	16	38.1
Duration of previous hospitalization in days	Median	14	9, 25

The nutritional status of the children was computed using weight for age z-scores. The majority of the children 51 (54.3%) were healthy to mildly underweight and the rest 43 (45.7%) were moderately to severely underweight.

Out of the 94 children, 26 (27.7%) had severe acute malnutrition (MUAC<11.0 cm), 8 (8.5%) had moderate malnutrition (MUAC 11.0 to 12.5 cm), 8 (8.5%) had mild malnutrition (MUAC 12.5 to 13.5 cm) and 27 (28.7%) were healthy (MUAC>13.5cm).

Of the 64 children who were above six months, 51 (79.7%) had been breastfed exclusively while the rest had not. Out of the 94 children, 3 (3.2%) were HIV positive, 18 (19.1%) had rickets, 7 (7.4%) had cerebral palsy and 9 (9.6%) had GERD. Those with other comorbidities were 10 (10.6%). The rest did not have comorbidities.

Out of the 94 children,12 (12.8%) had recurrent upper respiratory tract infections, 8 (8.5%) had recurrent adenoid hypertrophy and 2 (2.1%) had asthma. The children who had been previously hospitalised due to pneumonia/lower respiratory tract infections were 42 (44.7%). Of the children who had been hospitalised, the majority 26 (61.9%) had two or less hospitalisations and the rest had been hospitalised more than 2 times (Table 5).

4.3 Management in the hospital

Table 7 below presents the management of the children during admission. These include the mode of oxygenation, the antibiotic regimen and the investigations that were carried out.

Table 7: Management in the hospital (N = 94)

Variable	Detail	Frequency	%
Initial mode of oxygen delivery	Nasal prongs	58	61.7
	Non-rebreather mask	36	38.3
Change in antibiotics regimen from first line	Yes	37	39.4
	No	57	60.6
	Penicillin & aminoglycosides	18	19.1

Alternative antibiotic treatment	Cephalosporins	11	11.7
	Others	8	8.5
CXR done	Yes	74	78.7
Chest X-ray findings	Abnormal	23	31.1
Abnormal chest X-ray findings (**n = 23**)	Bronchopneumonia	3	13
	Opacification	7	30
	Hilar adenopathy	4	17.4
	Pleural effusion	1	4.3
	Lobar infiltration	8	35
Chest CT done	Yes	10	13.5
Chest CT scan findings (**n = 10**)	Abnormal	10	100
Abnormal chest CT scan findings (**n = 10**)	Opacification	2	20
	Pleural effusion	2	20
	Atelectasis	4	40
	Lobar infiltration	2	20

Of the 94 children, 58 (61.7%) received oxygen via nasal prongs and the rest received it via nonrebreather mask as their initial mode of oxygen delivery.

In terms of antibiotic changes made, the majority 57 (39.4%) were not switched from the first line of treatment, which is crystalline penicillin and gentamycin, 18 (19.1%) were on alternative penicillin and an aminoglycoside, 11 (11.7%) were on cephalosporins, four(4.2%) on carbapenems and four (4.2%) on additional macrolides.

Chest X-rays were done for the majority, 74 (78.7%) of the patients. Of the patients who had chest X-rays done, 23 (31.1%) showed abnormal findings. Of the 23 chest

X rays that showed abnormal findings, 8 (35%) showed lobar infiltration, 7 (30%) showed opacification, 4 (17.4%) had hilar adenopathy.

Of the 10 (13.5%) of the patients who had chest CT scans done, 10 (100%) showed abnormal findings, 4 (40%) showed that the patients had atelectasis and 2 (20%) had opacifications, pleural effusion, and lobar infiltration each (Table 7).

Objective 1 results: The Proportion of children whose respiratory symptoms and signs persisted up to four weeks after discharge from hospital

Out of 99 children enrolled in the study, 94 were assessed by the principal investigator at four weeks post discharge. Of the 94 children 35 had persisting respiratory symptoms and signs at four weeks post discharge. The proportion of children with persisting respiratory symptoms and signs was 37% (95% CI 28%, 48%). Children who presented with tachypnoea were only included if they presented with more than one symptom or sign.

Persisting respiratory symptoms and signs four weeks after hospital discharge

Three respiratory symptoms and three respiratory signs persisted up to four weeks post discharge. This information is presented in table 8 below.

Table 8: Persisting respiratory symptoms and signs four weeks after hospital discharge (N = 94)

Characteristic	Detail	Freq	%
Persisting symptoms of respiratory disease			
Cough	present	15	16
Difficulty breathing	present	10	10.6
Chest congestion	Present	9	9.6
Persisting signs of respiratory disease			
Respiratory rate	RR>90th centile for age (Tachypnoea)	7	7.4
Oxygen saturation	≤92%	19	20.2
Use of accessory muscles	Yes	18	19.1
Other characteristics of respiratory diseases four weeks post discharge			
Noisy breathing	Yes	12	12.8
Type of noisy breathing	Grunting	8	8.5
	Wheeze	1	1.1

	Snoring	3	3.2
Auscultation – breath sounds	Abnormal breath sounds (Crepitations)	28	29.8
Auscultation-air entry	Reduced	10	10.6
Percussion	Dull	9	9.6

Four symptoms were identified among the children four weeks post-discharge, and this included cough 15 (16%), difficulty breathing 10 (10.6%) and congested chest 9 (9.6%).

The abnormal respiratory signs that were identified four weeks after discharge from hospital were hypoxia 19 (20.2%), tachypnoea 7 (7.4%) and use of accessory muscles 18 (19.1%). Children who presented with tachypnoea alone with no other residual sign were not included.

Other respiratory symptoms identified in the follow-up period were noisy breathing 12 (12.8%) where 8 (8.5%) were grunting, 3 (3.2%) were snoring and 1 (1.1%) had a wheeze. On auscultation, 28 (29.8%) had abnormal breath sounds (crepitations). Ten (10.6%) of the children had reduced air entry. On percussion, 9 (9.6%) were dull and the rest were resonant.

Objective 2 results: Clinical spectrum of persisting respiratory symptoms and signs among the children who survive severe pneumonia

Under the spectrum of persisting symptoms and signs, each symptom or sign that persisted for four weeks and above has been presented in the bar chart in Figure 2. There were 15 (16%) children with cough, 10 (10.6%) with difficulty breathing and 9 (9.6%) had congested chests. In terms of abnormal respiratory signs, 19 (20.2%) had hypoxia, 7 (7.4%) had tachypnoea and 18 (19.1%) used accessory muscles of respiration (figure 3).

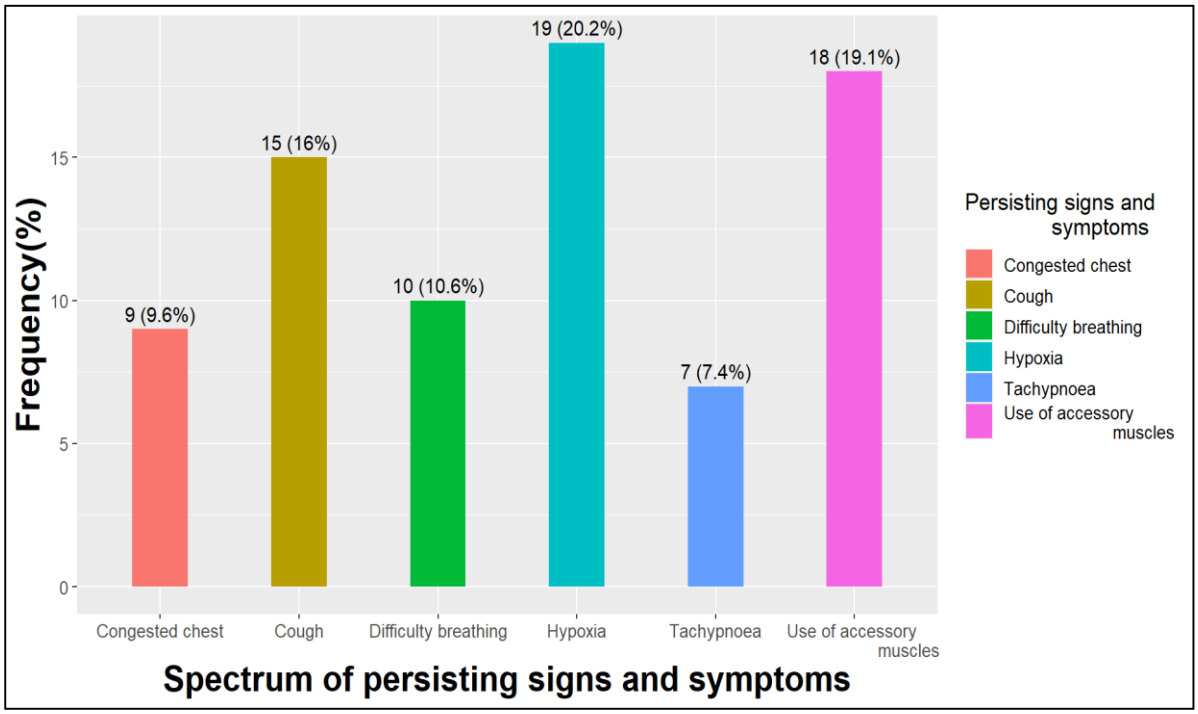

Figure 3: Clinical spectrum of persisting respiratory symptoms and signs four weeks post-discharge

4.4 Composite persisting respiratory symptoms and signs at follow-up

Some children had more than one persisting symptom, and more than one persisting sign present at one-month after hospital discharge. We further analysed for each child the number of residual symptoms, and the number of residual respiratory signs that were present one-month after hospital discharge. Three symptoms: cough, difficulty breathing, and congested chest were included in the composite. The three

signs included in the composite outcome were: use of accessory muscles, hypoxia, and tachypnoea. Children with tachypnoea were only included if they presented with another symptom or sign.

Table 9 below presents the frequency of occurrence of persisting symptoms and signs among the children at follow-up

Table 9: Composite of persisting respiratory symptoms and signs at follow-up

Symptoms N = 16	**Freq** n (%)	**Signs N = 29**	**Freq** n (%)
1	2 (12.5)	1	15 (51.7)
2	10 (62.5)	2	13 (44.8)
≥3	4 (25)	≥3	1 (3.4)

Of the 16 children with persisting respiratory symptoms, 2 (12.5%) had 1 symptom 10 (62.5%) had 2 symptoms and 4 (25%) had 3 or more symptoms. Of those with persisting respiratory signs, 15 (51.7%) had 1 sign, 13 (44.8%) had 2 signs and 1 (3.4%) had 3 or more signs (Table 9).

Objective 3 results: Risk factors for persisting respiratory symptoms and signs four weeks post discharge from the hospital

To assess for factors associated with persisting respiratory symptoms and signs, we created a composite outcome of all the three symptoms and three signs from table 9 combined. The results are presented in table 10 below.

4.5 Risk factors for persisting respiratory symptoms and signs: univariable analysis

The risk factors assessed in this section are presented in table 10 below. Of the factors assessed, only abnormal chest X-ray findings were found to be associated with persisting respiratory symptoms and sings at 5% significance level (P-value<0.05).

Table 10: Factors associated with persisting respiratory signs and symptoms four weeks following discharge

Factors	No. with data	Detail	Persistent N = 35 Freq (%)	Not N = 59 Freq (%)	Crude RR (95% CI)	p-value
Age in months	94		NA		0.96 (0.98, 1.06)	0.352
WAZ score	94		NA		0.93 (0.90,1.24)	0.541
Sex	37	Female	12 (32.4%)	25 (67.6%)	0.80 (0.42, 1.32)	0.438
	57	Male	23 (40.4%)	34 (59.6%)	*Reference*	
MUAC	34	Malnutrition (≤12.5 cm)	13 (38.2%)	21 (61.8%)	1.03 (0.51, 1.67)	0.925
	35	Mild to Normal (>12.5cm)	13 (37.1%)	22 (62.9%)	*Reference*	
Comorbidities	47	Present	15 (31.9%)	32 (68.1%)	0.70 (0.39, 1.22)	0.286
	47	Absent	20 (42.6%)	27 (57.4%)	*Reference*	
Source of cooking fuel	38	Unclean	16 (42.1%)	22 (57.9%)	1.24 (0.70, 1.85)	0.421
	56	Clean	19 (33.9%)	37 (66.1%)	*Reference*	
Exposure to Cigarette smoking	10	Yes	5 (50%)	5 (50%)	1.40 (0.59, 2.20)	0.492
	84	No	30 (35.7%)	54 (64.3%)	*Reference*	
Anormal chest Xray findings	23	Yes	18 (78.3%)	5 (21.7%)	3.26 (2.24, 3.82)	0.001
	71	No	17 (23.9%)	54 (76.1%)	*Reference*	
Abnormal chest CT scan findings	10	Yes	4 (40%)	6 (60%)	1.08 (0.40, 1.94)	1.00
	84	No	31 (36.9%)	53 (63.1%)	*Reference*	
Antibiotics changed	50	Yes	17 (34%)	33 (66%)	0.97 (0.50, 1.59)	0.912
	37	No	13 (35.1%)	24 (64.9%)	*Reference*	
Exclusive breastfeeding	13	No	4 (30.8%)	9 (69.2%)	0.74 (0.26, 1.51)	0.492
	51	Yes	21 (41.2%)	30 (58.8%)	*Reference*	
Mode of oxygenation	36	Non-rebreather mask	15 (41.7%)	21 (58.3%)	1.20 (0.68, 1.83)	0.484
	58	Nasal prongs	20 (34.5%)	38 (65.5%)	*Reference*	

WAZ- weight for age, MUAC- mid upper arm circumference, CT- computed tomography

Children whose chest X-ray findings were abnormal had 3.26 times higher risk of having persisting respiratory symptoms and signs compared with those who had normal chest X-ray findings, RR 3.26 (2.24, 3.28).

CHAPTER FIVE: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This study sought to look at the prevalence of and factors associated with persisting respiratory signs and symptoms after treatment for severe pneumonia. Children successfully treated for severe pneumonia were followed up four weeks after discharge. Studies have shown that respiratory symptoms after a viral lower respiratory tract infection can persist for up to four weeks, but should get better over time (24) A study done in India following up patients discharged after treatment for severe and very severe pneumonia assessed patients fortnightly for 3 months and concluded that it is necessary to establish a routine follow-up system for children following successful treatment for severe or very severe pneumonia in healthcare facilities for detecting medical problems early, understanding appropriate intervention and, thus, preventing death. Though this study did not assess risk factors.(25) There is a paucity of data on persisting symptoms after discharge and most studies have looked at factors associated with prolonged hospital stay and treatment failure of pneumonia. Several factors can lead to respiratory sequelae and these include; pulmonary TB, aspiration syndrome, asthma, immune deficiency disorders and vitamin D deficiency rickets. (26) Early infection with respiratory syncytial virus in children has also been linked to the development of wheezing and asthma symptoms after recovery. (27) Identifying and appropriately managing and following up children at-risk of respiratory sequelae may help to preserve long-term lung health. However, knowing who and when to investigate is challenging as there is little high-level evidence to support this.

5.2 Discussion

5.2.1 The proportion of persisting symptoms and signs

This study identified that out of 94 children, 35 had persisting respiratory signs and symptoms at four weeks post discharge. This reflected a 37% (95% CI 28%, 48%) prevalence. A meta-analysis by Nalbandian et al. on post-covid 19 symptoms reported a 32.6% persistence of respiratory symptoms among the patients who completed the survey. Of note, is that the meta-analysis focused only on COVID

19, primarily assessed adult cohorts and had limited data on children (28), and this would likely explain the difference.
A systematic review by Edmond et al. on Long Term Sequelae from childhood pneumonia found that children who were hospitalised and no pathogen isolated had a 17.6% risk of persisting symptoms, while those diagnosed with adenovirus pneumonia had a risk of 54.8%. (8) These values differing from our study may be attributed to the fact that we did not carry out microbiological assessments and that we had a smaller sample size.

5.2.2 The spectrum of persisting symptoms and signs

The clinical presentation of pneumonia includes but is not limited to cough, tachypnoea, wheezing in bacterial pneumonia, chest pain and decreased breath sounds. (29) In this study, the three symptoms that persisted beyond 28 days after discharge from the hospital were cough, difficulty in breathing, and chest congestion. In South Africa, Wesley A.G. pointed out cough and wheeze as having either persisted or recurred in 85% of the children under study (27). In another study in patients referred to a pulmonology clinic in Philadelphia after SARS-COV2 infection, persistent and/or exertional dyspnoea was the most common symptom observed in all children (97%), followed by cough (52%) and exercise intolerance (48%) (31)

This study showed cough as the most prevalent persisting symptom at 16% prevalence. Similarly, Anna N et al. showed a prevalence of cough of 18%, 1 month after treatment for a lower respiratory tract infection. (32) In a study of recurrent pneumonia, Hoang et al. found cough and wheeze as some of the features that the children presented with. (33)

In terms of the most prevalent sign at follow up, this study found that 20.2% of the children had hypoxia with an oxygen saturation of 92% or less. There were no comparable studies as the ones looking at respiratory sequelae did not look at oxygen saturations. We also found that 7.4% of the children followed up had tachypnoea using centiles for age and 19.1% used accessory muscles of breathing.

A comparable study found rapid breathing persisting at 14% and use of accessory muscles at 12% of study participants at four weeks though the study followed up children with a mixed grading of severity of pneumonia which could account for the slight differences.(25)

5.2.3 Risk factors for the persistence of pneumonia symptoms

Children with abnormal chest x-ray findings had 3.26 times higher risk of having persisting respiratory symptoms and signs, RR 3.26 (95% CI 2.24, 3.82). Abnormal chest X-ray findings have been associated with delayed recovery, treatment failure (39), and may also necessitate a change of antibiotics in children with pneumonia (40) but there is limited data on the association with respiratory sequelae.

Another factor of interest was exposure to cigarette smoking. Other studies have shown indoor tobacco smoking is significantly associated with poor respiratory outcomes in children and the world health organization (WHO) attributes the recurrence of pneumonia among children whose parents and/or guardians smoke cigarettes. (34) Smoke exposure has been reported as a significant risk factor for lower respiratory tract infections in studies (35), and predisposes children to higher carriage rates of *S. pneumoniae* and *H. influenza.* (36) However, our study did not show a statistically significant association between cigarette smoke exposure and persisting signs and symptoms after treatment for severe pneumonia, and this may be due to the small sample size and the possibility of incomplete disclosure from caregivers.

Our study showed that an association in increase in age by 1 year reduced the likelihood of persisting symptoms though not statistically significant. A similar study conducted in Nepal also showed that as age increases recovery time from illness also increases(37) Kasundriya et al. in their study of risk factors for severe pneumonia in India found that children above 12 months had significantly higher odds of severe pneumonia compared to those who were 12 months and below though this study never assessed recovery and resolution of symptoms. (38)
Our study revealed that high-resolution CT scan findings had an association with persisting signs and symptoms of pneumonia though not statistically significant.

Other factors of interest included nutritional status, exclusive breastfeeding for the first 6 months of life and comorbidities.

In our study, malnourished or underweight children did not have any statistically significant risk for persisting symptoms, and this may be attributed to the brief study period and the small sample size. Studies have shown that stunting is significantly associated with longer recovery time from the disease though these only assessed children who had longer stay in hospitals and required changes in antibiotics but, did not follow up children for persisting symptoms and signs after treatment. (41)

5.3 Conclusion

Successful follow up of the patients at four weeks post discharge was possible in about 95% of the children enrolled in the study. In this study, 37% of children had persisting abnormal respiratory signs and symptoms after treatment for severe pneumonia, beyond 28 days. The most common signs and symptoms were cough, chest congestion, difficulty in breathing, hypoxia, use of accessory muscles of breathing and tachypnoea.

Abnormal chest x-ray findings were found to be the most significant risk factors for persisting abnormal respiratory signs and symptoms.

5.4 Recommendation

It is important to have close follow up of children who survive severe pneumonia including proper physical examination and imaging where required, to appropriately identify and manage any morbidities.

There is also need for a larger study, with longer post-discharge follow up and in various levels of health service delivery, not just at a tertiary level to find stronger significance of predictors and risk factors for persisting signs and symptoms. This will guide protocols for their long-term management.

5.5 Study strengths

The close follow-up of patients from enrolment to 28 days post-discharge revealed a high level of consistency of the study tool.

There is limited data on the above study therefore this will provide a valuable contribution to the existing knowledge

This study operated within its budget estimate without extra costs and therefore demonstrated a degree of cost-effectiveness.

5.6 Study Limitations

This study cannot be generalized to other populations as it is a single-centre study.

The small sample size of 96 may have had a slight negative impact on the power of our study.

STUDY TIMELINES

ACTIVITY	MONTH 1-3	MONTH 4-6	MONTH 7-10	MONTH 10-12	MONTH 13-15
Proposal development					
Regulatory approval					
Data collection					
Data analysis					
Presentation of results & Dissertation write up					

STUDY BUDGET

Item	Quantity	Cost per unit	Total Cost
Principal investigator	1	N/a	
Statistician	1	20,000	20,000
Printing paper	6 rims	450	1,500
Pens	20	50	1,000
Ethics Review Committee	1	2,000	2,000
Publication and Dissemination	10	400	4,000
Communication	1	4,000	4,000
Research assistants	2	15,000	90,000
Transport costs for additional review	120	200	24,000
Other costs	1	8,300	8,300
Total			154,800

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APPENDICES

APPENDIX 1: PERCENTILE TABLES AND REFERENCE RANGES

PERCENTILE TABLE

SIGN	PERCENTILE
Tachypnoea at rest	Above 90th centile for age
Tachycardia at rest	Above 90th centile for age
Arterial oxygen saturation	Less than 94% at rest

HEART RATE CUT POINTS BASED ON AVERAGE PREDICTED VALUE WITHIN EACH AGE GROUP AND PERCENTILE

Age group	1st	5th	10th	50th	90th	95th	99th
0–<3 mo	103	113	119	140	164	171	186
3–<6 mo	98	108	114	135	159	167	182
6–<9 mo	94	104	110	131	156	163	178
9–<12 mo	91	101	107	128	153	160	176
12–<18 mo	87	97	103	124	149	157	173
18–<24 mo	82	92	98	120	146	154	170
2–<3 y	77	87	93	115	142	150	167
3–<4 y	71	82	88	111	138	146	164
4–<6 y	66	77	83	106	134	142	161
6–<8 y	61	71	77	100	128	137	155
8–<12 y	56	66	72	94	120	129	147
12–<15 y	51	61	66	87	112	121	138
15–<18 y	48	57	62	82	107	115	132

(42)

PATIENT ID: _____

RESPIRATORY RATE CUT POINTS BASED ON AVERAGE PREDICTED VALUE WITHIN EACH AGE GROUP AND PERCENTILE

Age group	1st	5th	10th	50th	90th	95th	99th
0–<3 mo	22	27	30	41	56	62	76
3–<6 mo	21	25	28	38	52	58	71
6–<9 mo	20	23	26	35	49	54	67
9–<12 mo	19	22	24	33	46	51	63
12–<18 mo	18	21	23	31	43	48	60
18–<24 mo	16	20	21	29	40	45	57
2–<3 y	16	18	20	27	37	42	54
3–<4 y	15	18	19	25	35	40	52
4–<6 y	14	17	18	24	33	37	50
6–<8 y	13	16	17	23	31	35	46
8–<12 y	13	15	16	21	28	31	41
12–<15 y	11	13	15	19	25	28	35
15–<18 y	11	13	14	18	23	26	32

(42)

Classification of Nutrition status by Weight for Height (WHZ)

Nutrition Status	Classification based on Weight for Height Z-score
Adequate	<2 to >-2 Z score
Moderate Acute Malnutrition (MAM)	≤ -2 but ≥ -3 Z score
Severe Acute Malnutrition (SAM)	< -3 SD

(43)

MUAC cut off points with corresponding colour and interpretation

Colour	Cut off points	Interpretation
Red	< 115 mm	Severely Acute Malnutrition
Yellow	115 mm to <125 mm	Moderate Acute Malnutrition
Green	>125 mm	Well nourished

(43)

DATA COLLECTION TOOLS

I. Patient Parent Questionnaire

Study Title: Prevalence and factors associated with persisting respiratory symptoms and signs four weeks after discharge from hospital following treatment for severe acute pneumonia in children aged 2 – 59 months

BIODATA

Facility code: _ _ _ _

Patient ID: (Facility code- Serial Number) _ _ _ _ - _ _ _ _

Date: ……

Date of Birth (dd/mm/yy): _____ Age: _____months

Sex (circle as appropriate): M F

a. Caregiver age in years……

Relationship to child: Mother___ Father___ Aunt___ Uncle___ Sister___

Brother___ Grandmother___ Grandfather___ Other___, specify ……

b. Anthropometrics (Current):

1. a) Weight: ___ ___. ___ kg (to one decimal).

2. a) Height: ___ ___. ___cm (to one decimal).

3. a) WHZ: ___ ___. ___ b) BMI: ___ ___. ___

4. Left Mid Upper Arm Circumference ___ ___. ___cm

c. Symptoms:

i). Respiratory Symptoms	Duration
1. Cough: Yes___ No___.	____weeks ___days
2. Inability to drink or breastfeed: Yes____ No____.	____weeks ___days
3. Altered level of consciousness or grunting: Yes____No__.	____weeks ___days
4. Difficulty in breathing: Yes____ No___.	____weeks ___days
5. Fast breathing: Yes____ No____.	____weeks ___days

6. Chest pain: Yes____ No____. ____weeks ___days

7. Congested chest: Yes____ No____. ____weeks ___days

8. Wheezing: Yes____ No____. ____weeks ___days

ii). ENT Symptoms

Duration

1. Blocked nose: Yes____ No____. ____weeks ___days

2. Runny nose: Yes____ No____. ____weeks ___days

3. Sneeze a lot: Yes____ No____. ____weeks ___days

iii). Past Medical History

1. Recurrent respiratory illnesses: URTIs___ recurrent wheeze/asthma___

adenoid hypertrophy___

2. Previous hospitalisation due pneumonia/LRTI: No___ Yes___

i). If yes, how many times___

ii). Age hospitalised (if many, first hospitalisation) ___

iii) Duration of last hospitalisation due respiratory problem. ____weeks ____days

d. Baseline findings

1. Body temperature: ___ ___. ___ 0 C

2. Oxygen saturation: ___ ___. ___ %

3. Respiratory rate: ___ ___ per minute RR centile for age __ __ %

4. Heart rate ___ ___ ___ per minute HR centile for age __ __ %

5. Mode of oxygen delivery_____

FiO2 required to sustain oxygen saturation above 94%_____

6. Was there a change in antibiotic regimen Yes ___ No____

Details_____

General Examination

1. Pallor: absent___ present___

2. Central colour: pink___ dusky___ cyanosis___

3. Using accessory muscles: Yes ___ No____ Tick all that apply:

Alar nasae flaring___ head nodding___ intercostal indrawing___

lower chest wall indrawing ___ subcostal/substernal___

4. Noisy breathing: absent___ present___ Tick all that apply:

wheeze___ stertor/snoring___ stridor___ grunting___

5. Hands: finger clubbing___ peripheral cyanosis___

Respiratory examination (Must tick Yes/No for every condition)

1. Obvious respiratory distress No__ Yes__

2. Chest shape: normal__ abnormal__

If abnormal, specify pigeon chest. barrel shape__ depressed sternum__

other__, specify ……

3. **Auscultation Findings**

Sign	**Right Lung**		**Location**	**Left Lung**		**Location**
a. Breath sounds	Normal	Abnormal		Normal	Abnormal	
b. Wheeze	Yes	No		Yes	No	
c. Crackles	Yes	No		Yes	No	
d. Air entry	Normal	Reduced		Normal	Reduced	
e. Percussion	Resonant	Dull		Resonant	Dull	

Sign	Right Lung		Location	Left Lung		Location
a. Breath sounds	Normal	Abnormal		Normal	Abnormal	
b. Wheeze	Yes	No		Yes	No	
c. Crackles	Yes	No		Yes	No	
d. Air entry	Normal	Reduced		Normal	Reduced	
e. Percussion	Resonant	Dull		Resonant	Dull	

Cardiovascular system exam

1. Apex beat: normal___ displaced___ (location __ th ICS)

2. 1st heart sound __ normal __ increased

3. 2nd heart sound __ normal __ increased

4. Murmur __ absent __ present

Murmur loudest in __ left parasternal border __ apex of heart

Other site, specify ……

5. Hepatomegaly __ absent __ present. No. cm below costal margin __ __ cm

Clinical Respiratory Diagnosis

Check all that apply:

☐Pneumonia ☐Bronchiolitis

☐Pneumonia with Pleural effusion ☐Aspiration pneumonia

Additional comorbidities

Check all that apply

1. Rickets: pre-existing____, new diagnosis____

2. CCF: pre-existing____, new diagnosis_____

3. HIV: pre-existing____, new diagnosis_____

4. Tuberculosis: pre-existing____, new diagnosis____

5. GERD: pre-existing____, new diagnosis____

PATIENT ID: _____

II. Weekly Assessment Form

DAY OF ADMISSION: ……

1. Respiratory rate____ breaths/minute centile for age____

2. Heart rate___ beats/minute centile for age

3. Temperature___ ^{0} C

4. Oxygen Saturation in Room air___%

5. FiO2 required to maintain saturation above 94%____

6. Day of Antibiotic treatment____

7. Current antibiotic regimen_____

8. Previous antibiotic regimen_____

9. Chest imaging done yes___ no____

Circle Appropriate

X-ray___ CT scan____

Abnormal findings yes___ no____

10. Plan for discharge yes____ no____

PATIENT ID: _____

III. Clinical Assessment at Paediatric Outpatient Clinic

a. Patient information

Sex: M F

Date of discharge____

Date of review___

Time between discharge and follow up review (in days) _____

b. Anthropometry

1. a) Weight: ___ ___. ___ kg (to one decimal).

2. a) Height: ___ ___. ___cm (to one decimal).

3. a) WHZ: ___ ___. ___ b) BMI: ___ ___. ___

4. Left Mid Upper Arm Circumference ___ ___. ___cm

b. Symptoms

i). Respiratory Symptoms Duration

1. Cough: Yes___ No___. ____weeks ___days

2. Inability to drink or breastfeed: Yes____ No____. ____weeks ___days

3. Altered level of consciousness or grunting: Yes____No__. ____weeks ___days

4. Difficulty in breathing: Yes____ No___. ____weeks ___days

5. Fast breathing: Yes____ No____. ____weeks ___days

6. Chest pain: Yes____ No____. ____weeks ___days

7. Congested chest: Yes____ No____. ____weeks ___days

8. Wheezing: Yes____ No____. ____weeks ___days

ii). ENT Symptoms **Duration**

1. Blocked nose: Yes____ No____. ____weeks ___days

2. Runny nose: Yes____ No____. ____weeks ___days

3. Sneeze a lot: Yes____ No____. ____weeks ___days

iii). Past Medical History

1. Recurrent respiratory illnesses: URTIs___ recurrent wheeze/asthma___

adenoid hypertrophy___

2. Previous hospitalisation due pneumonia/LRTI: No___ Yes___

i). If yes, how many times___

ii). Age hospitalised (if many, first hospitalisation) ___

1. iii) Duration of last hospitalisation due respiratory problem. ____weeks ____days

d. Respiratory Examination

1. Obvious respiratory distress No__ Yes__

2. Flaring nostrils: No__ Yes__

3. Accessory respiratory muscles (indrawing): No__ Yes__ If yes, specify site
Suprasternal/Supraclavicular__ Intercostal__ Lower chest wall__ Subcostal__

4. Noisy breathing: No__ Yes__ If yes, specify type

5. Wheeze__ Stridor__ Snoring/stertor__ Chest rattles__ Grunting__

6. Chest shape: normal__ abnormal__

If abnormal, specify pigeon chest. barrel shape__ depressed sternum__

other__, specify ……

7. **Auscultation Findings**

Sign	**Right Lung**		**Location**	**Left Lung**		**Location**
a. Breath sounds	Normal	Abnormal		Normal	Abnormal	
b. Wheeze	Yes	No		Yes	No	
c. Crackles	Yes	No		Yes	No	
d. Air entry	Normal	Reduced		Normal	Reduced	
e. Percussion	Resonant	Dull		Resonant	Dull	

Sign	Right Lung			Left Lung		
a. Breath sounds	Normal	Abnormal		Normal	Abnormal	
b. Wheeze	Yes	No		Yes	No	
c. Crackles	Yes	No		Yes	No	
d. Air entry	Normal	Reduced		Normal	Reduced	
e. Percussion	Resonant	Dull		Resonant	Dull	

Cardiovascular system exam

1. Apex beat: normal___ displaced___ location __ (intercostal space)

2. 1st heart sound __ normal __ increased

3. 2nd heart sound __ normal __ increased

4. Murmur __ absent __ present

Murmur loudest in __ left parasternal border __ apex of heart

Other site, specify ……

5. Hepatomegaly __ absent __ present. No. cm below costal margin __ __ cm

e. Associated Factors

1. Maternal level of education: None __ Primary __ Secondary __ Tertiary ___

2. Exclusive breastfeeding first 6 months of life Yes_____ No_____

3. Number of rooms in household____ number of persons in household___

4. Method used for heating or cooking in the house gas__ charcoal__ kerosene__ wood___ biogas__

5. Cigarette smoke exposure within the household: Yes____ No___

6. HIV status Positive [__] Negative [__] Unknown [__]

Clinical Respiratory Diagnosis

Check all that apply:

☐Pneumonia ☐Bronchiolitis

☐Pneumonia with Pleural effusion ☐Aspiration pneumonia

IV. Imaging Assessment Form

CHEST X-RAY done

__ Was not required

__ Was required but not yet done

__ CXR done

CHEST X-RAY Details:

i. If done, date first performed:

ii. Conclusion (Findings from the report): __ Normal __ Abnormal

(If abnormal, fill CXR reporting form)

iii. Reviewed by doctor Y/ N

Chest CT scan done

__ Was not required

__ Was required but not yet done

If not yet done, planned date for chest CT __ __ / __ __ / __ __

__ Chest CT scan done.

Chest CT Scan details

i. If done, date first performed:

ii. Conclusion (Findings from the report): __ Normal __ Abnormal

(If abnormal, fill Chest CT reporting form)

iii. Reviewed by doctor Y/ N

V. Imaging Reporting Form

1. Chest x-ray reported as abnormal:

☐Yes ☐No ☐Unknown

If abnormal findings, check all that apply:

☐Single lobar infiltrate ☐Pleural effusion ☐Pneumomediastinum

☐Enlarged heart ☐Multi-lobar infiltrate ☐Hilar adenopathy

☐Widened mediastinum ☐Enlarged trachea ☐Complete opacification

☐Granuloma ☐Pulmonary cavity or blebs ☐Enlarged epiglottis

☐Interstitial infiltrate ☐Pneumothorax ☐Empyema

Check all alveolar spaces with abnormality:

☐Left upper lobe ☐Left lower lobe ☐Right middle lobe

☐Left lingula ☐Right upper lobe ☐Right lower lobe

Summarize findings:

_____

_____

_____

_____

2. CT scan with abnormal findings:

☐Yes ☐No ☐Unknown

If abnormal findings, check all that apply:

☐Single lobar infiltrate ☐Pleural effusion ☐Pneumomediastinum ☐Enlarged heart

☐Multi-lobar infiltrate ☐Hilar adenopathy ☐Widened mediastinum ☐Enlarged trachea ☐Complete opacification ☐Granuloma ☐Pulmonary cavity or blebs ☐Enlarged epiglottis ☐Interstitial infiltrate ☐Pneumothorax ☐Empyema

Check all alveolar spaces with abnormality:

☐Left upper lobe ☐Left lower lobe ☐Right middle lobe

☐Left lingula ☐Right upper lobe ☐Right lower lobe

Summarize findings:

_____

_____

_____

_____

PATIENT ID: _____

PRELIMINARY CLINICIAN DIAGNOSIS

1. Summarize findings

_____

_____

_____

_____

_____

_____

_____

_____

_____

2. Does the child have persisting abnormal respiratory signs and symptoms?

Yes No

3. Does the child require a review by the paediatrician?

Yes No

(Initials __ __ __)

Date Paediatrician Review: __ __ / __ __ / __ __

Assessor Initials: __ __ __ Date (DD/MM/YY). __ __ / __ __ / __ __

Data entered by initials: __ __ __ Date of data entry (DD/MM/YY) __ __ / __ __ / __ __

Verified by: __ __ __ Date (DD/MM/YY). __ __ / __ __ / __ __

PATIENT ID: _____

CONSENT FORMS

I. Patient Information Sheet and Consent Form

Dear Participant,

I hereby request you to participate in a study titled: **PREVALENCE AND FACTORS ASSOCIATED WITH PERSISTING RESPIRATORY SYMPTOMS AND SIGNS FOUR WEEKS AFTER DISCHARGE FROM HOSPITAL FOLLOWING TREATMENT FOR SEVERE ACUTE PNEUMONIA IN CHILDREN AGED 2 – 59 MONTHS AT KENYATTA NATIONAL HOSPITAL.**

PRINCIPAL INVESTIGATOR: DR EDITH J. SEREM

INSTITUTIONAL AFFILIATION: UNIVERSITY OF NAIROBI

Introduction and purpose of the study

Pneumonia has a high disease burden within our country. Advances in research and healthcare have reduced the morbidity and mortality of pneumonia. After treatment, some patients recover fully, but a percentage of patients admitted in the KNH paediatric ward have persistent abnormal respiratory signs and symptoms. As the principal investigator, my objective is to determine the proportion of children with persisting abnormal respiratory signs and symptoms 4-8 weeks following recovery from severe pneumonia. To also assess the predictors of persisting abnormal respiratory signs and symptoms in patients who recover from severe pneumonia.

Research Process

As the parent/ guardian, the investigator and research assistant will explain the study details and request your signed consent to recruit the child into the study. You will then answer questions about your child's symptoms and treatment. And the consent allows for some of this information to be obtained from health records, and a full physical examination will be conducted on the child at different points of contact; a weekly evaluation, and a follow-up visit four weeks after hospital discharge.

The researcher will interview the parent to collect data on the clinical history and socio-demographic data. The researcher will examine the child to capture

anthropometry, vital signs, and respiratory exam and review medical records for other relevant clinical information. The researcher will do a follow-up review every week thereafter until discharge to capture the child's clinical status, key information on treatment and comorbidities, and CXR if available. When the primary clinical team recommends the discharge of the child, the researcher will do the final clinical evaluation, especially to capture respiratory clinical information. The researcher will then give a follow-up appointment visit at KNH POPC four to eight weeks post-discharge. Telephone reminders will be made two days prior to the scheduled visit to enhance follow-up.

The principal investigator will conduct a clinical evaluation four weeks post-discharge to assess respiratory function, including signs and symptoms, chest X-ray, and high-resolution chest computed tomography (HRCT). Some considered signs and symptoms include tachycardia, tachypnoea, grunting, hypoxemia- saturation of less than 94%, cough, difficulty in breathing, and wheezing. Patients who require follow-up and the provision of further interventions will be directed as appropriate.

Patients will meet the transport cost to the hospital for the 4week post hospitalisation clinic visit if visit is scheduled for the same date as the outpatient clinic visit. Should the study visit and clinic visit be scheduled for a separate date, then the principal investigator shall provide transportation cost to and from the facility.

Risks

There are no anticipated risks associated with participating in the study. The study will be carried out by trained professionals and within the hospital

Benefits

The research will not have a direct benefit to you personally. However, the results will provide crucial clinical information to health care providers to better manage pneumonia patients.

Study participation & Right to Withdraw

Participation in this study is voluntary, and there are no consequences should you decline to consent to the study or pull out at any time of the study.

Confidentiality

Should you choose to participate in the study, please note that all your information will be confidential, and your privacy will be protected entirely. We will use a code number to identify you in a password-protected computer database and keep all our paper records in a locked file cabinet.

During the duration of participation and after the conclusion of the study, should you be found to require further treatment, the investigator will link you to appropriate care.

Investigator's contact

If you have further questions or concerns about participating in this study, kindly contact the principal investigator **Dr Edith Serem on 0722819237**.

For more information about your rights as a research participant, you may contact the Secretary/Chairperson, Kenyatta National Hospital-University of Nairobi Ethics and Research Committee Telephone No. 2726300 Ext. 44102 email uonknh_erc@uonbi.ac.ke.

The study staff will reimburse your call charges to these numbers if the call is for study-related communication.

Participants Statement

I have read this consent form or had the information read to me. I have had the chance to discuss this research study with a study counsellor. I have had my questions answered in a language that I understand. The risks and benefits have been explained to me. I understand that my participation in this study is voluntary and that I may choose to withdraw at any time. I freely agree to participate in this research study.

I understand that all efforts will be made to keep information regarding my personal identity confidential.

By signing this consent form, I have not given up any of my legal rights as a participant in a research study.

Participant printed name:

I agree to participate in this research study	Participant's signature	Date
Participant signature or thumb stamp	Participant's thumb stamp	Date

Participant contact information _____

I, the investigator, having explained in depth the purpose of the study, hereby commit that confidentiality of the data collected will be maintained and only details relevant to the study will be collected and shared as outlined in the study procedures

Investigator _____

Signature_____

Date _____

PATIENT ID: _____

II. Karatasi Ya Taarifa Ya Mgonjwa Na Fomu Ya Ridhaa

KICHWA**: MAAMBUKIZI NA MAMBO YANAYOHUSIANA NA DALILI KUDUMU ZA KUPUMUA NA KUPITISHA WIKI NNE BAADA YA KURUHUSIWA KUTOKA HOSPITALI KUFUATIA MATIBABU YA PNEUMONIA MKALI KWA WATOTO WENYE UMRI WA MIAKA 2 – 59 KATIKA HOSPITALI KUU YA KENYATTA.**

UPELELEZI MKUU**: DR. EDITH JEMUTAI SEREM**

USHIRIKI WA TAASISI**: CHUO KIKUU CHA NAIROBI**

UTANGULIZI

Nimonia ina mzigo mkubwa wa magonjwa ndani ya nchi yetu. Maendeleo katika utafiti na huduma za afya yamepunguza maradhi na vifo vya nimonia. Baada ya matibabu, baadhi ya wagonjwa hupona kabisa lakini asilimia ya wagonjwa waliolazwa katika wodi ya watoto ya KNH wana dalili na dalili zisizo za kawaida za kupumua. Kama mchunguzi mkuu lengo langu ni kubainisha idadi ya watoto walio na dalili na dalili zisizo za kawaida za kupumua wiki 4-8 baada ya kupona nimonia kali. Ili pia kutathmini vitabiri vya dalili na dalili zisizo za kawaida za kupumua kwa wagonjwa wanaopona kutoka kwa nimonia kali.

Kama mzazi/mlezi, mpelelezi na msaidizi wa utafiti atakueleza maelezo ya utafiti, akuombe kibali chako kilichotiwa saini na kumwajiri mtoto katika utafiti. Baada ya hapo, utajibu mfululizo wa maswali kuhusu dalili za mtoto wako, na matibabu. Na idhini inaruhusu baadhi ya habari hii kupatikana kutoka kwa rekodi za afya, uchunguzi kamili wa kimwili utafanyika kwa mtoto katika maeneo tofauti ya kuwasiliana.

Iwapo utachagua kushiriki katika utafiti, tafadhali kumbuka kuwa taarifa zako zote zitakuwa siri na faragha yako italindwa kadri uwezavyo. Tutatumia nambari ya msimbo kukutambua katika hifadhidata ya kompyuta iliyolindwa na nenosiri na tutaweka rekodi zetu zote za karatasi kwenye kabati ya faili iliyofungwa.

Wakati wa ushiriki na baada ya kumalizika kwa utafiti, ikiwa utapatikana unahitaji matibabu zaidi, mpelelezi atakuunganisha kwa utunzaji unaofaa.

Hakuna hatari zinazotarajiwa zinazohusiana na kushiriki katika utafiti. Utafiti huo utafanywa na wataalamu waliofunzwa na ndani ya hospitali

Kushiriki katika utafiti huu ni kwa hiari na hakuna matokeo yoyote iwapo utakataa kuidhinisha utafiti au kujiondoa wakati wowote wa muda wa utafiti.

Ikiwa una maswali zaidi au wasiwasi kuhusu kushiriki katika utafiti huu, tafadhali wasiliana na mpelelezi mkuu Dk Edith Serem kwa nambari 0722819237.

Kwa maelezo zaidi kuhusu haki zako kama mshiriki wa utafiti unaweza kuwasiliana na Katibu/Mwenyekiti, Hospitali ya Kitaifa ya Kenyatta-Kamati ya Maadili na Utafiti ya Chuo Kikuu cha Nairobi Nambari 2726300 Ext. 44102 barua pepe uonknh_erc@uonbi.ac.ke.

Wafanyikazi wa utafiti watakurudishia gharama zako za kupiga simu kwa nambari hizi ikiwa simu ni ya mawasiliano yanayohusiana na masomo.

IV. Kauli ya washiriki

Ninakubali kwa uhuru kushiriki katika utafiti huu wa utafiti.

Ninaelewa kuwa juhudi zote zitafanywa ili kuweka taarifa kuhusu utambulisho wangu wa kibinafsi kuwa siri.

Kwa kutia saini fomu hii ya idhini, sijaacha haki zozote za kisheria nilizo nazo kama mshiriki katika utafiti wa utafiti.

Jina lililochapishwa la mshiriki: …….

Ninakubali kushiriki katika utafiti huu		
Sahihi ya mshiriki au muhuri wa kidole gumba		

V. Kauli ya Mtafiti

Mimi, niliyetia sahihi chini, nimeeleza kikamilifu maelezo muhimu ya utafiti huu kwa mshiriki aliyetajwa hapo juu na ninaamini kuwa mshiriki ameelewa na ametoa ridhaa yake kwa hiari na kwa uhuru.

Jina la Mtafiti: _____

Tarehe:_____Sahihi:_____

Jukumu katika utafiti: _____

UNIVERSITY OF NAIROBI
FACULTY 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/499

1st December, 2022

Dr. Edith Jemutai Serem
Reg. No H58/37183/2020
Dept. of Paediatrics & Child Health
Faculty of Health Sciences
University of Nairobi

01 DEC 2022

Dear Dr. Serem,

RESEARCH PROPOSAL: PREVALENCE AND FACTORS ASSOCIATED WITH PERSISTING RESPIRATORY SYMPTOMS AND SIGNS FOUR WEEKS AFTER DISCHARGE FROM HOSPITAL FOLLOWING TREATMENT FOR SEVERE ACUTE PNEUMONIA IN CHILDREN AGED 2-59 MONTHS (P248/03/2022

This is to inform you that KNH-UoN ERC has reviewed and approved your above research proposal. Your application approval number is **P248/03/2022.** The approval period is 1st December 2022 – 31st November 2023.

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by KNH-UoN ERC.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to KNH-UoN ERC 72 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affected 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.
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. 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.
vii. Submission of an executive summary report within 90 days upon completion of the study to KNH-UoN ERC.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely,

DR. BEATRICE K.M. AMUGUNE
SECRETARY, KNH-UoN ERC

c.c. The Dean, Faculty of Health Sciences, UoN
The Senior Director, CS, KNH
The Assistant Director, Health Information Dept., KNH
The Chairperson, KNH- UoN ERC
The Chair, Dept. of Paediatrics & Child Health, UoN
Supervisor: Prof. Elizabeth M Obimbo, Dept. of Paediatrics & Child Health, UoN
Dr. Florence Murila, Dept. of Paediatrics & Child Health, UoN

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: 15th December 2022

Dr. Edith Jemutai Serem
Reg. No.H58/37183/2020
Department of Paediatrics & Child Health
Faculty of Health Sciences
University of Nairobi

Dear Dr. Serem,

RE: AUTHORITY TO COLLECT DATA IN PAEDIATRICS DEPARTMENT

Following approval of your Research proposal by the KNH/UON-Ethics & Research Committee 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 **"Prevalence and factors associated with persisting respiratory symptoms and signs four weeks after discharge from hospital following treatment for severe acute pneumonia in children aged 2-59 months.** Kindly liaise with the Senior Assistant Chief Nurse (SACN), Paediatric General Wards.

You will also be required to submit a report of your study findings to the office of the HOD, Paediatrics - KNH after completion of your study.

Dr. Juliana Muiva - Gitobu
Head of Department- Paediatrics

Cc. SACN, Paediatric General Wards

ab

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