ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES

DEPARTMENT OF ZOOLOGICAL SCIENCE

General Biology program

Prevalence and associated risk factors of pneumonia among under-five children in Bishoftu General Hospital, East Shoa Ethiopia

By

Taye Tamrat Haile

July, 2024

Addis Ababa, Ethiopia

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A Thesis Submitted to Addis Ababa University, College of Natural and Computational Sciences, Department of Zoological Sciences in Partial Fulfillment of the requirements for Master of Science Degree in Biology

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Advisor: Asnake Desalegn (PhD)

July, 2024

Addis Ababa, Ethiopia

APPROVAL SHEET

Addis Ababa University

This is to certify that the thesis is prepared by Taye Tamrat Haile, entitled: “Prevalence and associated risk factors of pneumonia among under-five children in Bishoftu General Hospital, East Shoa Ethiopia”, and submitted in partial fulfillment of the requirements for the awards of the degree of masters of science (M.Sc.) in Biology.

Approved by Board of Examiners

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DECLARATION

I declare that the work which is being presented in this thesis entitled “Prevalence and associated risk factors of pneumonia among under-five children in Bishoftu General Hospital, East Shoa Ethiopia” is the result of my own investigation except as cited in the references. I have undertaken the study independently with the guidance and support of my research advisor. All the sources of the materials used in this thesis paper have been duly acknowledged. Moreover, the thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature _____

Taye Tamrat Haile

This thesis has been submitted for examination with my approval as university advisor.

Advisor’s Signature _____

Asnake Desalegn (PhD)

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LIST OF ACRONYMS

ARTI	Acute Respiratory Tract Infection
DRSP	Drug-Resistant Streptococcus Pneumonia
ICU	Intensive care unit
MUAC	Mid Upper Arm Circumference
OPD	Outpatient department
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organization

ABSTRACT

Pneumonia is defined as inflammation of the lung parenchyma structures, usually caused by bacteria or viruses. Pneumonia is the leading cause of morbidity and mortality in children under five in developing countries, including Ethiopia. According to World Health Organization report, pneumonia was responsible for 16 percent of the estimated 5.9 million deaths in children under 5 years of age. Pneumonia can be easily treated and prevented by reducing the amount of risk. The primary objective of this study was to determine the prevalence of pneumonia and associated factors in children under five years of age at Bishoftu General Hospital, East Shoa, Ethiopia. This study was a hospital-based cross-sectional study involving 348 study participants. The pre-test of the questionnaire was conducted on a non-study sample, representing 10% of the sample size. The collected data were entered and analyzed using Statistical Package for Statistical Analysis (SPSS) version 27. Statistical analysis of significant associations was reported using analysis of variance with 95% confidence interval and p-value less than 0:05 in multivariate logistic regression. The overall prevalence of pneumonia was 22.1% and this was relatively high. The type of fuel, the cooking area, the child's position while cooking, the kitchen not being separate from the main house, the number of windows in the kitchen, smoking in the house, breastfeeding status of the baby, vaccination status of the child, vitamin A intake status, and not taking the child to the clinic immediately after sickness were the most important variables found to be associated with under five pneumonias. Health education on the potential hazards of using charcoal and wood as a fuel, keeping children away from cooking place, educating mothers to discourage carrying of child on their back when food cooking, exclusive breastfeeding and nutrition, increased immunization and vitamin A supplementation, and avoiding cigarette smoke exposure are recommended to prevent under five pneumonias.

Key words: under five pneumonia risk factors prevalence

1. INTRODUCTION

1.1 Background

A serious respiratory disease that affects the lungs is pneumonia. When healthy people breathe, small sacs in the lungs called alveoli fill with air. Pneumonia causes the lung alveoli to fill with pus and fluid, which limits oxygen use and makes breathing difficult (WHO, 2021).

Pneumonia can be classified by several factors: location of infection (such as in the community or in a hospital); type of pneumonia (bacterial, viral, fungal, inhaled, lung inhalation); and medical severity (no pneumonia, pneumonia, or severe pneumonia) (Mackenzie, 2016). Both pneumonia and pneumonia can have similar symptoms. On the other hand, the symptoms of pneumonia can be more severe than pneumonia.

In children under five years of age, pneumonia is recognized by shortness of breath or a low chest wall retraction, in which the child's chest moves or retracts during breathing (in healthy people, the chest expands during breathing). This condition can be diagnosed with or without fever. Bacterial infections can cause asthma. Severely ill infants may not be able to drink or eat, and may experience loss of consciousness, fatigue, and hypothermia (WHO, 2021).

Streptococcus pneumonia was isolated in 20% of patients; however, antibiotic resistance of the above bacteria, including drug-resistant Streptococcus pneumonia (DRSP) and methicillin-resistant Staphylococcus aurous, has become more common in children (Eddy, 2011). Adenovirus, par influenza virus, influenza virus, rhinovirus, corona virus, and respiratory syncytial virus (RSV) are common viruses that cause pneumonia. Although fungal pneumonia is rare, it is more likely to occur in people with weakened immune systems or other health problems. Many viruses can cause lung damage.

Globally, many researchers had conducted researches to identify risk factors of pneumonia. In their study, low birth weight, malnutrition, indoor air pollution, parental smoking, being unvaccinated, overcrowding, lack of separate kitchen, being not on exclusive breast feeding, and maternal education were identified as factors associated with occurrence of pneumonia in under-five children (Nirmolia, 2018).

In 2016, an estimated 900,000 children died of pneumonia worldwide, accounting for approximately 16% of the 5.6 million deaths among children under five years of age worldwide (Hogan et al., 2018). According to the World Health Organization (Pires et al., 2015), approximately 5.9 million children under five died that year, approximately 16% of which were due to pneumonia. The highest burden of pneumonia in children under five (50%) in the world occurs in Sub-Saharan Africa (Nair et al., 2013).

About 490,000 children of under-five died of pneumonia in sub-Saharan Africa in 2016 alone (UNICEF, 2016). Ethiopia has one of the highest rates of pneumonia in Sub-Saharan Africa, with an estimated 3,370,000 children affected each year. In Ethiopia, pneumonia accounts for 18% of all deaths among more than 40,000 children under five (Pires et al., 2015). Pneumonia has long been recognized as the cause of the most deaths in children under five annually, even though these deaths are easily treatable and preventable with affordable and appropriate services such as vaccinations, nutrition, breastfeeding, zinc and vitamin A supplements, management of nutrition, safe drinking water, sanitation and environmental factors (Chopra et al., 2013).

Although many strategies have been adopted and implemented by the Ethiopian government to reduce pneumonia morbidity and mortality, the burden and severity of childhood pneumonia remain high and continue to cause child mortality. These factors include inadequate access to care, low coverage and affordability of preventive measures such as vaccination, and lack of control over good ideas that require the creation of new ideas that can be derived through research (Zar, 2016).

Despite improvements achieved through various interventions, pneumonia remains the leading cause of death among children under five years of age in Ethiopia. Diseases such as measles, AIDS, and malaria also frequently affect children (World Health Organization, 2006). It is the leading cause of death among children worldwide.

1.2 Statement of the problem

More children under the age of five die from pneumonia than from other known diseases such as measles, AIDS and malaria (World Health Organization, 2006). It is the leading cause of death among children worldwide. In 2015, an estimated 921,000 children under the age of five

died from pneumonia each year. The majority of low- and middle-income countries (LMICs) are in South Asia and Sub-Saharan Africa, where more than 95% of deaths occur (Zewudu et al., 2020).

According to Wardlaw et al. (2014), pneumonia is the leading cause of morbidity and mortality among children under five in Ethiopia. Pneumonia affects approximately 3,370,000 children each year, accounting for 20% of all deaths and more than 40,000 deaths in children of under five. Pneumonia is also a leading cause of death after birth.

Pneumonia has received little attention because there is little research on the disease. Although there is evidence that these measures are inexpensive and effective (i.e. reduce the costs of pneumonia without limitation), their scale-up has been slow. This is the result of estimating the severity of pneumonia.

Concerns have been raised that primary health care providers, such as community health workers, are giving antibiotics to children with pneumonia and that these practices will make antibiotics more serious and make it more difficult to spread in the community (Greenwood et al., 2007).

Although pneumonia is the most common cause of death in children under the age of five, studies in Ethiopia, especially in rural areas, do not provide sufficient information about pneumonia and its effects. Data on the prevalence of pneumonia and their related risk factors are important for planning child health care services but limited in our countries. Despite this fact, there is still no understanding of the prevalence and risk of pneumonia in Ethiopia (Yoseph and Fentahun, 2020).

It is important to assess the prevalence and risk factors of pneumonia in the country as this will make the estimation more accurate. Also, the prevalence of pneumonia in children under five years of age and its impact as well as its risk factors in Bishoftu Town has not been investigated. Therefore, the aim of this study was to determine the prevalence and risk factors of pneumonia in children under five years of age treated in a public hospital in Bishoftu Town, East Shoa, Ethiopia.

1.3 Research Questions

- ✓ What is the prevalence of pneumonia in children under five years of age at Bishoftu General Hospital, East Shoa, Ethiopia?
- ✓ What are the risk factors of pneumonia in children under five years of age, Bishoftu General Hospital, East Shoa, Ethiopia?

1.4 Objectives of the study

1.4.1 General objective

To evaluate the prevalence and contributing risk factors of pneumonia in children of under five at Bishoftu General Hospital in East Shoa, Ethiopia.

1.4.2 Specific objectives

- ❖ To find out how common pneumonia is in children under five at Bishoftu General Hospital in East Shoa, Ethiopia.
- ❖ To determine the risk factors for pneumonia in children under five at Bishoftu General Hospital in East Shoa, Ethiopia.

1.5 Significance of the study

The result of this study provides information for health office institutions, society, policy makers and other stalk holders regarding prevalence and risk factors of pneumonia in under five years of children. Data from this study informs community health programs at reducing pneumonia prevalence among under five children, eventually improving child health outcomes. Engaging with hospital administrators to discuss how research findings can be integrated into practice can foster a culture of evidence-based care.

1.6 Scope of the study

The research wascarried outin Bishoftu General Hospital based on the data collected in under five OPD (outpatient department), pediatric ward and neonatal ICU (intensive care unit).

2. LITERATURE REVIEW

2.1 Prevalence of pneumonia in under five children

A lower respiratory tract disease that affects the lungs is pneumonia. In 2018 alone, it killed 802,000 children under the age of five. Approximately 1,400 cases of pneumonia are reported worldwide each year, or 1 in every 71 children (UNICEF, 2019). In 2018, pneumonia killed approximately 802,000 children under the age of five worldwide, with 2,200 deaths every day. According to UNICEF (2018), more than 1,400 cases of pneumonia occur per 100,000 children each year, or 1 in every 71 children; the highest incidence is in South Asia, West Africa, and Central Africa, with 2,500 patients and 1,620 patients per 100,000 children. In 2019, pneumonia claimed the lives of 740,180 children under the age of 5, accounting for 14% of all child deaths and 22% of all deaths in children aged 1–5. Where children and families are affected by pneumonia, deaths from the disease are highest in South Asia and Sub-Saharan Africa (World Health Organization, 2021). Treatment and management Pneumonia accounts for 22% of under-5 deaths, or 55 deaths per 1,000 live births (Owais et al., 2010). In Ethiopia, pneumonia accounts for 28% of deaths among children under the age of five, making it a leading cause of death in the country (CSA, 2016). The children below all had pneumonia. According to the Ethiopia Demographic Health Survey Report 2016 (CSA, 2016), the prevalence of respiratory diseases in Ethiopia is 7%. According to a study conducted in Sidamazone in the Wondo Genet region of Ethiopia, 33.5% of children under the age of five suffer from pneumonia (Teshome, 2017). According to a study conducted in Este city of Ethiopia, 16.1% of children under the age of five suffer from pneumonia (Gedefaw et al. 2014). A study conducted in Jimma region of western Ethiopia revealed that 28.1% of children under the age of five suffer from pneumonia (Lema et al., 2018). According to an interdisciplinary study conducted at the Gondar University Referral Hospital, 18.5% of children under the age of five suffer from pneumonia. It is the burden of lung disease. Pneumonia has become an important public health problem due to the spread of the disease and the negative effects it has on children's health, especially their development and growth, and the problems in the implementation of quality control.

2.2 Risk Factors of pneumonia in under-five children

A more in-depth understanding of the risk factors associated with pneumonia is necessary to develop effective prevention strategies. The first step in developing effective preventive measures is to identify the risk factor or disease determinant (Fadl et al., 2020). These factors include poor nutrition and immunity (Fonseca et al., 1996), low fertility (Mahalanabis et al., 2002; Nira et al., 2013), breastfeeding (Abel et al., 2014; Mahalanabis et al., 2014), place of birth (Ujunwa and Ezeonu, 2014), and age of the child (Gabbad et al., 2014). Impact (Manya, 2005).

2.2.1 Demographic risk factors

Age of children and Mother

According to Fadl et al. (2020), the risk of pneumonia is higher in children (over 12 months). This can be explained by the fact that children in this age group are at risk of developing pneumonia due to their small airways and weak airways. (2014) indicate that the age of the mother and the child are specifically associated with the risk of pneumonia, with women aged 30 and over being more likely to have children with pneumonia than women of the same age, aged 20 to 29 (most of the study participants). This may be because people in this age group are more aware of the benefits and need for early home treatment for respiratory symptoms to prevent pneumonia.

Sex of children

Fadl (2020) noted that a meta-analysis showed that boys are more likely to get pneumonia than girls. The difference between the sexes could be explained by the fact that girls have a stronger immune system than boys. In addition, there is evidence that boys have narrowed airways at an early age, which makes them more likely to get pneumonia (Mahalanabis et al., 2002). A study on pneumonia in Brazil supports the higher risk in boys (Victora et al., 1994). An increased risk of pneumonia has been reported in children aged 2 to 6 months (Hasanet et al., 2001; Zafaret et al., 2002).

Parental education

Abel et al. (2014) found that paternal literacy was associated with the incidence of pneumonia in children, with the higher the paternal literacy, the higher the risk of pneumonia. Children whose fathers had not completed primary school were more likely to develop pneumonia than children whose fathers had completed university. When both factors were included in the explanatory model, a study on childhood pneumonia in Brazil found that paternal education was more associated with the disease than maternal education (Victora et al. 1994). Low maternal education is associated with higher rates of hospitalization and morbidity due to pneumonia, even in less developed countries (Hassan et al., 2008).

2.2.2 Socio-economic Risk Factors

The relationship between lung disease and other socio-cultural factors varies across countries, as shown by different indicators. Young people in underdeveloped countries are three to six times more likely to develop pneumonia. Underdeveloped countries not only have more lung disease, they also have more deaths. Childhood deaths from pneumonia are associated with poor nutrition, indoor air quality, poor water and sanitation, inadequate access to health care, and poverty, including maternal lack of knowledge and proper infant care, which increases the severity of the disease (Ramezani et al., 2015). Studies have shown that parental education and residence are two risk factors for pneumonia in children under five.

Place of Residence

Unexpectedly, a decrease in maternal health has been shown to be associated with an approximately fivefold increase in the risk of developing pneumonia (Mahalanabis et al., 2002).The mortality rate from acute respiratory infections varies by location in Bangladesh. The leading cause of death is both rural and urban, with 22.3% of deaths occurring in rural areas and 16.8% in urban areas. Children from the poorest families living in rural areas and those with less education are more likely to die from pneumonia (BDHS, 2005).

2.2.3 Environmental Risk Factors

Living in overcrowded housing, using biomass fuel (such as wood or dung) for cooking and heating, parental smoking, and inadequate ventilation are important environmental variables that increase the risk of pneumonia in children (World Health Organization, 2021).

Inadequate ventilation

Inadequate ventilation increases humidity in the home, creating a favorable environment for mold, respiratory diseases, and bacteria, leading to respiratory diseases. Ventilation can promote the removal of indoor air pollutants by improving air circulation, thus reducing the risk of respiratory infections in young children under five (Sacks et al., 2011). It is the most studied environmental risk factor for respiratory diseases. This increases the risk of bacteria adhering to the respiratory epithelium and forming bacteria in the air, causing respiratory diseases (Vanker et al., 2017). Many studies have clearly shown the link between environmental smoke (also known as passive smoking) and respiratory diseases in children. Cigarette smoke contains measurable amounts of carbon monoxide, ammonia, nicotine, hydrogen cyanide, small particles, and other carcinogens. According to Jamies et al. (2003), children who smoke have a 1.5-2.0 times higher incidence of pneumonia and lower lung function scores than children who do not smoke. The risk is almost 80% (Dherani et al., 2008). This finding suggests that indoor air pollution is a significant factor in the increased incidence of respiratory diseases in children (Mahalanabis et al., 2002). Gedefaw et al., (2014) found that children in homes that use coal are seven times more likely to develop pneumonia than children in homes that do not use coal. Children who are carried on their mothers' backs while cooking are more likely to get pneumonia than children who are not carried on their mothers' backs. Household pollution from biomass fuel is a major problem. Respiratory immunity, whether specific or not, will be adversely affected by air pollution from biomass fuel use. Low lung disease incidence is difficult. On the other hand, 11.6% of people smoke. Crowded environments promote the spread of airborne diseases. Therefore, overcrowding (generally defined as the number of people living in an apartment) is a major risk for both the child's room and the family in Asia and Africa. Crowding is defined as children aged 0-10 living with a child and children sleeping in the same room as that child. The combination of these factors

is associated with an increased risk of pneumonia and tends to occur in rural and urban areas (Cardoso, 2004). Gedefaw et al., (2014) found that children in overcrowded households are four times more likely to develop pneumonia than children in less crowded households. Crowded households increase the risk of infection. Gedefaw et al., (2014) found that keeping cattle at home was a significant risk factor for pneumonia in children under five years of age. This may be because the shelters where the cattle were kept were wet and unsanitary.

Cockroach Infestation

A study conducted by Batu et al in 2019 revealed that the risk of developing pneumonia in children under the age of 5 living in homes with insect problems increased by 1.98 times. According to research conducted in the same place, cockroaches are a significant source of infection, including various antibiotic resistance species of the Klebsiella genus.

2.2.4 Nutritional Factors

Malnutrition, breastfeeding, low birth weight, and levels of vitamin A and other micronutrients are nutritional factors that may influence pneumonia (Manya, 2005).

Malnutrition

Young people who do not consume enough energy become weak and get pneumonia. It has been shown that long-term under nutrition can cause stunting and that stunted children have a 2.5 times greater risk of pneumonia than children without stunting (Gedefaw as et al., 2014).

Anthropometric measurements are frequently used to assess malnutrition in epidemiological studies. Many studies have examined the relationship between lung disease and malnutrition, especially weight for age (Zafar et al., 2002). When all tests were combined and a Z score of -2 was used as the cut-off point, the incidence of pneumonia in malnourished children was two to four times higher. However, these milestones need to be reconsidered for multicultural use (Victora, 1992). An analysis of ten long-term community-based studies of children under five years of age found that less active children were more likely to die from infectious diseases. For pneumonia, the percentage of cases attributed to weight was 53%. Low birth rates are a sign of fetal starvation and may be associated with infant mortality (Black et al., 2003).

Exclusive breast feeding

Children who were exclusively breastfed for at least six months were 108 times less likely to develop pneumonia than children who were exclusively breastfed (Dessie et al., 2022). According toBiruk et al. (2020) the average duration of breastfeeding is short (around three months) in wealthy and some poor areas, in many rural and urban areas, breastfeeding continues widely until infants are 12 to 18 months old, although early dosing is common. Cesar found that adding nutritional supplements to breast milk was associated with a 13.4-fold increase in the relative risk of pneumonia in all infants (Cesar et al., 1999). According to Cerqueiro et al. (1990) and other studies, babies who are not breastfed are 1.5 to 4 times more likely to develop pneumonia. Babies 0 to 5 months of age who are not breastfed are five times more likely to die from pneumonia. Babies 6 to 11 months of age who are not breastfed are also more likely to die from these causes (Blacket al., 2003).

2.2.5 Immunization factors

Vaccination in children can prevent diseases. Children with diarrhea and other illnesses may have lower immunity, making them more susceptible to infections such as pneumonia (Abel et al., 2014). According to Zhang et al. (2013), pneumonia is the leading cause of hospitalization and death among children with severe immune suppression, including children with HIV infection. A cross-sectional study carried out in Uruguay revealed that prevalence of pneumonia decreased between 2009 and 2012 by 27.3% and 46.4%, respectively. The incidence decreased in children aged 6-35 months. The study found a reduction in hospitalizations for pneumonia after the use of PCV_7 and a significant reduction after the introduction of PCV_{13}(Hortal et al., 2014). Roth et al. (2004), found that Bacille Calmette Guerin (BCG) was a marker of increased capacity in adults. Haemophilus influenzae type b (Hib) conjugate vaccines are effective in reducing Haemophilus influenzae type b meningitis. Furthermore, 20% to 25% of pneumonia cases may be Hib-related (Mulholland et al., 1992). In the program, Hib conjugate vaccine was found to be 31% (95% CI: ± 9%, 57%) effective in infants with radiation-induced pneumonia, suggesting that vaccination with Hib drugs is effective in preventing bleeding that cannot be achieved in the hospital. treatment of pneumonia (Andrade et al., 2004). After the advent of penicillin and sulfonamides,

pneumococcal polysaccharide vaccine was quickly withdrawn from the American market and was first licensed in the United States in 1946. Successful trials and research into disease prevention have yielded very positive results. Pneumococcal vaccines are immunogenic, safe, and provide immunity in infants. Their widespread use should lead to protection of animals because they reduce the transport and destruction of antibodies in the body (Choo and Finn, 2001). Since pneumonia is a common manifestation of measles, children can be protected from measles by receiving measles vaccination. The pentavalent vaccine, together with other vaccines, reduces the risk of pneumonia by reducing diphtheria, pertussis, and Haemophilus influenza.

2.3 Conceptual frame work

As discussed in the review, there are substantial empirical researches that support the existence of different risk factors that increase prevalence of pneumonia particularly among under-five children. In this study, under-five pneumonia is dependent variable and the independent variables are those factors that are related to under-five pneumonia likedemographic factors such as age of children and mother, gender of children and parental education;socio-economic factors including place of residence; environmental factors like inadequate ventilation and cockroach infestation; nutritional factors such as malnutrition and exclusive breast feeding;and immunization factors such as vaccination status of children.

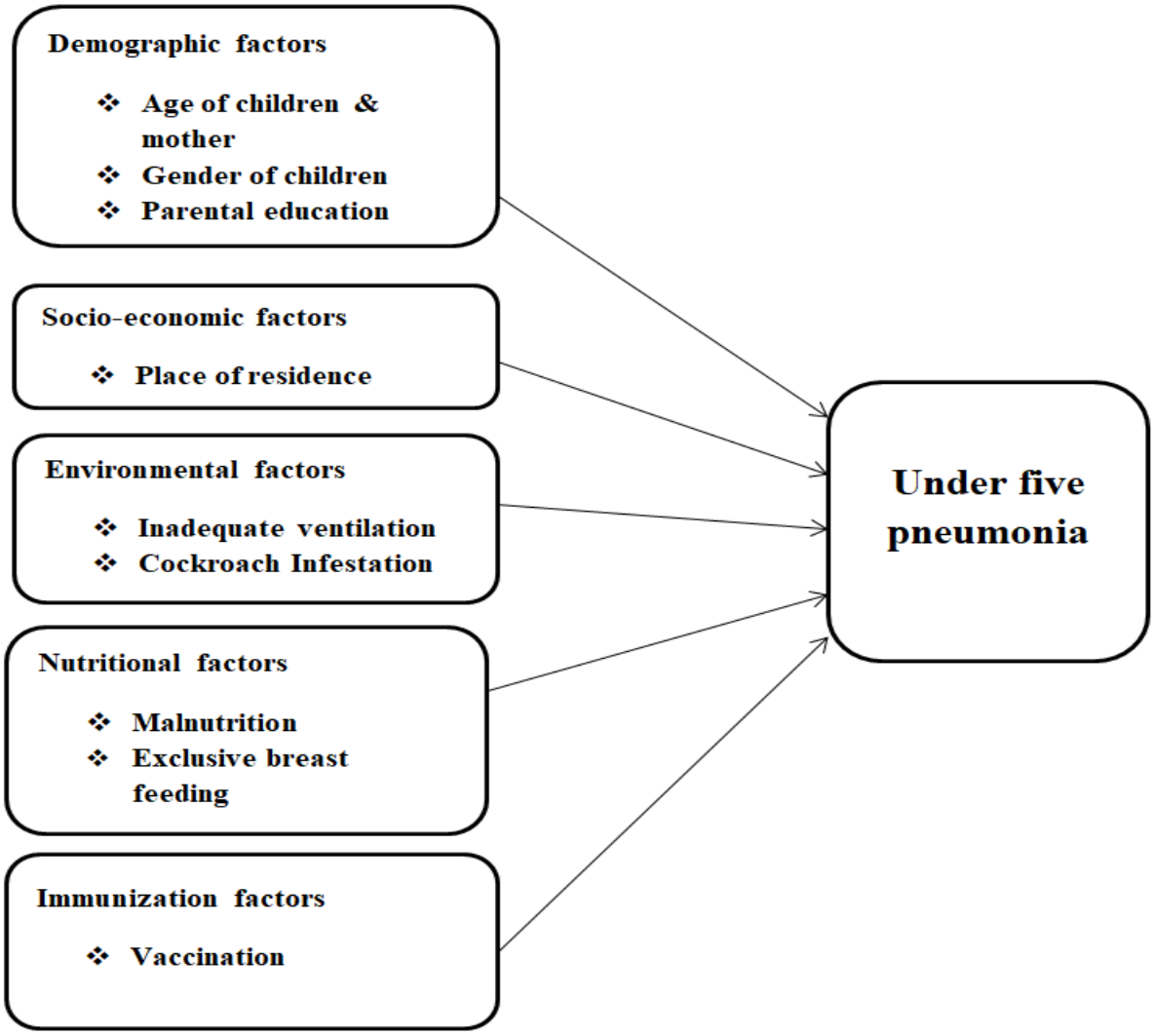

Figure1: Conceptual Frame work which shows risk factors of pneumonia among under five children

3. MATERIALS AND METHODS

3.1 Description of Study area

This study was conducted at Bishoftu General Hospital. Bishoftu is located in East Shewa Zone, Oromia Region, Ethiopia, about 47 kilometers south of the Ethiopian capital, Addis Ababa, and at an altitude of 1,920 meters above sea level. The terrain is undulating, with the northern and eastern parts being flat and surrounded by many lakes, while the southern part is dominated by hills. According to the 2007 census of the National Bureau of Statistics, Bishoftu has an area of 40.02 square kilometers and populations of 99,928, of whom 47,860 are male and 52,068 are female. The town's total population, as projected by the Ethiopian Statistics Service for the current year 2022, was 207,383 (98,277 men and 109,106 women). Bishoftu had 73,372 people living there as of the 1994 census, of which 35,058 were men and 38,314 were women.

3.2 Study Design and study period

A hospital-based study was conducted on children under five years of age who attended under 5 OPD sessions at Bishoftu General Hospital between 24April 2023 and 23 May 2023.

3.3 Population

3.3.1 Source of Population

The study population was all children under 5 years of age receiving outpatient treatment at Bishoftu General Hospital.

3.3.2 Study population

The universe of the study consisted of children under 5 years of age and their mothers/guardians who applied to the Bishoftu General Hospital polyclinic on the date of data collection.

3.4 Eligibility Criteria

3.4.1 Inclusion criteria

Children under five years of age who have not received anti-pneumococcal vaccine and children attended by their parents/guardians.

3.4.2 Exclusion Criteria

Children under five years of age whose parents/guardians hadhearing impairments and whose parents/guardians refuse to participate were excluded from this study.

3.5 Variables of the study

3.5.1 Dependent Variable

The dependent variable in this study was the prevalence of pneumonia among under five children.

3.5.2 Independent variables

In this study the independent variables were:

- ✓ demographic factors such as age of children and mother, gender of children and parental education
- ✓ socio-economic factors such as place of residence
- ✓ Environmental factors like inadequate ventilation, parental smoking, location of child while cooking and fuel source
- ✓ Nutritional factors such as malnutrition, exclusive breast feeding, zinc and vitamin A supplementation
- ✓ Immunization factors such as vaccination status of children.

3.6 Sample Size Determination

No similar study has been conducted in the study area before; the prevalence of pneumonia in children under 5 years of age in Wondo Genet Zone, Sidama Region, SNNPR, Ethiopia was 33.5% with a margin of error of 5%. Therefore, the minimum sample size (n) should be determined using a single population proportional formula for cross-sectional analysis. Considering the 95% confidence level, 5% margin of error and the unknown population size of children under 5 years of age, the sample size is calculated as follows:

$n_o = (Z_{\alpha/2})^2\, p(1-p)\, /d^2$ Where, n_o - initial Sample size

z- Standard normal value at 95% CI which is 1.96

p- Estimated population proportion is 0.335

d- Possible margin of error tolerated which is 5%.

$n_o=(1.96)^2\ 0.335(1-0.335)/\ (0.05)^2$

$n_o = 343$

A 5% cut-off was added to compensate for non-responders and reduce errors due to non-compliance, resulting in a final sample of 360 study participants.

The final sample size, $n_f$was:-

$n_f= 343 + 343*5\%= 360$

3.7 Data Collection procedures

The risk awareness questionnaire was written in English and translated into Afan Oromo (local language) by a translator (expert). The experts then translated AfanOromo back into English to check consistency. The questionnaire was pre-tested on non-study individuals by taking 10 % of the total sample size Participants and parents of the children were asked to fill out a questionnaire to obtain information about their health characteristics and riskfactors for pneumonia. Finally, medical records regarding the child's current health status were recorded.

3.8 Data quality control

Six registered nurses and one Bachelor of Science nurse were involved in the study during the data collection. Data collectors and auditors were also given two-day training. The questionnaires filled by the data collectors were reviewed for completeness and consistency by the auditor to ensure the quality of the data. The researcher analyzed the data before the data analysis stage to check the completeness of the data collection.

3.9 Data Processing and Analysis

The data were first checked manually for completeness and then coded and entered into SPSS. These data were analyzed using Statistical Analysis for Social Sciences (SPSS) version 27. The prevalence of pneumonia was determined by carrying out descriptive statistical analysis. Binary

logistic regression, that is, both bivariate and multivariate logistic regression, was used to analyze significant independent variables. Variables with a p- value less than 0.25 in bivariate binary logistic regression were further analyzed in multivariate logistic regression. A P value less than 0.05 was considered statistically significant.

3.10 Operational Definition

Under five children - refers to children of age between two months and five years.

3.11 Ethical Consideration

3.11.1 Ethical Approval

Ethical approval was obtained from the Research Committee of the Faculty of Natural and Applied Sciences, Addis Ababa University, and a joint letter was written to Bishoftu General Hospital. Informed consent was obtained from the study participants before data collection. Protect data privacy and confidentiality by registering the data collectors. People are not forced to participate in the study; voluntary participation is an ethically important aspect of the research. Since the respondents/participants will not be willing to complete the questionnaire, the researcher will bid farewell to the respondents/participants anonymously and complete all the questions by providing their own answers.

4. RESULT

Three hundred sixty (360) questionnaires were filled and out of these, three hundred forty-eight (348) of them were analyzed. The rest 12 were removed since they were not complete.

4.1 Demographic characteristics of the respondents

Respondents were asked to fill their demographic data like sex of children, age of children and mother, and educational standard of the children's parent to understand their background. This section presented the general characteristics of the respondents who were involved in the study.

4.1.1 Distribution of Children by their sex, age and residence

As indicated in table 1, among 348 children, 186(53.4%) of them were males and 162(46.6%) were female. This shows that the number of males who were participated in this research were greater than females.

The table shows that majority of the children, 93 (26.7%) out of 348children, were found within the age category of between one year and two years and majority of them, (334) 96% of respondents were from urban areas and only (14) 4% were from rural areas.

4.1.2 Distribution of Children parents by their marital status, age of mother, educational status, income, occupation and family members

The distribution of the respondents with respect to marital status, age of mother, educational status, income, occupation and family members was depicted in table1.Regarding the marital status of children's parent, majority, 94%(327)were married, 1.7%(6) single, 3.2%(11) divorced and the rest 1.1%(4)were widowed. Most of the children mothers, 37.9% (132) were within the age category of 25 to 35 years. Moreover, most of them, 32.8% (114) were at secondary educational level and most, 29.3% (102) were merchants. With respect to the family monthly income, most (41.1%) (143) of the respondents' average monthly income was in the range between 2000 and 5000 Ethiopian birr. The number of family members in most (60.6%) (211) of the respondents was at most 4.

Table 1: Demographic characteristics of respondents in Bishoftu General Hospital, East Shoa, Ethiopia, July

Variables	Category	Frequency (N=348)	Percent
Sex of the child	Male	186	53.4
	Female	162	46.6
Age of the child below 5	Between 2 months and 1 year	81	23.3
	1 to 2 years	93	26.7
	2 to 3 years	90	25.9
	3 to 5years	84	24.1
Age of the mother	Less than 25	112	32.2
	25 to 35 years	132	37.9
	35 to 45years	104	29.9
Marital status	Married	327	94.0
	Single	6	1.7
	Divorced	11	3.2
	Windowed	4	1.1
Educational status of mother	Illiterate	13	3.7
	Read and write	2	0.6
	Primary (1-8)	109	31.3
	Garde (9-12)	114	32.8
	Diploma and above	110	31.6
Educational status of father	Illiterate	56	16.1
	Primary (1-8)	99	28.4
	Garde (9-12)	96	27.6
	Diploma and above	97	27.9

Residence of the child	Urban	334	96
	Rural	14	4
Monthly income of the family	Below 1000 birr	7	2
	1000-2000 birr	67	19.3
	2000-5000 birr	143	41.1
	Above 5000	131	37.6
Members of the family	<=4	211	60.6
	5 – 8	107	30.7
	Above 8	30	8.6
Child's mother occupation	House wife	91	26.1
	Civil servant	45	12.9
	Merchant	102	29.3
	Student	2	0.6
	Daily labor	50	14.4
	Other	58	16.7
Child's father occupation	Civil servant	117	33.6
	Merchant	91	26.1
	Daily labor	6	1.7
	Driver	95	27.3
	Other	39	11.2

4.2 Environmental characteristics of the respondents

This section presented the environmental characteristics of the respondents such as house hold cigarette smoking exposure, type of fuel source used for cooking, separation of kitchen from the main house, number of windows in house and kitchen, number of rooms in house, place of cooking, location of child during cooking, and toilet facility. The environmental characteristics of the respondents were analyzed using SPSS version 27 and the result was depicted in table2.

As shown in table2, 209(59.7%) of the respondents of the studywere exposed to parental cigarette smoke, while the rest 139 (40.3%) of the participants were not exposed to house hold cigarette smoke. This shows that majority of the children were exposed to house hold smoke of cigarette.

The distribution of the respondents with respect to the type of fuel source used for cooking, 218 (62.1 %) of the study participants used charcoal, 82 (23.7 %) used wood, 24 (7.3 %) used electricity, 11 (3.1 %) used kerosene, 9 (2.5 %) used animal dung and the rest, 4 (1.1 %) used crop wastes. This implied that majority of the children were exposed to air pollution which was caused mainly by the smoke of charcoal and wood as their family used these fuel sources for cooking. Table2 also indicated that majority, 184 (52.5%) of the respondents had kitchen separated from the main house while the rest 164 (47.5 %) of the respondents had no separated kitchen.

Regarding the number of rooms in the house, 114 (33.8%) of the respondents had one room, 181 (51. 7 %) had two rooms, and the house of the rest study participants 43 (14.5%) hadthree or more rooms. Table2 also showed that with respect to place of cooking, 58 (15. 6%) of the respondents used living room, 141 (41. 9 %) used kitchen, and the rest 149 (42. 5 %) used out doors for cooking. Moreover, 175 (49.7 %) of the respondents had no window in their kitchen for ventilation, and 24 (8.5 %) of them had no any window even in their main house. 172 (50 %) of the respondents had only one window in their kitchen and 192 (55.9 %) of the respondents had only one window in their main house. From the total study participants, only 1(0.3 %) had two or more windows in their kitchen and only 122 (35.6 %) had two or more windows in their main house. This result indicated that most of the respondents' houses including their kitchen were not adequately ventilated.

With respect to the child location during cooking, the study result in table2 indicated that from the total study participants majority, 202 (56. 7 %) of the children were carried on their mothers back or besides their mother near cooking room during cooking, while the rest 146 (43.3 %) of the children were outside the cooking room during cooking time. This result indicated that most children in the study participants were exposed to the pollutants that might be emitted in the cooking rooms.

Regarding toilet facility at home, the result in table 2 indicated that open pit latrine was used by majority, 181 (51. 3 %) of the respondents, ventilated improved latrine was used by 142 (40. 2 %) of the study participants, and open field was used by the rest 30 (8.5 %) of the respondents.

Table 2:Environmental characteristics of respondents in Bishoftu General Hospital, East Shoa, Ethiopia

Variables	Category	Frequency (N=348)	Percent
Number of rooms in the house	One	114	33.8
	Two	181	51.7
	Above three	43	14.5
Place used for cooking	Living room	58	15.6
	Kitchen	141	41.9
	Outdoors	149	42.5
Location of the child during cooking	Carrying mothers back or besides during cooking	202	56.7
	Outside of the cooking house	146	43.3
Child sleep same house used for cooking	Yes	194	55.8
	No	154	44.2
Kitchen separated from main house	Yes	184	52.5
	No	164	47.5
Number of windows in kitchen	None	175	49.7
	One	172	50.0
	>=2	1	0.3
Number of windows in house	None	24	8.5
	One	192	55.9
	>=2	122	35.6

House hold cigarette smoking exposure	Yes	209	59.7
	No	139	40.3
Toilet facility at home	Open pit latrine	181	51.3
	Ventilated improve pit latrine	142	40.2
	Open field	30	8.5
Type of fuel source used for cooking	Charcoal	218	62.1
	Wood	82	23.7
	Electricity	24	7.3
	Kerosene	11	3.1
	Animal dung	9	2.5
	Crop wastes	4	1.1

4.3 Immunization and Nutritional characteristics of the respondents

This section presented the immunization status of the child including vitamin A and zinc supplementation, vaccination status of children, distance from home to health facility, transportation to hospital, child care giver at home, duration for child sickness before coming to health facility and the time the child taken to health facility as soon as sick. It also presented the nutritional status of the child such as breast-feeding status of the child during the first six months of life, duration for child breast feeding, and starting time for complementary feeding.

Among 348 participants of the study, during the first six months of life 58 (16.7%) of children practiced exclusive breast feeding, 231 (66.4%) practiced mixed breast feeding and the rest 59 (17%) of the children were not breast feed at all. This indicated that most of the children who participated in this research had record of mixed breast feedingrather than exclusive breast feeding.

According to table 3 of SPSS result, from the total participants of the study, 281 (80.7 %) of the children breast fed for the range of 1 to 23 months, 8 (2.3 %) of the children for 24 to 36 months and the rest 59 (17 %) of the children were not breast feed at all. The result in table 3 also indicated that majority 188 (54 %) of the children in the study started complementary feeding in

the age between soon after birth and 6 months. This result implied that most of the children were not well nourished by their mothers' breast milk.

Regarding immunization status of the child, 15 (4.3 %) of the children were fully vaccinated, 26 (7.5 %) were up to date with respect to vaccination, 174 (50 %) were partially vaccinated and the rest, 133 (38.2 %) of the children were not vaccinated. This result showed that most of the children in the study had not finished the scheduled immunization. Among the study participants majority, 301 (86.5%) of the children had not taken vitamin A within the first six months, and majority, 300 (86.2%) of the children had not taken zinc supplementation.

With respect to timing of visiting the health facility while children feel sick, majority, 257 (73.9%) of the children were not taken to health facility as soon as they sick. This implied that they had high chance of developing other complications of disease as they were too late to visit the health care.

Table 3:Immunization and nutritional characteristics of respondents in Bishoftu General Hospital, East Shoa, Ethiopia, July

Variable	Category	Frequency (N=348)	Percent
Breast feeding status of the child during first 6 months of life	Exclusive breastfeeding	58	16.7
	Mixed breastfeeding	231	66.4
	Not breastfeeding	59	17
Length of time for child breast feeding	1-23 months	281	80.7
	24-36 months	8	2.3
	not at all	59	17
Starting time for complementary feeding	soon after birth	60	17.2
	after few weeks	42	12.1
	1 - 6 months	188	54
	after 6 months	58	16.7

Child care giver at home	parental care	332	95.4
	Home maid/care giver	16	4.6
Vaccination status of child	Fully vaccinated	15	4.3
	Up to date	26	7.5
	Partial vaccinated	174	50
	Unvaccinated	133	38.2
vitamin A taken within 6 months	Yes	47	13.5
	No	301	86.5
Zinc supplementation taken	Yes	48	13.8
	No	300	86.2
child taken to health facility as soon as sick	Yes	91	26.1
	No	257	73.9
Distance from home to health facility	1 - 3 km	85	24.4
	3 - 10 km	98	28.2
	10 - 15 km	118	33.9
	greater than 15 km	47	13.5
Duration for child sickness before coming to hospital	less than 1 week	87	25
	1 - 2 week	137	39.4
	more than 2 weeks	124	35.6
Used transport for coming to hospital	Walking	70	20.1
	Public service vehicle	76	21.8
	Other	202	58

4.4 Prevalence, signs and symptoms of pneumonia among under five children

The distribution of the respondents (under five children) with respect to their signs and symptoms of pneumonia including the prevalence of the disease pneumonia were analyzed using SPSS software version 27 and the results were depicted in tables. Table 4 indicated that out of the total respondents in the study, 77 (22.1 %) of the children were suffer from pneumonia. Therefore, the result of this study revealed that the prevalence of pneumonia among under five children in the study area was 22.1 %.

Regarding the signs and symptoms, among 348 respondents, 239 (68.7%) had cough, 109 (31.3 %) had fever. Among the respondents, 50 (14.4%) had history of fast breathing, 155 (44.5 %) had difficulty of breathing 1 (0.3 %) had chest wall indrawing, 130 (37.4 %) had chills. In children under 5 years of age who have cough and / or difficult breathing, with or without fever, pneumonia is diagnosed by the presence of either fast breathing or lower chest wall indrawing (in a healthy person, the chest expands during inhalation).

Table 4: Child diagnosis for pneumonia for now or last two weeks

Pneumonia	Frequency	Percent
No	271	77.9
Yes	77	22.1
Total	348	100.0

As indicated in table 5, among 77 children who developed pneumonia, 12 (15.6 %) were confirmed to have severe pneumonia and became admitted. These children were those who had shown at least one of the diagnostic criteria of severe pneumonia. Out of 77 children who were suffer from pneumonia, 6 (7.8%) of them had simultaneous signs and symptoms of moderate to severe respiratory distress, central cyanosis or hypoxemia i.e. oxygen saturation < 90% and inability to breast feed or drink or vomit everything they take. 2 (2.6 %) of the children had simultaneous signs and symptoms of moderate to severe respiratory distress, central cyanosis or hypoxemia and were lethargy and unconscious. 3 (3.9 %) of the children had simultaneous signs and symptoms of moderate to severe respiratory distress, inability to breast feed or drink or vomit everything they take and were lethargy and unconscious. 1 (1.3 %) of the children had

simultaneous signs and symptoms of central cyanosis or hypoxemia, inability to breast feed or drink or vomit everything they take and were lethargy and unconscious.

Table 5: Other sign and symptoms in child who has cough or breathing difficulties

Other sign and symptoms	Frequency	Percent
1, 2, 3	6	7.8
1, 2, 4	2	2.6
1, 3, 4	3	3.9
2, 3, 4	1	1.3

N.B

1.; moderate to severe respiratory distress

2.; central cyanosis or hypoxemia

3.; inability to breast feed or drink or vomit

4.; lethargy and unconscious

4.5 Regression Analysis

First important covariates (independent variables that were at least moderately associated with dependent variable) were identified using bivariate binary logistic regression. The candidate variables were selected based on the Wald test from logistic regression and p-value cut-off point of 0.25, which is a purposeful selection algorithm as proposed by Hosmer and Lemeshow. After identifying the candidate variables, those which had p-value of less than 0.25 were further analyzed by multivariate logistic regression. This was to predict the probability of a dependent variable based on multiple independent variables. This means multivariate logistic regression analysis was conducted to predict the relationships between dependent variable (diagnosis of under-five pneumonia) and many independent variables.

In this study, a total of 34 covariates (independent variables) were included for the analysis of predictors of pneumonia among under-five children. Ten of these were identified as the main associated factors with the pooled odds ratio ranging from 1.7 to 4.7.These predictors were type of fuel source, place used for cooking, location of child during cooking, kitchen separated from

main house, number of windows in the kitchen, house hold cigarette smoking exposure, breast feeding status of the child during the first six months of life, vaccination status of the child, vitamin A taken within six months and child taken to health facility as soon as sick. The multivariate binary logistic regression analysis results were depicted in table 6.

The result of multivariate regression analysis revealed that there was significant association between use of charcoal as fuel source and pneumonia among under five children. In this study, table 6 indicated that children whose families use charcoal as fuel source had 2.45 times more probability to have pneumonia as compared to children whose families did not use charcoal as fuel sources (P=0.04, AOR = 2.45; 95% CI (1.13, 5.31)).This result showed that children from the household who used the main house for a place of cooking were 4 times more likely to develop pneumonia as compared to those from household cook food in the kitchen (P=0.028, AOR =4.335; 95% CI (1.66, 3.66)). The result pointed that children who were located in cooking room during cooking had increased risk of developing pneumonia as compared to those children who were located outside the cooking room (P=0.002, AOR=3.69; 95% CI (1.615, 8.442)). This study showed that children who live in house which had no separate kitchen were 3.8 times more likely to develop pneumonia than those who live in house which had separate kitchen (P=0.001, AOR=3.79; 95% CI (1.7, 8.4)). The study showed that the presence or absence and number of windows in kitchen had role in developing childhood pneumonia. It indicated that absence of window in kitchen increased the likelihood of developing under five pneumonias (P=0.027, AOR=2.337; 95% CI(1.103, 4.949)). The finding of this study revealed that the presence of household cigarette smoking exposure increased the probability of developing under five pneumonia 4.69 times as compared to those children who were not exposed to household cigarette smoke(P=0.0005, AOR=4.7; 95% CI(1.46, 3.808)).

This study also showed that children who were not in exclusive breast feeding had 4.1 times more risk of developing under five pneumonias as compared to those who were in exclusive breast feeding(P= 0.0033, AOR=4.09; 95% CI (1.37, 6.9)). The result revealed unvaccinated children were 2.45 times more likely to have pneumonia as compared to children who fully vaccinated (P=0.002, AOR = 2.45; 95% CI (1.13, 5.31)). Children who were not ever supplemented with vitamin A were 2.85 times more likely to develop pneumonia as compared to children who got vitamin A supplementation (P=0.003, AOR= 2.85; 95% CI (1.36, 5.56)).The

study indicated that children who were not taken to health care institutions as soon as they were sick had more increased risk of developing under five pneumonia as compared to those children who were taken as soon as they were sick. (P=0.0021, AOR=1.7; 95% CI (1.18, 3.36)).

Table 6: Multivariate logistic regression analysis factors associated to pneumonia among under - five children at Bishoftu General Hospital in East Shoa Zone, Ethiopia, July

Variable	Category	Pneumonia		P value	AOR (95% CI)	CI (95 %)
		Yes	No			
Type of fuel source used for cooking	Charcoal	21	52	.04	2.45	1.13-5.31
	Wood	14	51			
	Electricity	6	73			
	Kerosene	5	48			
	Animal dung	19	24			
	Crop wastes	12	23			
	Other					
Place used for cooking	Living room	38	15	.028	4.335	1.66-3.66
	Kitchen	11	135			
	Outdoors	28	121			
Location of the child during cooking	caring mothers back or besides during cooking	76	119	.002	3.693	1.615-8.442
	Outside of the cooking house	1	152			
Kitchen separated from main house	Yes	23	162			
	No	54	109	.001	3.79	1.7-8.4
Number of windows in kitchen	none	49	123	.027	2.337	1.103-4.949
	one	28	147			
	two or more	0	1			
house hold	Yes	39	112	.0005	4.7	1.46-3.808

cigarette smoking exposure	No	38	159			
Breast feeding status of the child during first 6 months of life	Exclusive breastfeeding	1	57			
	Mixed Breast feeding	30	201			
	Not Breast feeding	46	13	.0033	4.09	1.37-6.9
Vaccination status of child	Fully vaccinated	0	15			
	Up to date	0	26			
	Partial vaccinated	46	128			
	Unvaccinated	31	102	.002	2.45	1.13-5.31
Vitamin A taken within 6 months of life	Yes	0	47			
	No	77	224	.003	2.85	1.36-5.56
Child taken to health facility as soon as sick	Yes	0	91			
	No	77	180	.0021	1.7	1.18-3.36

5. DISCUSSION

5.1 Interpretation of the overall result

Currently, pneumonia among under-five children is a driving cause of morbidity and mortality in middle- and low-income countries including Ethiopia. In Ethiopia, contradicted and inconsistent studies have been conducted to assess the prevalence and predictors of pneumonia among under-five children. The impact is still higher and with abundant discrepancy and inconstancy across regions. Data on the prevalence of pneumonia among under five children and its related risk factors are important for planning child healthcare services but scarce in Ethiopia, particularly in the study area, Bishoftu General Hospital. As far as our knowledge, regardless of these facts, in the study area, there is a scarcity of information regarding the prevalence and predictors of pneumonia. Thus, assessing the pooled prevalence of pneumonia among under five children and its predictors in the study area is essential and will provide an overall figure with better estimation. This research is essential to understand the prevalence of pneumonia among under-five children and the factors that affect them in order to intervene to increase patients, families, and communities' satisfaction with health services, and to set criteria for enhancing the quality of under-five healthcare facilities. Assessing the prevalence and its risk factors of pneumonia is essential for proper planning of child healthcare services, for proper management and prevention strategy.

The prevalence of pneumonia among under-five children in the current study was 22.1%. This finding was in agreement with a study such as a systematic review and meta-analysis conducted in Ethiopia by Yoseph and Fentahun (2020) which was 20.68%.It was also in line with a report from Bangladesh, which was 21.3 % (Azad, 2008).However, this result was lower than 33.5% which was obtained at a study conducted in Sidama zone, Ethiopia (Teshome, 2017)and it was also lower than 28.1 % which was result obtained at a study conducted in Jimma zone, South West of Ethiopia (Lema et al, 2018). But in contrast to this result, it was higher than 17.7 % which was result of a study conducted in Arisi zone, Ethiopia (Batu et al, 2019)and also higher than 16.1 % which was conducted in Este town and the surrounding rural Kebeles, Northwest Ethiopia (Gedefaw et al., 2014).The possible reason for the difference in the prevalence of pneumonia might include the time of data collection, assessment method used, and difference in the level of advancement as well as the aggregation of risk factors.

Type of fuel source, place of cooking, location of child during cooking, the kitchen not being separated from the main house for food cooking, number of windows in kitchen, house hold cigarette smoking exposure, breast feeding status of the child during the first 6 months of life, vaccination status of the child, status of vitamin A taken within 6 months of life and timing of the child taken to health institutions as soon as the child was sick were risk factors of pneumonia among under-five children in the current study as these were confirmed by higher AOR .

This study showed that children from the household who used charcoal as their main fuel source were 2.45 times more likely to develop pneumonia than those who did not use it. This finding was supported by other studies such as a survey conducted in Jima zone reported that use of wood as a fuel source increase the risk of developing under five pneumonia three times (Lema et al., 2018). The association between using charcoal as a source of fuel and pneumonia in under-five children might be due to the fact that using woods and charcoal as a source of fuel results in release of smokes containing major air pollutants like carbon monoxide and particulate matters which causes indoor air pollution (Chafe et al., 2015). Indoor air pollution and inhaling wood smoke in turn impairs the function of pulmonary alveolar macrophages and epithelial cells which will increase the likelihood of pulmonary infections including pneumonia (Cardani et al., 2017).

As shown in Table 4.6, this study showed that under five children from the household who did not have separated kitchen and used the main house for a place of cooking were 3.8 times more likely to develop pneumonia than those from the family having a separated kitchen. This result was in line with other studies conducted in Gamo zone, Southern Ethiopia, which indicated that children from families who did not have separate kitchen were 5.8 times more likely to develop pneumonia (Yerukneh et al., 2021). It was also in line with studies conducted in Wondo Genet, southern Ethiopia which pointed that lack of separate kitchen was significantly associated with occurrence of pneumonia AOR=6.83 (Teshome, 2017). A study conducted in Estie town Northwest Ethiopia (Gedefaw et al., 2014)also supported the association between cooking food in the main house and development of under-five pneumonias. This research indicated that children from the household who used their main house for a place of cooking were 4.3 times more likely to develop pneumonia than those who did not use their main house as cooking place. This finding was in line with the result obtained in Jima zone, which suggested that cooking food

in living room were high risk factor for under five pneumonia with AOR of 3.27 (Lema et al, 2018).

According to this study caring of the child on mothers back during cooking increase the risk of child to develop pneumonia by 3.7 times. It is consistent with community based cross sectional study conducted in Munesa District, Arsi Zone, Oromia Region, Ethiopia which indicated that children which were located on their mothers back during cooking were 12 times more likely to develop pneumonia((Batu et al, 2019) and it is also consistent with cross sectional study conducted in public hospitals in Jimma zone, Ethiopia which showed that children on their mothers back during cooking were 3 times more likely to develop pneumonia as compared to others(Lema et al, 2018).

Table 4.6 indicated that in this study, children from households where their kitchen does not have window were 2.3 times more likely to develop pneumonia as compared to children from households where their kitchen has windows. This result was in line with the result obtained in Wondo Genet district, Sidama zone, SNNPR, Ethiopia, which indicated that absence of window in kitchen increase the risk of under-five pneumonia by 2.64 times (Abuka, 2017). It is also consistent with the result in Jima zone, which showed that children from families which had no windows in their kitchen were 2.5 times more likely to develop pneumonia than those which had windows in their kitchen (Lema, 2018).

According to this study, children who were exposed to household cigarette smokers were 5 times more likely to develop pneumonia as compared to those who were not exposed. This result was supported by other study like a study conducted in Hulet Ejju Enesie District, North Central Ethiopia, which reported that the presence of any smokers in the family increase the chance of developing pneumonia in children of below five by 14 times AOR = 13.72 (Solomon and Nardos, 2022). The association might be due to the presence of any smoker in the home leads to children inhaled smoke. This cigarette smoke inhalation kills normal flora which able to compete for pathogen from adherence and altered bacterial acquisition and oral mucosal colonization in favor of periodontal pathogens.

With respect to breastfeeding in the first 6 months of the children’s age, the odds of being vulnerable to developing pneumonia was 4 times more likely among children who were not

exclusively breastfed as compared to those under-five children who were exclusively breastfed. This finding was supported by the study conducted in Gamo Zone, Southern Ethiopia, which reported that children who were not on exclusive breast feeding were 3.3 times more vulnerable to develop pneumonia than others (Yerukneh et al, 2021).

Regarding vitamin A supplementation, this study also found that under-five children who were not supplemented by vitamin A were nearly 3 times more likely to suffer from pneumonia as compared to children who had vitamin A supplementation. Studies in Gamo Zone supported this current result and reported that lack of vitamin A supplementation in children increase the chance of developing pneumonia 5 times than other children who were properly supplemented with vitamin A (Yerukneh et al., 2021). This association could be explained by the fact that vitamin A is an essential micronutrient that governs many biological processes and a deficiency of vitamin A will cause an imbalance between pro- and anti-inflammatory factors and excessive immune response (Al-Qahtani et al., 2024).

This study indicated that unvaccinated under-five children were about 2.5 times more vulnerable to suffering from pneumonia as compared to those children who completed their vaccination. This was almost similar to the result obtained in Gamo Zone (Yerukneh et al., 2021). This association could be due to the loss of strong enough immunity for causative agents.

According to this study, not taking children to health institutions as soon as they were sick, the children were 1.7 more likely to develop complicated diseases including pneumonia. This result was supported by the cross-sectional study conducted at Mulago National Referral Hospital, Uganda (Ekyaruhanga et al., 2023). This cross-sectional study which was conducted in Uganda showed that more than half of the caregivers delayed seeking healthcare for their children with pneumonia symptoms. Caregivers, who first sought care elsewhere, lived more than 5 km from the hospital, and earned less than 28 USD per month were more likely to delay seeking healthcare for their children with severe pneumonia.

5.2 Strength and Limitation of the study

5.2.1 Strength of the study

The use of large sample size is an advantage in this study.

5.2.2 Limitations of the study

This study was institution-based research with data gathered from a single hospital in Bishoftu; therefore, conclusions may not be easily extrapolated to patients visited to other areas.

This study was conducted in one season and may not reflect the actual prevalence of pneumonia among the study participants.

Even though the cases of pneumonia were diagnosed from history taking by physicians, this study did not use chest x-ray, blood cultures, MUAC and other techniques to confirm pneumonia. This study simply used physician's diagnosis from patient cards. Hence, this may not be as reliable as pneumonia confirmation using laboratory diagnostic methods

6. CONCLUSION and RECOMMENDATION

6.1 Conclusion

This study showed that the prevalence rate of pneumonia was relatively high in Bishoftu compared to other studies conducted in different regions of Ethiopia and other parts of developing countries. Type of fuel source, place of cooking, location of child during cooking, the kitchen not being separated from the main house for food cooking, number of windows in kitchen, house hold cigarette smoking exposure, breast feeding status of the child during the first 6 months of life, vaccination status of the child, status of vitamin A taken within 6 months of life and timing of the child taken to health institutions as soon as the child was sick were potential risk factors of pneumonia among under-five children in the current study.

6.2 Recommendation

- ✓ Appropriate intervention on potential determinants such as health education on the potential hazards of using charcoal and wood as a fuel,place of food cooking, location of child during cooking (woreda health office and health extension should educate mothers to discourage carrying of child on mothers back when food cooking), exclusive breastfeeding and nutrition, increased immunization and vitamin A supplementation, and avoiding and living away from cigarette smoke exposure are recommended to prevent under five pneumonia.
- ✓ City administration health office should work in collaboration with different stakeholders including creating community awareness on health benefits of ventilated and improved housing conditions.
- ✓ Other independent potential predictors of under-five pneumonia such as ARTI and effect of malnutrition should be considered.
- ✓ Future researchers should include techniques such as chest X-rays, blood culture and MUAC to enhance diagnostic accuracy

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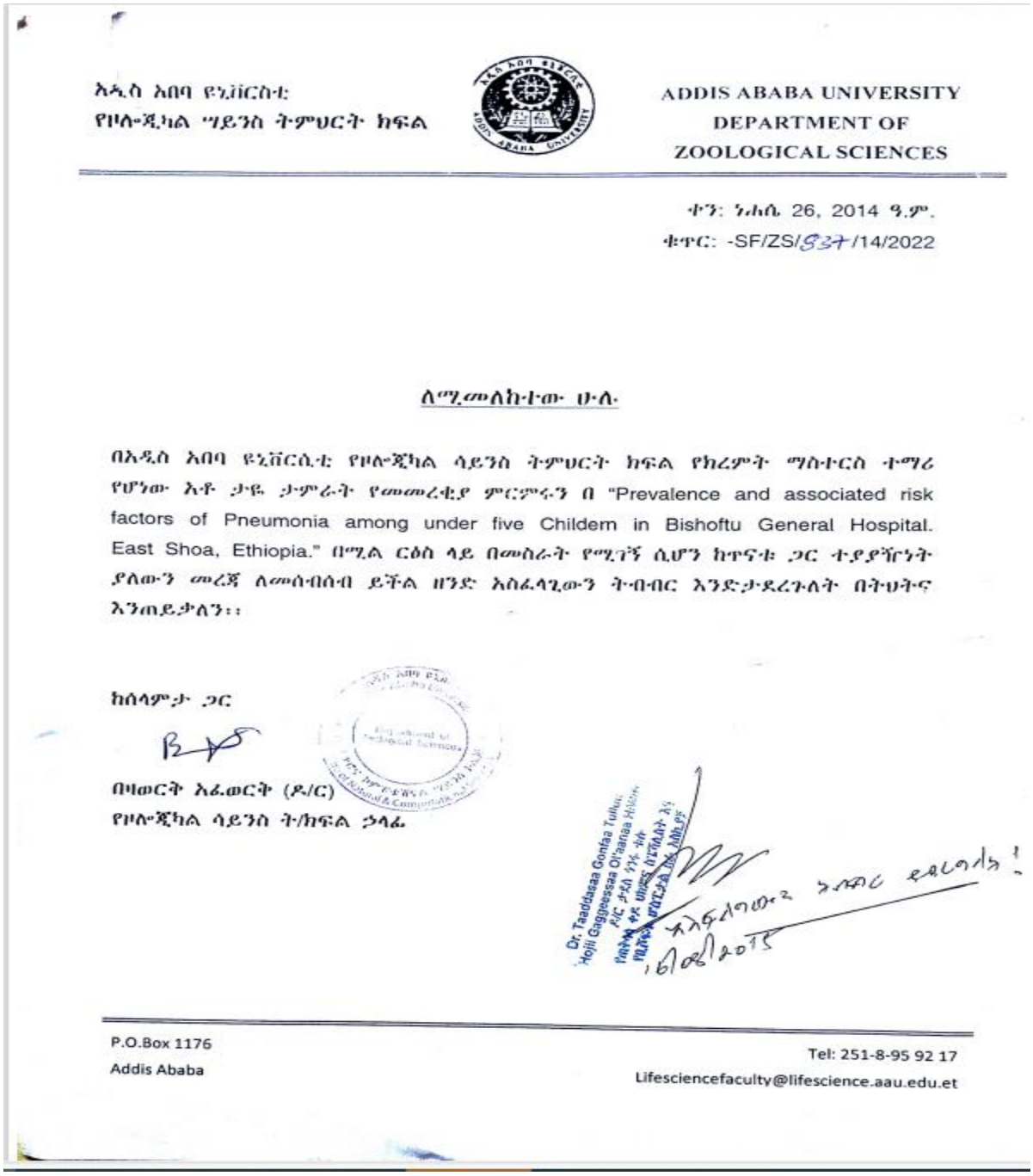
Appendix I

Letter of Cooperation from AAU to Bishoftu General Hospital



አዲስ አበባ ዩኒቨርስቲ
የዞሎጂካል ሳይንስ ትምህርት ክፍል

ADDIS ABABA UNIVERSITY
DEPARTMENT OF
ZOOLOGICAL SCIENCES

ቀን: ነሐሴ 26, 2014 ዓ.ም.
ቁጥር: -SF/ZS/937/14/2022

ለሚመለከተው ሁሉ

በአዲስ አበባ ዩኒቨርሲቲ የዞሎጂካል ሳይንስ ትምህርት ክፍል የክረምት ማስተርስ ተማሪ የሆነው አቶ ታዬ ታምራት የመመረቂያ ምርምሩን በ "Prevalence and associated risk factors of Pneumonia among under five Childern in Bishoftu General Hospital. East Shoa, Ethiopia." በሚል ርዕስ ላይ በመስራት የሚገኝ ሲሆን ከጥናቱ ጋር ተያያዥነት ያለውን መረጃ ለመሰብሰብ ይችል ዘንድ አስፈላጊውን ትብብር እንድታደረጉለት በትህትና እንጠይቃለን::

ከሰላምታ ጋር

በላወርቅ አፈወርቅ (ዶ/ር)
የዞሎጂካል ሳይንስ ት/ክፍል ኃላፊ

Dr. Taaddasaa Gonfaa Tulluu
Hojii Gaggeessaa Oo'aanisa Hiikkaa

P.O.Box 1176
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Appendix II

Information Sheet

Title of the Research: Prevalence and associated risk factors of pneumonia among under-five children in Bishoftu General Hospital, East Shoa Ethiopia

Name of Investigator: TayeTamrat

Name of the Organization: Bishoftu General Hospital, East Shoa Ethiopia

Name of the Sponsor: Addis Ababa University

Introduction: This document has been developed for the administration office of Bishoftu General Hospital. The form's objectives are to obtain authorization to conduct the research, to be transparent about the purpose of the study and the methods of data collecting to the above-mentioned office.

The purpose of the research: to determine the prevalence of pneumonia in children under five at Bishoftu General Hospital in East Shoa, Ethiopia, as well as its contributing factors.

Procedure: To accomplish the aforementioned goal, data required for the research will be obtained from the medical records of children under five years old and their mother or care giver.

Risk and/or Discomfort: Since the study will be carried out by gathering the necessary data from the mother or care giver of a kid under five and the child's medical record, there won't be any harm done to the patients. All information gathered will be kept totally confidential and in a secure location. No name or other identifying information will be entered on the questionnaire. The information that was retrieved will only be utilized for research.

Benefits: Although there are no direct benefits from this research, there are indirect benefits for the participant and other program clients. This is due to the fact that clients in the program will benefit from receiving the proper care and treatment services if program planners are creating the anticipated plan.

Confidentiality: The data gathered will be kept private, not shared with anybody outside the investigator, and stored in a protected system with a computer passcode.

Who to contact: The institutional review board of AAU's Department of Zoological Science, College of Natural and Computational Sciences, will examine and approve this research proposal. You can reach the Investigator at the following address if you have any questions.

Name: TayeTamrat

Institution: Addis Ababa University, College of Natural and Computational Sciences Department of zoological Science.

Tele: +251- 933617589

E-mail: tayetamrat2121@gmail.com

Appendix III

Patient Information

Dear sir/madam my name is Taye Tamrat and I am a graduate student in Addis Ababa University, College of Natural and Computational Sciences, Department of zoological Science. Currently I am conducting research on "Prevalence and associated risk factors of pneumonia among under-five children in Bishoftu General Hospital, East Shoa Ethiopia". The research is undertaken as academic requirements of partial fulfillment of the requirements for the Degree of Master of Science in General Biology.

The questionnaire is designed with the perspective of risk factors for pneumonia in children under five in mind. The study will not put participants at danger and is meant to benefit the entire community, including those who are taking part in it. The government and the district health office will utilize the study's findings as the foundation for their logical decision-making when creating plans to address this issue. It takes roughly 20 minutes to complete the questionnaire. Of all the kids that frequent this hospital's outpatient department, your child was chosen at random using a lottery system. You may withdraw from the study at any moment; your participation is completely voluntary. If you do not demonstrate a desire to participate, there will be no consequences. I genuinely hope you will take the time and be honest in responding to all of the questions.

Lastly, let me assure you that your response will remain private and be utilized exclusively for scholarly purposes. I appreciate your cooperation in advance and the time you have taken out.

Please feel free to contact me if you have any questions.

Yours sincerely

TayeTamrat

Email: tayetamrat2121@gmail.com

Tel: +251933617589

Appendix IV

Consent Form

I have read the information above and have had an opportunity to ask questions about the research and how my information will be used. I understand the purpose of the research and what my participation involves. I consent (agree) to participate in the research project and the following has been explained to me:

- ✓ The study might not directly benefit me
- ✓ The participation is entirely voluntary
- ✓ I have the right to withdraw from the study at any time without facing any consequences
- ✓ The risks associated with the research project, such as potential discomfort, harm, or inconvenience
- ✓ The precautions taken to reduce the risks
- ✓ The obligations and duties I have
- ✓ The person I should contact if I have any complaints about the research or its conduct
- ✓ The security and confidentiality of my personal information

Name of the interviewed _____

Date_____

Signature _____. Addresses_____

Name of the interviewer _____ Sign. _____

Name of the supervisor. _____. Sign. _____

Appendix V

Questionnaire: English version

Questions related to the determinants and prevalence of pneumonia in children aged less than five years.

Card No_____ Date_____ Questionnaire code: _____

Instruction: Choose the appropriate answers of the study participants for each of the following questions.

No	**Part I Questions from demographic factors**	**Coding category**
101	Sex of the child	1 Male 2 Female
102	Age of the child	1. Between 2 months & 1 year 2. 1 – 2 year 3. 2 – 3 year 4. 3- 5 year
103	Age of the mother	1. Less than 25 years 2. 25 – 35 years 3. 35 – 45 years 4. Above 45 years
104	Marital status of parent	1 Married 2 Single 3 Divorced

		4 Windowed
105	Educational status of mother?	1 Illiterate 2 Read and write 3 Primary (1-8) 4 Grade (9-12) 5 Diploma and above
106	Educational status of father?	1 Illiterate 2 Read and write 3 Primary (1-8) 4 Grade (9-12) 5 Diploma and above

No	**Part II Socio-economic factors**	**Coding category**
201	Residence of the child?	1 Urban 2 Rural
202	Monthly Income of the family?	1. Below 1000 birr 2. 1000 – 2000 birr 3. 2000 – 5000 birr 4. Above 5000 birr
203	How many members in your family?	1. less than or equals to 4 2. 5 – 8 3. Above 8

204	Child mother current occupation?	1 Housewife 2 Civil servant 3 Merchant 4 Student 5 Daily labor 6 Other
205	Child father current occupation?	1 Farmer 2 Student 3 Civil servant 4 Merchant 5 Daily labor 6 driver 7 Other

N o	**Part III questions on environmental factors**	**Coding category**
301	How many rooms are there in your house (including the sitting room)?	1. One 2. two 3. three or more
302	With what type of fuel source do you	1 Charcoal

	cook at home?	2 Wood 3 Electricity 4 Kerosene 5 Animal dung 6 Crop wastes 7 Other
303	Where do you usually cook your food?	1 Living room 2 Kitchen 3 Outdoors
304	Where is the usual location of the child during cooking?	1 caring mothers back or besides during cooking 2 Outside of the cooking house
305	Do children sleep in the same house used for cooking?	1 Yes 2 No
306	Is the kitchen separated from the main house?	1 Yes 2 No
307	Number of windows in the kitchen	1. none 2. one 3. two or more
308	Number of windows in the house	1. none 2. one 3. two or more

309	Does the child have house hold cigarette Smoking exposure?	1 Yes 2 No
310	What is the main source of drinking water for family?	1 Piped water 2 Protected dug well 3 None protected dug well 4 Sparing water 5 Rain water 6 River/pond/ /dam
311	What kind of toilet facility do you have at home?	1 Open pit latrine 2 Ventilated improve pit latrine 3 Open field

No	**Part IV Questions on Nutritional factors**	**Coding category**
401	Breast feeding status of the child during the first 6 months of life	1 Exclusive breastfeeding 2 Mixed Breast feeding 3 Not Breast feeding
402	For how long have you breast feed your child?	1 up to date 2 1-23 months 3 24- 36 months

		4 >37 month 5 not at all
403	When Complementary feeding start?	1. Soon after birth 2. After few weeks 3. 1 – 6 months 4. After 6 months
404	Who is child care giver at home?	1 Parental care 2 Home maid/ care giver

No	**Part V Questions on immunization factors**	**Coding category**
501	What is Vaccination Status of child?	1 Fully vaccinated 2 Up to date 3 Partial vaccinated 4 Unvaccinated
502	Does your child taken Vitamin A supplementation within 6 months?	1 Yes 2 No
503	Does your child take Zinc Supplementation?	1 Yes 2 No
504	Do you take your child to health facility as soon as sick?	1 Yes 2 No

		If yes skip to 506
505	If Q no 504 is no for what reason?	1 Health facility far from home 2 I can't afford payment 3 I 'am busy by other work 4 Other
506	What is the estimated distance from your home to health facility by Km?	1. 1 – 3 km 2. 3 – 10 km 3. 10 – 15 km 4. Above 15 km
507	How long was the child sick before coming to this hospital for this illness?	**1.** Less than 1 week **2.** 1 – 2 weeks **3.** More than two weeks
508	Which means of transport did you use to come to this hospital?	1 Walking 2 motor-cycle 3 Public service vehicle 4 Personal vehicle 5 Other

No	Part VI Criteria to diagnosis pneumonia	
601	Does a child diagnosis for pneumonia for now or last two weeks? From card.	1 Yes 2 No

602	Does child have the following sign and symptoms?	1. Cough 2. Fast breathing 3. Difficult of breathing 4. Fever 5. chills 6. Loss of appetite, nausea, vomiting 7. Malaise/ lethargy 8. Chest wall in drawing 9. Crackles or stridor or wheezing sound
603	Does the child who hascough or difficulty ofbreathinghave at least one of the following?	1. Moderate to severe respiratory distress 2. Central cyanosis or Hypoxemia (oxygen saturation<90 %). 3. Inability to breastfeed or drink, or vomiting everything 4. Convulsions, lethargy or unconsciousness or Capillary refill ≥2 second 5. None of these

THANKS

Appendix VI

Questionnaire: Afan Oromo version

Gaaffiiwwan murteessitootni fi babal'ina dhukkuba sombaa daa'imman umuriin isaanii waggaa shan gadi ta'e irratti.

KaardiiLakk_____Guyyaa_____Koodiigaaffii:_____

Qajeelfama: Tokkoon tokkoon gaaffilee armaan gadiitiif deebii hirmaattoota qo'annichaa sirrii ta'e filadhu.

Lakki	**Kutaa I Gaaffiiwwan sababoota dimogiraafii irraadhufan**	Ramaddiikoodii
101	Walqunnamtii saalaa daa'imaa	1 Dhiira 2 Dubartii
102	Umuriidaa'imaa	Ifagodhaa.....
103	Umuriihaadha	Ifagodhaa.....
104	Haalagaa'elaa warraa	1 Fuudhaa fi heeruma 2 Qofa 3 Hiikkaan 4 Foddaakanqaban
105	Haala barnootaa haadha?	1 Dubbisuu fi barreessuu kan hindandeenye 2 Dubbisuu fi barreessuu 3 Sadarkaatokkoffaa (1-8)

		4 Kutaa (9-12) 5 Dippiloomaa fi isaaol
106	Haala barnoota abbaa?	1 Dubbisuu fi barreessuu kan hindandeenye 2 Dubbisuu fi barreessuu 3 Sadarkaatokkoffaa (1-8) 4 Kutaa (9-12) 5 Dippiloomaa fi isaaol

Lakki	**Kutaa II Qabxiileehawaas-dinagdee**	**Ramaddiikoodii**
201	Bakka jireenyaa daa'imaa?	1 Magaalaa2 Baadiyyaa
202	GaliiJi'aamaatii?	Ifagodhaa.....
203	Maatii keessan keessaa miseensonni meeqa?	Ifagodhaa.....
204	Mucaa haadha hojiiammaa?	1 Haadhamanaa 2 Hojjettuu mootummaa 3 Daldalaa 4 Barataa 5 Hojii guyyaa guyyaa 6 Kanbirooibsi---------- .

205	Mucaa abbaa hojii ammaa?	1 Qonnaanbulaa 2 Barataa 3 Hojjetaa mootummaa 4 Daldalaa 5 Hojiiguyyaaguyyaa 6 konkolaachisaa 7 Kanbirooibsi----------

Lakki	**KutaaIIIGaaffileedhimmootanaannooirratti**	**Ramaddiikoodii**
301	Manakeessan (kutaataa'umsaadabalatee) kutaameeqatujira?	Ifagodhaa.....
302	Madda boba'aagosa akkamiitiin mana keessatti nyaata bilcheessitu?	1 Charcoal 5 Mancaabeeyladaa 2 Muka6 Balfamidhaanii 3 Humnaibsaa7 Kanbirooibsu 4 Kerosene
303	Yeroo baayyee nyaata keessaneessatti bilcheessita?	1 Kutaajireenyaa 2 Kushina

		3 Ala
304	Yeroo nyaata bilcheessuun bakki daa'imaa barameeessa jira?	1 haadholii kunuunsan duuba ykn kana malees yeroo nyaata bilcheessan 2 Mana nyaata bilcheessuunala
305	Ijoolleen mana nyaata bilcheessuuf ittifayyadaman tokko keessani rafu?	1 Eeyyee 2 Lakki
306	Kushiiniin mana guddicha irraaa dabaafamee jiraa?	1 Eeyyee 2 Lakki
307	Baay'ina foddaa mana nyaataa keessa jiru	Ifagodhaa----------
308	Baay'ina foddaa mana keessaa	Ifagodhaa----------
309	Mucaan sun sigaaraa manaa qabaa Tamboo xuuxuuf saaxilamuu?	1 Eeyyee 2 Lakki
310	Maddi bishaan dhugaatii maatiif inni guddaan maali?	1.Bishaan ujummoo 2 Boolla qotame kaneegame 3 Boolla qotame kaneegamu hinjiru 4 Bishaan qusachuu 5 Bishaan roobaa 6 Laga/kubbaa/ /hidha
311	Mana keessatti mana fincaanii akkamii qabdu?	1 Mana fincaanii boolla banaa

		2 Mana fincaanii boolla foyyessuu qilleensa qabu 3 Dirree banaa

Lakki	**Kutaa IV Gaaffiiwwan Qabxiilee Soorataa**	**Ramaddiikoodii**
401	Haala harma hoosisuu daa'imaa ji'oota 6 jalqabaa jireenya isaa keessatti	1 Harma hoosisuu qofa 2 Harmawalmakaa 3 Harma hoosisuumiti
402	Yeroo hammamiif daa'ima keessan harma hoosiftaniittu?	1 hangaammaatti3 Ji'a 24- 36 2 Ji'a 1-23 4>ji'a 37
403	Nyaata dabalataa yoom jalqaba?	Ifagodhaa----------
404	Mana keessatti knuunsa daa'immanii eenyu?	1 Kunuunsawarraa 2 Hojjettuu manaa/ kunuunsaa

Lakki	**Kutaa V Gaaffiiwwan sababoota talaallii**	**Ramaddiikoodii**
501	HaalliTalaalliidaa'imaamaali?	1 Guutummaatti talaalamee 2 Hangaammaatti

		3 Gartokkoon talaalamee 4 Hintalaalamne
502	Mucaan keessan ji'a 6 keessatti dabalata Vitamin A fudhataa?	1 Eeyyee 2 Lakki
503	Mucaankeessan Zinc Supplementation nifudhataa?	1 Eeyyee 2 Lakki
504	Daa'ima keessan akkuma dhukkubsateen gara dhaabbata fayyaa geessuu?	1 Eeyyee 2 Lakki Yoo eeyye ta'ee gara 506 darbi
505	Yoo Q lakk 201 lakki sababamaaliif?	1Dhaabbata fayyaa Mana irraa fagaate 2 Kaffaltii hindanda'u 3Hojiibiraatiin 'kanqabame 4 Kanbiraa
506	Fageenyi mana keessan irraa gara dhaabbata fayyaatti tilmaamame Km?	Ifagodhaa----------
507	Mucaan kun dhukkuba kanaaf gara hospitaala kana osoohindhufin yeroo hangamii dhukkubsatee ture?	Ifagodhaa----------
508	Garahospitaala kana dhufuuf meeshaa geejjibaa kamiin fayyadamte?	1 Miillaandeemuu 2 motor-cycle

		3 Konkolaataatajaajilaummataa 4 Konkolaataadhuunfaa 5 Kanbiro

Laki	Kutaa VI Ulaagaalee dhukkuba sombaaa dabaasuuf gargaaran	
601	Mucaan tokko ammaaf moo turban lamaaf dhukkuba sombaatiin qabama?	1 Eeyyee 2 Lakki
602	Mucaan mallattoo fi mallattoolee armaan gadii niqabaa?	1. Qufaaturtii qufaa 2. Saffisaan hafuura baafachuu 3. Hafuura baafachuun rakkisaa 4. Ho'aqaamaa 5. qorra 6. Fedhii nyaataa dhabuu, garaakaasaa, garaa kaasaa 7. Malaise/ lethargy 8. Dallaagaraa fakkiikaasuu keessatti 9. Sagalee crackles ykn stridor ykn wheezing

603	Daa'imni Qufaa ykn hafuura baafachuu rakkisaa dabalataan yooxiqqaate kanneen armaan gadii keessaa tokko qabaa?	1.Sirnii afuura bafannaa ukkamamuu 2.Qaamni isaa(ija, hidhii) gara cuuquliisatti jijjiramuu 3. Nyaata ykn harma fudhachuu dadhabuu ykn nyaata hunda oldeebisuu 4.Hurgufuu, baay'eedadhabuu, of wallaaluu

GALATOOMAA!