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PREVALENCE AND ASSOCIATED RISK FACTORS OF PNEUMONIA AMONG UNDER-FIVE CHILDREN VISITING GINDE WOYIN HEALTH CENTER, GONCHA SISO ENESIE DISTRICT, NORTHWEST ETHIOPIA

ABEBAW, BIZUALEM

BAHIR DAR UNIVERSITY
GRADUATE STUDIES OFFICE
COLLEGE OF SCIENCE
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BIZUALEM ABEBAW MELIE

ADVISOR: DESTAW DAMTIE (Ph.D., Associate Professor)

A THESIS SUBMITTED TO THE DEPARTMENT OF BIOLOGY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTERS OF SCIENCE DEGREE IN BIOLOGY (BIOMEDICAL SCIENCES)

JULY, 2021
BAHIR DAR, ETHIOPIA

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APPROVAL SHEET OF THESIS FOR DEFENSE IN ADVISOR'S

As the thesis advisor, I hereby certify that I have supervised, read, and evaluated this thesis entitled "**Prevalence and associated risk factors of pneumonia among under-five children visiting Ginde Woyin Health center, Goncha Siso Enesie district, Northwest Ethiopia**" by **Bizualem Abebaw Melie** prepared under my guidance. I recommend that it can be submitted as fulfilling the thesis requirement.

Destaw Damtie (Ph.D., Associate pro.) ---------- ------/----/----

Advisor's name Signature Date

Bizualem Abebaw Melie ---------- ----/------/----

Student's name Signature Date

BAHIR DAR UNIVERSITY

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COLLEGE OF SCIENCE

DEPARTMENT OF BIOLOGY

APPROVAL SHEET OF THESIS FOR DEFENSE RESULT IN EXAMINERS

As a member of the Board of Examiners of the M.Sc. Thesis opens Defense Examination, we certify that we have read, evaluated the thesis entitled "**Prevalence and associated risk factors of pneumonia among under-five children visiting Ginde Woyin Health center, Goncha Siso Enesie district, Northwest Ethiopia"** by **Bizualem Abebaw Melie**, and examined the candidate. We recommended that the thesis be accepted as fulfilling the thesis requirement for the degree of Master of Science in Bio-Medical Science.

Board of Examiners

_____ _____/____/____

Internal Examiner I Signature Date

_____ _____ ___/_____/____

Internal Examiner II Signature Date

_____ _____ ___/____/____

External Examiner Signature Date

DEDICATION

I dedicate this Thesis to my family for their love, affection, and unlimited inspiration during this research work and my success in life.

DECLARATION (STATEMENT OF AUTHOR)

For this thesis first, I declare that this thesis is the result of my work and that all sources or material used have been duly acknowledged (cited). This thesis is submitted for the partial fulfillment of the requirements of M.Sc. in Biology (Biomedical Sciences) degree at Bahir Dar University and to be made available at the university's Library under the rules of the library. I confidently declare that this thesis has not been submitted to any other institution anywhere for the award of any academic degree or certificate.

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Bizualem Abebaw Melie _____

Name of the student Signature

Bahir Dar University, Bahir Dar

Place

_____/_____/_____

Date of submission

BIOGRAPHY OF THE PRINCIPAL INVESTIGATOR

The author was born on April 01/1982 in East Gojjam Zone, Enarje Enawuga district, Yegossa Kebele. He completed his primary education (grade 1-6) at Yegossa primary school and went to Debre Work to finish secondary education. Upon fruit-filling achievement of high school studies, He joined at Debre Markos Teachers Education College in September 2000 and graduated Diploma in Biology teacher in June 2002. He entered to Debre Markos University in June 2004 and graduated with B.Ed. in Biology in 2009. After completing the training, He was employed by Goncha Siso Enesie district Education office as a Biology diploma teacher in 2003, and worked in different primary and secondary schools from 2003 - 2010 in Goncha Siso Enesie district. From 2011 up to now he had been serving as an education office expert in Sedie district. In 2012, He joined to the Department of Biology, Bahir Dar University to pursue Master of Science in Biology (Biomedical Sciences).

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ACRONYMS / ABBREVIATIONS

AIDS- Acquired Immune Deficiency Syndrome

ALRI- Acute lower respiratory infection

AOR- Adjusted Odds Ratio

ARI- Acute respiratory infection

ARTI- Acute respiratory tract infection

CAP- Community acquired pneumonia

CHERG- Children Health Epidemiology Reference Group

CI- Confidence Interval

ETB- Ethiopian Total Birr

EDHS- Ethiopian Demographic and Health Survey

GSEDCO- Goncha Siso Enesie district communication office

Hib- *Hemophilus Influenzae* Type B vaccine

HAP- Hospital acquired pneumonia

M.a.s.l- meter above sea level

MCEE- Maternal Children Epidemiology Estimation

MRSA- methicillin resistant *staphylococcus aureus*

NGO- Non- governmental organization

OPD- Out Patient Department

PCV- Pneumococcal Conjugate Vaccine

SPSS- Statistical Package for Social Science

UNICEF- United Nations Children Fund

WHO- World Health Organization

SNNPR- Southern Nations, Nationalities and Peoples

URTI- Upper Respiratory Tract Infection

US- United States

X^2- Chi-square

ABSTRACT

Pneumonia is one of the leading causes of morbidity and mortality due to environmental factors, health facility factors, and nutritional factors. It is a severe disease in under-five children in various localities of Ethiopia. This study aimed to assess the prevalence of pneumonia and its associated risk factors among under-five children visiting Ginde Woyin health center, Goncha Siso Enesie district, Northwest Ethiopia. A health center-based cross-sectional study was conducted, among 403 participants by systematic random sampling technique. Data were collected by questionnaire survey and sputum test laboratory diagnosis. The Data was analyzed using Statistical Package for Social Science (SPSS) version 26.0 and descriptive statics. All variables were used in the binary logistic regression. To determine potential predictors of under-five pneumonia variables with p- values less than 0.25 were further considered for multivariate logistic regression and P-value < 0.05 at 95% Confidence interval was declared statistically significant. The overall prevalence of pneumonia among under-five children in the study area was 24.3%, (95%CI: 20.1, 28.3). Using wood as source of fuel for cooking (AOR = 3.535; 95% CI: 0.829-9.724; P= 0.047), cooking in kitchens without windows (AOR = 3.419; 95% CI: 0.140-10.253; P = 0.020), starting complementary food before six months of age(AOR = 1.513; 95% CI: 0.67- 4.482; P = 0.003),mixed breastfeeding (AOR= 1.213; 95% CI: 0.071- 0.641; P = 0.006), cough (AOR = 4.049; 95% CI: 1.014-7.173; P < 0.0001), fast breathing rates (AOR= 2.022; 95% CI: 0.676, 5.701; P < 0.0001), chest tightness (AOR = 1.230; 95% CI: 0.703- 3.754; P = 0.015), and difficulty of breathing (AOR= 3.033; 95% CI: 0.9 - 8.117; P < 0.0001) were potential associated factors for under-five pneumonia. This study shows that the prevalence of under-five pneumonia was high. Thus**,** monitoring the breastfeeding habit, promoting using kitchen with windows, increasing using non-smoked materials as a fuel source are recommended.

Keywords: Associated risk factors, Prevalence, Under-five pneumonia

1. INTRODUCTION

1.1 Background of the study

Pneumonia is a disease of the lung or the inflammation of the parenchyma structures of the lung, such as the alveoli and bronchioles (Alcamo, 2015). It is the reason associated with mortality that challenges most health care providers and the community (Nair and Niederman, 2011). In people affected with pneumonia, the alveoli filled with pus and fluid. This situation makes breathing painful and limits oxygen intake (Jokinen and Scott, 2010). Pneumonia attacks every age group but particularly, under-five children susceptible to disease. They get pneumonia infection during inhalation process, micro-organisms that cause the infection were entered to the respiratory systems (WHO, 2006). Pneumonia occurs as a result of different infection-causing microorganisms like viruses, bacteria, and infrequently fungi. The common causative agents are *Streptococcus* for bacterial pneumonia and Syncytial virus for viral pneumonia, and Coccidioido for fungal pneumonia in children (Nair and Niederman, 2011; WHO, 2016). The manifestation of both bacterial and viral pneumonia is almost similar. Wheezing is more common in viral infections (WHO, 2016).

Pneumonia is the most dangerous outcome of acute respiratory infection (ARI) that kills more children than other diseases. It results in the mortality of a lot of under-five children in many countries of the world. For example, in 2018 alone, it resulted in 802,000 under-five mortalities. Globally, 162,000 in Nigeria, 127,000 in India, 58,000 in Pakistan, 40,000 in Democratic Republic of the Congo, 32,000 in Ethiopia, 19,000 in Indonesia,18,000 in China, 18,000 in Chad, 16,000 in Angola, 15,000 in United Republic of Tanzania, 15,000 in Somalia, 13,000 in Niger, 13,000 in Mali, 12,000 in Bangladesh, and 11,000 in Sudan (UNICEF, 2019). Around 153,000 (19%) of them died within their first month of age which is close to 2,200 under-five mortalities per day and one child in every 39 seconds (UNICEF, 2018). The annual global cases of pneumonia reach 1,400 cases per 100,000 children, or one case per seventy-one children (WHO, 2018).

In Ethiopia, pneumonia is the leading cause of morbidity and mortality among under-five children, and it had been estimated that 44,000 children encounter pneumonia annually, which contributes to 20% of all the causes of deaths of under-five every year and a leading cause of death during the postnatal period (UNICEF, 2018).

There are different risk factors for pneumonia in under-five in developing countries. socio-demographic status (educational status, occupation, monthly income, family size of the family), living condition factors (housing condition, toilet facility, water facility, cooking area, rooms in main house), co-morbid diseases (diarrhea, upper respiratory tract infections (URTI), asthma) were associated risk factors of pneumonia (Amare Deribew *et al.*, 2007; Gebretsadike Shibre, 2015; Ramezani *et al*., 2015; Roomaney *et al*., 2016; Teshome Abuka, 2017; Gritly *e*t *al*., 2018; Yoseph Merkeb Alamneh and Fentahun Adane, 2020).

According to Ginde Woyin (Goncha Siso Enesie District) health center clinical reports, under-five pneumonia was the first from the top 10 diseases in 2020. Neither the National nor the regional reports present the prevalence and associated risk factors of under-five pneumonia in Goncha Siso Enesie District. Therefore, the present study was undertaken to assess the prevalence, associated risk factors of pneumonia among under-five children attending Ginde Woyin health center, Goncha Siso Enesie district, Northwest Ethiopia.

1.2 Statement of the problem

Childhood pneumonia has been the common cause of under-five mortality and morbidity worldwide with the developing nations carrying the highest pneumonia burden (WHO, 2006).

Globally, more than 802,000 under-five children were affected by pneumonia in 2018 resulting in 2,200 mortalities per day. Globally, there are over 1,400 cases of pneumonia per 100,000 Children, or one case per 71 children every year, with the highest incidence occurring in South Asia (2,500 cases per 100,000 children) and West and Central Africa (1,620 cases per 100,000 children) (UNICEF, 2020). The prevalence of pneumonia in Australia was 4.1% (Kiruz *et al*., 2013), Mali (6.7%) (Benet *et al*., 2015), Bangladeshi (21.3%) (Kmak, 2009), India (16.34%) (Nirmolia *et al*., 2018), and Nigeria (31.6%) (Ujunwa and Ezeonu, 2014). The major difference for

this prevalence were the presence of different variables or risk factors in the study area like socio-demographic factor, environmental factor, nutritional factors.

Ethiopia is home to about 13.7 million under-five children, 12% of the total population of 116 million (UNDESA, 2021). Despite intervention and sustained efforts from a range of stakeholders in Ethiopia, pneumonia is still a leading cause of under-five morbidity and mortality. It constitutes 20% of all under-five mortalities due to different diseases (UNICEF, 2015). The pooled prevalence of pneumonia among under-five in the Amhara region was 26.78%, followed by the Oromia region (22.65%) and Addis Ababa (4.8%) (Yoseph Merkeb Alamneh and Fentahun Adane, 2020). In the study conducted on Bacteremic Community-Acquired Pneumonia in Ethiopian Children, the prevalence of pneumonia was 5.6% (Abel Abera *et al.*, 2019). In a community-based cross-sectional study done in the sub-cities of Gondar, Northwest Ethiopia, the prevalence of pneumonia among under-five children was 12% (Zewudu Andualem *et al*., 2020).

The majority of studies on pneumonia carried out in developed nation, with only insignificant studies were conducted in Ethiopia. Some variables that were found to be risk of pneumonia in one study may not necessarily to be a risk factor of pneumonia in other study; those possible risk factors of under-five pneumonia vary across the geographical location. It might be difficult to generalize the result to the other regions outside of the study area. The burden and severity of pneumonia in Ethiopia were very high due to limited coverage and affordability of effective preventive interventions like immunization of Pneumococcal Conjugate Vaccine (PCV), Respiratory syncytial virus (RSV)**,** lack of best access to worry, and unavailability of effective management techniques. In Ethiopia, children also have high exposure to pneumonia compared to high-income countries. The vast difference between the current incompatibly severe peals of pneumonia reflects poorly designed prevention mechanisms in developing settings like Ethiopia (WHO and UNICEF, 2012). Therefore, it is best to look at the combination of strategies to reduce morbidity and mortality from pneumonia. These include preventive strategies such as routine immunizations, supplementation of vitamin A and Zinc, control of environmental factors, promotion of breastfeeding, good nutrition, safe drinking water, and sanitation (Zar *et al*., 2013; Gray and Zar, 2010). The most cultural gap about pneumonia infection was mothers' awareness about health care-seeking behavior related to

children health. Parents in the study area were not perceived children illness, as a serious enough. Distance from health center, lack of money at the family level for seeking treatment at the hospital level, and most mothers in rural areas did not have knowledge about severity of under-five pneumonia. Besides, the insufficient attention that had given to under five pneumonia infection and risk factors was one of the pushing issues in order to study the present problem (Tsion Assefa *et al*., 2008).

Goncha Siso Enesie district has diverse agro-climatic regions Kolla, Dega, Woyna Dega, and Wurech. The district is with topography difficult for transportation and has poor access to health facilities, sanitary facilities, and safe drinking water. Irrespective of such vulnerabilities to infections, no research works had been conducted in the study area. The study was carried out to fill the above-mentioned gaps by assessing the prevalence and associated risk factors of pneumonia among under-five children attending Ginde Woyin health center in Goncha Siso Enesie district, Northwest Ethiopia

1.3 Objectives of the study

1.3.1 General objective of the study

To assess the prevalence and associated risk factors of pneumonia among under-five children attending Ginde Woyin health center, Goncha Siso Enesie district, Northwest Ethiopia, 2021.

1.3.2 Specific objectives of the Study

- To determine the prevalence of pneumonia among under-five children who visited Ginde Woyin health center from February 3, 2021 to April 10, 2021.
- To identify the major factors associated with pneumonia among under-five who attended Ginde Woyin health center from February 3, 2021 to April 10, 2021.
- To determine the association between the prevalence of pneumonia and associated risk factors among under-five who attended Ginde Woyin health center from February 3, 2021 to April 10, 2021

1.4 Significance of the study

The finding was given information for the health offices, NGOs, and the children's families or societies were benefited, in such a way that they know their infection

status and associated risk factors and taken prophylactic and preventive measures. The study was used as a reference for other researchers who are interested to investigate more about the prevalence of pneumonia and its associated factors around Goncha Siso Enesie District in particular and in the Amhara Region in general.

1.5 Limitation of the study

The study was limited to sputum and blood test with pulse oxi-metry. But these tests can't strictly identify pneumonia. Including the chest X-ray test helps to look at the extent of the infection (prevalence) of pneumonia. This may underestimate the prevalence of pneumonia among the study subjects.

The investigators used a cross-sectional study due to a shortage of time. This might limit the advantage of longitudinal studies covering different seasons which may provide a better understanding of the occurrence of pneumonia in the study area and help to guide interventions. Further studies based on chest radiography and blood cultures and/or cultures of bronchi, alveolar lavage to confirm the presence of pneumonia and conducting a longitudinal study were highly encouraged.

2. LITERATURE REVIEW

Pneumonia is the parenchymal inflammatory condition of the lung tissue caused by infectious microorganisms (viruses, bacteria, fungi, and parasites). Global mortality due to pneumonia is high in the extremes of ages (Under- five years and above 75years) (Ruuskanen *et al*., 2011). Depending on where it is acquired, it is grouped into community-acquired pneumonia (CAP) and hospital-acquired pneumonia (HAP) (Dunn, 2005). Community-acquired pneumonia is common, and diagnosed in a person from the community who is not recently hospitalized. Based on etiological agents, pneumonia can be bacterial and viral. For children between 2 to 24 months, viruses (Respiratory syncytial virus (RSV), Human meta-pneumo virus, Boca-viruses, Para-influenza viruses, Influenza A and B, Rhinovirus, Adenovirus, and Entero-virus) are the most common causes of pneumonia. *Streptococcus pneumoniae, Chlamydia trachomatis*, and the less common *mycoplasma pneuminiae, hemophilus influenza* (type b and non-type able) and *Chlamydophila pneumoniae* are the causes of bacterial pneumonia *(*Kumar *et al*., 2011).

2. 1. Global incidence and prevalence of pneumonia

Pneumonia is the common infectious reason behind death of children worldwide. Annually, approximately 120–156 million cases of acute lower respiratory infections (ALRI) occur globally, of which 1.4 million die. Around 15% of deaths are in under-five children and 90–95% of those deaths occur in the developing world. The majority (2/3) of pneumonia episodes in under-five children occurs in just 15 countries, with South Asia and Sub-Saharan Africa collectively enduring the highest burden of more than half the global total cases of children pneumonia (UNICEF. 2017). WHO and Health Epidemiology Reference Group calculated the median international incidence of clinical pneumonia to be 0.28 episodes per children-year (Li *et al*., 2010). This equates to an annual incidence of 150.7 million new cases, of that 11-20 million (7-13%) are severe enough to require Hospital Admission (UNICEF, 2017). Global child mortality, including pneumonia mortality, has decreased substantially since 2000.However, mortality remains high, an estimated 921 000 under-five died by pneumonia in 2015 (Liu *et al*., 2016). Monitoring mortality is advantageous to watch the underlying incidences of pneumonia, to inform the preventive intervention

strategies, and health facility planning because the burden of pneumonia on both in-patient and out-patient health-care services is substantial (Rudan *et al*., 2004).

The five countries with large pneumonia deaths in under-five children were India (127,000), Nigeria (162,000), Pakistan (58,000), the Democratic Republic of Congo (40,000), and Ethiopia (32,000) (UNICEF analysis, 2018). In China, pneumonia is the single leading expansion for childhood mortality, contributing to 17.4% of the whole of deaths in under-five children (Liu *et al*., 2012). According to the 2011 pneumonia death report, 74% of all under-five concentrated within the 15 high burden countries. Ten of these countries are in Africa, including Ethiopia (Walker *et al*., 2013). The latest countdown 2014 report explains the profile of the 75 countries where over 95% of all childhood pneumonia deaths occurred. The overwhelming majority of countdown countries from Africa experienced a disproportionately high load of pneumonia cases. The under-five pneumonia caused mortality by 2012 was, 18% in Ruanda, 16% in Sierra Leone, 19% in Somalia, 20% in South Sudan, and 17% in South Africa. Conversely, Peru (10%), Nepal (14%), Mozambique (14%), and Morocco (13%) carry a pneumonia caseload (WHO and UNICEF, 2015). Since 2000; however, mortality remains high: an estimated 921 000 under-five children died from pneumonia in 2015 (Liu *et al*., 2016).

2.2. The prevalence of pneumonia among under-five children in Ethiopia

In Ethiopia, pneumonia is the common cause of death among under-five children and the 2008 WHO report showed there were 389,000 under-five deaths, of which 22% were due to pneumonia (UNICEF, 2011). Ethiopia is one of the Sub-Sahara Africa countries with the highest rates of pneumonia, with an estimated 3,370,000 children encounter pneumonia annually, which contributes to 18% of all causes of deaths of more than 40,000 under-five children every year (UNICEF, 2018).

According to subgroup analysis by a region report, the pooled prevalence of pneumonia among under-five children was 27.68% in the Amhara region followed by 22.65% in Oromia region, and 4.8% in Addis Ababa (Yoseph Merkeb Alamneh and Fentahun Adane, 2020), The very recent 2016 Ethiopian Demographic Health Survey (EDHS) revealed that the prevalence of ARI in Ethiopia is 18% (Central Statistical Agency, 2016). In the review conducted on magnitude and predictor of pneumonia

among under-five children in Ethiopia out of 12 studies the pooled prevalence of the magnitude of the disease was 20.68% (Yoseph Merkeb Alamneh and Fentahun Adane, 2020). In the study conducted on Bacteremic Community-Acquired Pneumonia in Ethiopian children, the prevalence of pneumonia was 5.6% (Abel Abera *et al.*, 2019).For instance, a Case- control study in Gilgel Gibe revealed that 42% of post-neonatal and 22.6% of neonatal mortality were attributable to pneumonia (Amare Deribew *et al.,* 2007). In another study on Munesa district, Arsi zone, Oromia region Ethiopia, the prevalence of pneumonia in under-five children was 17.7% (Batu *et al*., 2018*).* Additionally, the cross-sectional study conducted on a public hospital in Jimma zone, South West Ethiopia the prevalence of pneumonia was 28.1% (Kenenisa Tegenu *et al*., 2018), The Prevalence of pneumonia among under-five children in Wondo Genet district, Sidama zone, SNNPR, Ethiopia was 33.5% (Teshome Abuka, 2017). In Estie town and rural kebele, the community based cross-sectional study done within all two weeks the prevalence of pneumonia was 16.1% (Gedefaw Abeje *et al.,* 2014). In a community-based cross-sectional study done in the sub-cities of Gondar, Northwest Ethiopia, the prevalence of pneumonia among under-five children was 12% (Zewudu Andualem *et al*., 2020). In the community-based cross-sectional study conducted in Debre Birhan district, Northwest Ethiopia the prevalence of pneumonia was 5.5% (Gebretsadike Shibre, 2015). Another community-based cross-sectional study on pneumonia remains a leading public health problem among under-five children in a peri-urban area of Northern Ethiopia; the prevalence was 17.1% (Awoke Keleb *et al.,* 2020).

2. 3. Associated risk factors to under –five children pneumonia

2.3.1. Environmental factors

2.3.1.1. Air pollution

Air pollution could significantly enhance the risk of respiratory infection, including pneumonia. About half of childhood pneumonia deaths are related to air pollution. Outdoor pollution may be a risk to children, especially with the growing rate of urbanization in high burden pneumonia countries. But indoor pollution generated by unclean fuels for cooking and heating poses a greater global threat (Worku Tefera *et al.,* 2016). Indoor pollution contributes to 62% of pollution associated with children pneumonia death. About 3.8 million people died every year prematurely from illness

attributable to the household air pollution caused by the inefficient use of solid fuels and kerosene for cooking. Among these 3.8 million deaths (27%) were due to pneumonia. Household air pollution is also risk for acute lower respiratory infections (pneumonia), exposure to household air pollution almost doubles the risk for childhood pneumonia and is responsible for 45% of all pneumonia deaths in under-five children (WHO, 2018).

A Cross-sectional survey conducted in Rasuwa district, Nepal indicates that (31.4%) of the under-five children who lived in the household using biomass fuels suffered from ALRI, and use of the traditional or open type of cooking stove was found to be significantly associated with ALRI among children (Sharma *et al*., 2015).A systematic review of indoor pollution and pneumonia risk among under-five children in developing countries found a strong association with pneumonia morbidity and mortality (Sonego *et al*., 2015).Indoor air pollution tends to be worse in Peri-urban communities where biomass fuels are more frequently used in cooking and heating due to lack of access to other forms of energy (UNICEF, 2016).

2.3.1.2Traditional cooking style

Children from households which have kitchen without ventilation had 3.4times more chance of developing pneumonia as compared to children from households which had kitchen with ventilation (Teshome Abuka, 2017).Charcoal use for cooking, carrying on the back of a children during the time of cooking and place of cooking were statistically significantly associated with pneumonia after controlling for the possible extraneous variables, but animal dung use for cooking showed no relationship with the incidence of pneumonia (Gedefaw Abeje *et al.*, 2014).

The study conducted on pneumonia, **caring of children on mothers back during food cooking** (Kenenisa Tegenu, *et al.*, 2018; Batu Lema, 2019), food cooking in the main house (Kenenisa Tegenu *et al*., 2018; Yoseph Merkeb Alamneh and Fentahun Adane, 2020), use of wood as fuel source(Kenenisa Tegenu *et al*., 2018), absence of windows in the kitchen (Kenenisa Tegenu *et al*., 2018), the habit of not opening doors while cooking (Zewudu Andualem *et al*., 2020) were the possible determinant factors for the prevalence of pneumonia.

2. 3.1.3. Sanitation and overcrowding

The safe water source is essential for both drinking and other uses include hand-washing and improve sanitation facilities to prevent pneumonia (UNICEF/WHO,

2012). Conditions of poverty include inappropriate sanitation, overcrowded living conditions, lack of clean water, and irregular hand washing contribute to children pneumonia. Studies suggest that in impoverished communities, regular hand washing can reduce the incidence of Children pneumonia by 16% (Chopra *et al*., 2013). The odds of developing pneumonia among children with hand washing before feeding using water only was 3.80 more as compared to those children with hand washing using both water and soap (Sefinew Getaneh *et al.,* 2019*)*. Another study conducted on pneumonia (Awoke Keleb *et al*., 2020) showed that overcrowding increases pneumonia by more than three-fold, An Unmatched Case-Control Study conducted in Gondar University, children of parents who did not follow proper hand washing practice (Yordanos Markos *et al*., 2019), and study conducted on Determinants of Community Acquired Pneumonia among children in Kersa District, Southwest Ethiopia: Facility Based Case Control Study, more than four family members (Daniel Geleta *et al*., 2016)were the possible determinant factors for pneumonia cases.

2.3.2. Health facility and Children care factor

2.3.2.1 Availability /distance/cost of health facilities

The Federal Ministry of Health of Ethiopia (EFMOH) has incorporated pneumococcal conjugate vaccine in its expanded program on immunization in 2011 to prevent against the severe forms of pneumococcal disease in childhood. Despite the global and government efforts, pneumonia in Ethiopia remains a considerable problem. Beyond death, pneumonia in children could result in a substantial economic burden in the affected society. This is mainly related to the costs incurred during diagnosis, outpatient and inpatient treatment of cases at health facilities (EFMOH, 2011).The Cross-sectional study done in Derra district, North-Shoa zone, Ethiopia, maternal behaviors in seeking medical care for diseases of children is affected by factors such as socio-economic status, mother's knowledge and beliefs about the cause and severity of the disease and their traditional beliefs (Tsion Assefa *et al*., 2008).

2.3.2.2. Immunization/vaccination

South Africa has included the *Hemophilus Influenzae* Type B (Hib) vaccine into national guidelines, with the potential to cut back Hib invasive disease by 46% to 93% in vaccine recipients. A recent review of intervention packages shows that the program of childhood immunization and control of pneumonia mortality in children are highly cost-effective (Madhi *et al*., 2010). In a cross-sectional study in Uruguay,

pneumonia incidence decreased, between 2009 and 2012, by 27.3% and 46.4% respectively, and from 2001–2004 and 2009–2012 comparison showed that the major difference of 20.4% for consolidated pneumonia hospitalizations. Major incidence decline was recorded among children 6 to 35 months old. An overall significant reduction in pneumonia hospitalization was observed following the introduction of PCV7 and the change to PCV13 (Hortal *et al*., 2014).

Different studies conducted in Ethiopia showed that children who have unvaccinated (Kenenisa Tegenu, 2018; Yoseph Merkeb Alamneh and Fentahun Adane, 2020) lack of Zinc supplementation and wasting (Daniel Geleta *et al*., 2016) were the risk factors for the development of pneumonia.

2.3.2.3. Co-morbidity

Co-morbidity elevates the risk of pneumonia. Diarrheal diseases are the determinants of under-five pneumonia established by the children health epidemiology reference group (CHERG) an academic review group started by WHO. Diarrhea caused acute respiratory tract infections like pneumonia in a cohort study among children in Ghana and Brazil (Schmidt *et al*., 2009). Measles is an established risk factor for pneumonia. Pneumonia mortality caused by measles reached as high as 86% (Duke *et al*., 2003). Measles accelerates the fatality rate of pneumonia through immune suppression. A case-control study in Pakistan shows that children who have a history of measles were susceptible to pneumonia compared to children who had no history of measles. Lack of measles immunization is among the leading risk factors that predispose the 02 -59-monthyear's old children to pneumonia (Rudan *et al*., 2008). The Child Health Epidemiology Reference Group (CHERG) revealed that HIV/AIDS, Malaria, and Malnutrition identified to be associated with increased occurrence of pneumonia (Lanata *et al*., 2004), Anemia in children is recently studied to be significantly associated with the development of pneumonia (Sheikh *et al*., 2014).

The study conducted in different district of Ethiopia showed that the history of acute respiratory tract infection **(**Batu Lema *et al***.,** 2019), having previous upper respiratory tract infection (Daniel Geleta *et al*., 2016), children who had diarrhea in the past fifteen days of data collection (Yordanos Markos *et al*., 2019), children with history of co- residence with URTI family (Sefinew Getaneh *et al*., 2019), children having Past history of measles and diarrhea (Gebretsadike Shebrie, 2015) were the possible risk factors for pneumonia.

2. 3.3. Nutritional factors

Children who have inappropriate weaning times to be at increased risk of pneumonia infection. Both delayed and early weaning were thoughts to be the risk factor for malnutrition. It is a strong predictor of pneumonia (pore *et al*., 2010). The same case-control study identified the nutritional status of the children to be significantly associated with the development of pneumonia in under-fives. Exclusive breastfeeding for the first six months of a children's life has a protective effect on both the incidence and severity of pneumonia (Horta *et al*., 2013). Not exclusively feeding children younger than six months of age is another factor that puts them at higher risk of pneumonia. Under-nutrition, zinc (Aggarwal *et al*., 2007; Walker *et al*., 2013), and vitamin A (Lanata *et al*., 2004) deficiencies have an independent risk factor of pneumonia in under-five children.

Under-nutrition, were identified by atrophy, stunting, and specific nutritional deficiencies, is related to approximately half all death in children. Consequently, the presence of severe acute malnutrition can enhance mortality from pneumonia 15 times (Reed *et al*., 2012). Children whose weight is less than 70% of the weight for their age are eight times at risk of mortality from pneumonia than their counter parts (Ramezani *et al.*, 2015).

A case-control study conducted at Nepalgunj Medical College, Kohalspur Teaching Hospital, Kohalpur, Nepal indicated that moderate wasting was present on 36.4% of the case group and 16.8% of the control group, and it was absolutely significantly associated with Acute lower respiratory infection (ALRI) (Mishra *et al*., 2016).

The followings are the possible risk factors of pneumonia according to studies done in different districts of Ethiopia. Vitamin A supplementation status and malnutrition (Yoseph Merkeb Alamneh and Fentahun Adane, 2020), non- exclusive breast feeding during the first six month of life (Daniel Geleta *et al*., 2016), lack of zinc supplementation, and wasting (Daniel Geleta *et al*., 2016).

2.4 Causes of pneumonia

There are several types of infectious agents that can cause pneumonia. these are bacterial, viral and fungal pneumonia. the most common bacterial pneumonia are *Streptococcus pneumoniae*. Other causes include *Mycoplasm pneumoniae*, *Haemophilus influenzae,* and *Legionella pneumophila*. Respiratory virus also the

causes of pneumonia. these include influenza, respiratory syncytial virus and rhinovirus. Viral pneumonia is usually milder and can improve in one to three weeks without treatments. Fungal cause pneumonia in people with weakened immune system**.**

2.5 Pathogenesis and Modes of transmission of Pneumonia

Lung is a spongy structure which helps in purifying blood and has three lobes in the right lung and two lobes in the left lung. Microorganisms (germs) enter through the respiratory route by inhalation or aspiration, hematogenous spread, pharyngeal secretions, and reactivation latent. The organisms reach bronchioles and proliferate (multiply). Inflammation occurs in alveolar spaces. Pathological changes depend on the type of organism, the age and the condition of the host/ patient. Pneumonia is transmitted when germs from the body of someone with pneumonia spread to another person in a variety of ways including inhaling the infection, this can occur when a person with pneumonia coughs or sneezes and other person inhale the infected particles. This is more likely between people in close contact with each other, such as parents or children in poorly ventilated spaces and through the mouth or eyes when a person touches a surface that an infected person has coughed or sneezed on. When a person with an infection coughs into their hand, the second person can become infected if they touch their mouth or eyes without washing their hands. Food particles and irritants from the intestinal tract can also cause pneumonia (Aderele *et al.,* 2004)

2.6 Prevention and Control of Pneumonia

Early diagnosis, breast feeding, immunization ,health education about danger signs of severe pneumonia to mother, vitamin A supplementation, minimize exposure to smoke, separate living rooms from kitchen , improve the type of stoves used to decrease the amount of smoke released in the house, reduce overcrowding , reduction of air pollution in the house, living rooms are not shared with domestic animals, open doors and windows for good ventilation, do not expose children to smoke from cooking areas or from cigarette and Pneumonia must be treated without delay (Luby *et al*., 2005).

2. 7. Conceptual Framework

The morbidity of under-five pneumonia is the greatest impediment to children health universally though the prevalence varies significantly across various regions, with developing countries bearing the highest burden. The pneumonia studies in developing countries such as Ethiopia, though limited, showed that the disease is the major cause of morbidity and mortality of children under the age of five years.

Under-five pneumonia is the dependent variable, and factors that are related to under-five pneumonia are socio-demographic factors (educational level, family size, income, residence, and occupation); environmental factors (indoor air pollution, poor ventilation, overcrowded lifestyle, tobacco smoke exposure, and exposes to the children to un-favorable environmental conditions children care factors (availability, distance, and cost of health facility), and immunization related to under-five pneumonia. One factor may directly or indirectly affect other factors. For example, the environmental factors may affect the nutritional status or the health facility or the child care factor. Generally, the concepts of the factors are listed below (Figure 1).

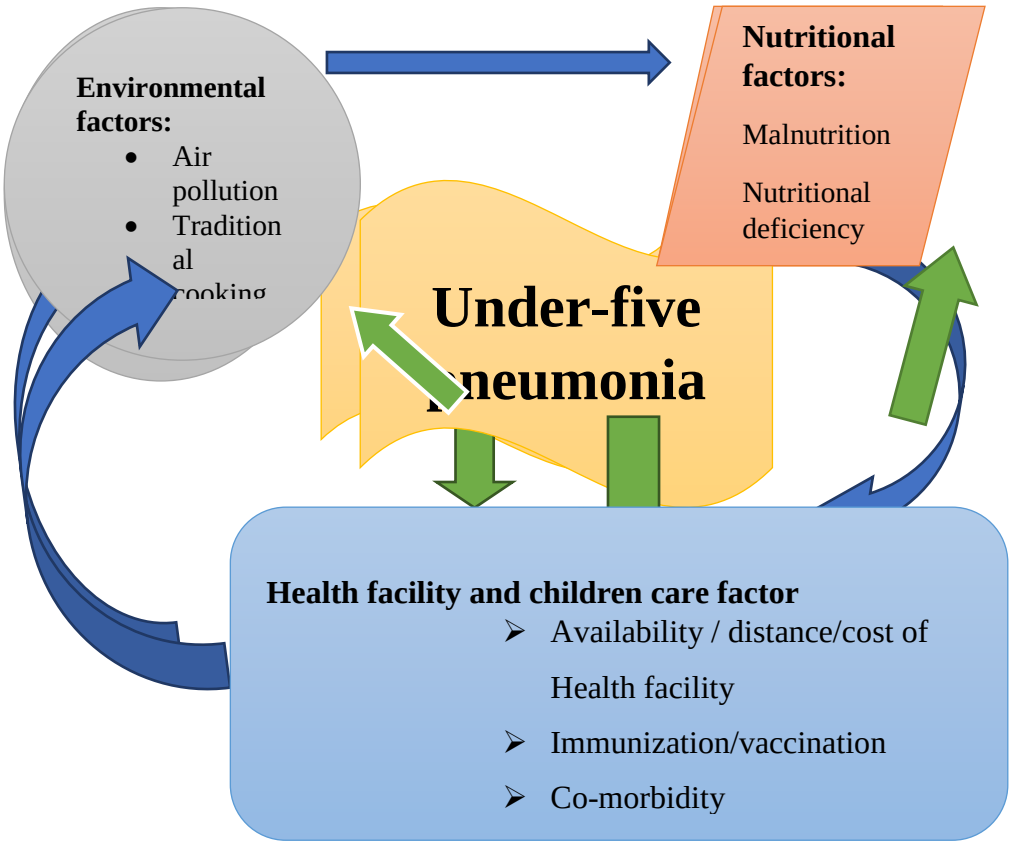

Figure 1: Conceptual frame work on associated factors to pneumonia

3. MATERIAL AND METHODS

3.1 Description of the study area

Goncha Siso Enesie is one of the districts in the Amhara National Regional State. It has 43 administrative Keble's (41 rural, 2 urban). The capital city of the district is Ginde Woyin, located in East Gojjam administrative zone. The district is found 335 km Northwest of Addis Ababa, 158 km from Debre Marko's (the city of Zonal administration), and 152 km East of Bahir Dar (the capital city of Amhara Regional State). The district is located at $10^0$8'00" to $11^0$09'00" North latitude and between $37^0$9'00" to $39^0$00'0.00" East longitudes (Figure 2). The district is bordered by Enarje Enawuga District in the South, South Gondar zone in the North, Enebsie Sarmider District in the East, and Hulet Eju Enesie District in the West (GSEDCO, 2020).

The topography of the district is 45% plain, 39% mountain, and 15.87% low land (depression), and 0.13% is occupied by water bodies. Its elevation ranges from 1000-3400 masl. The district is divided into three climatic zones 12% Dega, 48% Woyna-dega, and 40% Kola. The mean annual rainfall ranges from 762mm-1825mm and the average range of temperature is 120C-250C. The soil type is15% literate (red soil), 5% black soil (chrome soil), 60% lato soil (brown), and 20%gray.

The main economic activity of the people in this area is agriculture. The most dominant food crops grown in the area are Teff (*Eragrosis teff*), Maize (*Zea may*s), Wheat (*Triticum aestivum*), and Barley (*Hordeum vulgare)*. The district is also known for vegetables and fruit production (Goncha Siso Enesie district Agriculture office, 2020). The district also has one lake (Bahir Georges Lake), rivers (Blue Nile, Bina, Azuari, Tiwa, Chiye, and Tigdar, are among the major and including other small rivers, all these are tributaries of the Abay) and have medium access of drinking water.

According to Ethiopian Census 2021 Current Year Projection Amhara, East Gojjam, Goncha Siso Enesie the total population of the district was 192,628; from these male accounts 94,613(49.12%) and female 95,015 (50.88%). The rural people 183,948 (95.49%); urban peoples were 8680 (4.51%). (https://www.qotera.org/en US/Amhara/east-Gojjam/goncha-siso-enese/1/9/2021. 9:02)

There are eight Health centers and 43 Health posts in the district. Ginde Woyin Health center is among the Eights which is our study area and serves for 35,813 (male 16116, female 19697) populations. Under this health center, six rural and two urban health posts are assigned to implement the health extension program. The main reason to select Ginde woyin Health center was under-five pneumonia were the first from the top 10 disease in 2020 clinical report (Goncha Siso Enesie Health Office Annual Report, 2020).

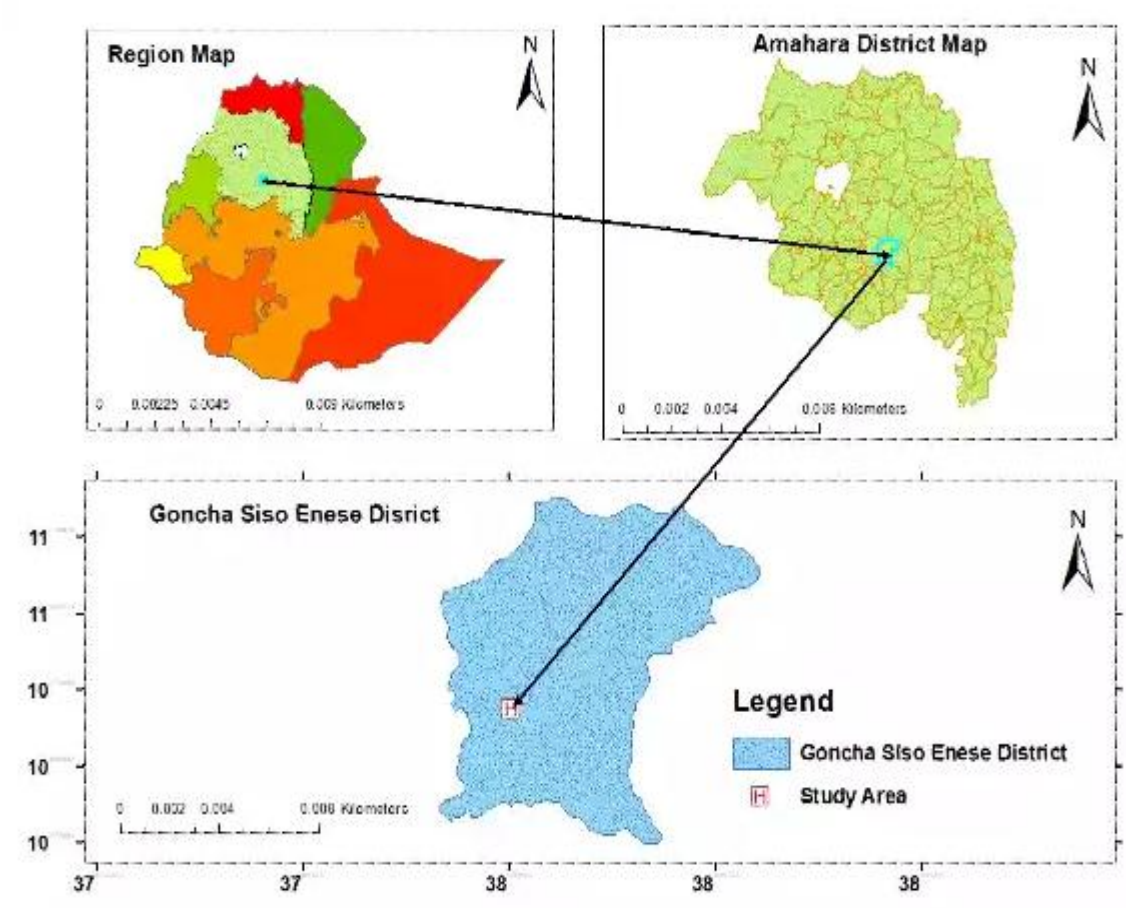

Figure 2: Location map of the study area

3.2 Study Design

A health center-based cross-sectional study of pneumonia prevalence and associated factors among the under-five children attending Ginde Woyin health center was conducted.

3.3 Source Population

All under-five children who get serves from Ginde Woyin health center from February 3, 2021 to April 10, 2021 were the source population.

3.4 Study population

The Study populations were under-five children who were attended Ginde Woyin Health Center from February 3, 2021 to April 10, 2021.

3.5. Sample size determination

The sample size was estimated using the following statistical formula (Naing *et al*., 2006)

$$n= \frac{z^2\ p(1-p)}{d^2}$$

where *n* = the minimum required sample size, *z* = 1:96 at 95%confidence interval, *p* = prevalence of under-five pneumonia, and *d* = margin of the sampling error assumed to be 0.05. Since the overall prevalence rate (*p*) of intestinal parasites was not known in the study area, it was taken as 50% and this gave a minimum sample size of 384.

$$n= \frac{1.96^2 X\ 0.5(1-0.5)}{0.05^2} = 384$$

To minimize errors arising from the likelihood of noncompliance or possible dropout, 5% of the sample size was added to the normal sample size. Consequently,403 total samples were selected.

3.6. Sampling Techniques

The participants were selected by using systematic random sampling technique from under-five outpatient department (OPD) registration book of Ginde Woyin health center. This were done by using intervals based on sample size and average number of under-five children per day who attending to the health center.

3.7. Eligibility Criteria

3.7.1. Inclusion criteria

Under-five children who didn't take anti-pneumonia drugs and those whose parents/ primary guardians were voluntary to sign consent were included.

3.7.2. Exclusion criteria

Under-five children who taken anti-pneumonia drugs, those children and parents/guardians who have hearing impairments and whose parents or guardians didn't sign consents were excluded.

3.8. Variables of the study

The independent variables of the study are socio-demographic factors (Age, Sex, Occupation of parents, the educational status of parents, and family size); environmental factors (source of fuel, the presence/absence of a separate kitchen, window in kitchen, and main house, cooking area and overcrowding); nutritional factors and co-morbidity (breastfeeding and vaccination status of the children, history of ARTI, chronic disease, and diarrhoea); sign and symptom (cough, fast breathing rates, chest tightness, difficulty of breathing, fever). The dependent variable was the prevalence of pneumonia among under-five children.

3.10. Data Collection

3.10.1. Questionnaire survey

A structured questionnaire based on known socio-demographic data, environmental factors, nutritional characteristics, vaccination status, signs and symptoms of pneumonia, and knowledge about pneumonia infections were developed in English and translated into Amharic. The questionnaire was pretested using seven individuals outside the study population to check its correctness of the questions. Then all ambiguity points were corrected before the questionnaires given to the actual study participants. Then the correct questionnaire was given to the respondents. Finally, the responses were translated back into English.

3.11. Diagnosing methods of Pneumonia

Clinical and laboratory diagnostic techniques were used in detection of Pneumonia.

3.11.1. Clinical Diagnosis

Clinically under five pneumonia patients detected, based on a group of signs and symptoms related to lower respiratory tract infection like fever, cough, fast or difficult breathing, ongoing vomiting, and extremes of temperature. The clinical diagnosis was done by the health center laboratory technician.

3.11.2 Physical Examination of pneumonia

Physically pneumonia was examined by measuring the heart rate and oxygen level in the blood. So, to listen the heart rate the nurse puts the stethoscope flat disc or hallow cup on a patient’s body and the earpieces go in to the nurse ear. The disc and the tube of stethoscope amplify small sound such as the sound of a patient’s lung, heart and

other sounds inside the body, making them sound louder. The amplified sound travels up the stethoscope tube to the earpiece that the nurse listens through.

The oxygen level in the body were measured using pulse oximetry. To check this a clip like device called a probe were placed on the nurse finger or ear lobe the count /read the oxygen level.

3.11.3. Collection of sputum

Steps used to collect a sputum sample for pneumonia diagnosis were: Brushing the teeth and rinse the mouth without using antiseptic mouthwash, next take a couple of long, deep breaths. Then breathe deeply again and cough hard until sputum comes up. Spit out the sputum into the sample cup. Then Keep coughing up sputum until the cup is filled to the marker, which is approximately one teaspoon. Finally, Screw on the cup lid, and wash and dry the outside of it.

3.11.4. Laboratory examination of sputum samples

The collected sputum sample was smeared on the laboratory slide, dry by air. Next, use a heat source to fix the slide. After fixation carbon fusion was added, then heat. After waiting five minutes wash by water and then 3% of acidic alcohol was added, and wait for three minutes then wash by water. After this Methylen blue was added and wait for one minute, then wash it with water and put in the air until it becomes dry. Finally, after drying put the slide on the microscope and examine it.

3.12. Data analysis

Statistical package for social science (SPSS) version 26.0, Descriptive statistics was used to show the prevalence of pneumonia among the different socio-demographic groups of the under-five children. Chi-square (χ^2) test was performed to verify the possible association between the prevalence of pneumonia from socio-demographic characteristics, co-morbidity, nutritional factor, and environmental sanitation factor.

Multivariable Logistic regression was used to measure the strengths or the degrees of association between the prevalence of pneumonia and its associated risk factors. In the modeling process, univariate analyses were first be done with a 0.25 level of significance to select the candidate variables for multivariable analysis. The variables, significant at the univariate analysis, then are included in the multivariable analysis (Lemeshow *et al*., 2013). The results of the association were considered significant

when the p-values are below 0.05. The 95% CI was used to show the accuracy of data analysis.

3.13. Data quality control

Both data collectors and a supervisor were trained for two days on the objective and data collection techniques of the study. A supervisor was checking the completeness and consistencies of questionnaires filled by the data collectors to ensure the quality. The principal was evaluating the data before going to the data analysis stage to verify its correctness. After collecting the pre-test data, each response was be checked for any potential problem related to the instrument, such as any difficult question which did not satisfy the respondent's psychology, not understandable or unclear question to reply. Finally, a corrective measure was taken.

3.14. Ethical considerations

Before conducting the investigation, the investigator was obtained ethical clearance from the ethical committee of Science College, Bahir Dar University. A letter describing the objective of the research was written to Ginde Woyin Health Center. Consent form was obtained from the parents/guardians of children after explaining the purpose and the procedures of the study. Finally, children whose test results were positive provided standard drugs for the treatment of their illness as prescribed by a physician from Ginde Woyin health center.

4. RESULT

4.1. **Socio demographic characteristics of the respondents**

The study population consisted of under-five children from heterogeneous groups in terms of residence, size of family, monthly income, educational status, and occupation. The socio-demographic characteristics of the respondents are listed in Table 1. 403 under-five children were included in the study with a response rate of 100% (199 = 49.4% male; and 204 =50.6% female children). Age-wise, the respondents were 1 to 3 (n= 201, 49.9%), less than one (n = 146, 36.2%), and 4 to 5 (n = 56, 13.9%). The majority of the study participants (n = 245, 60.8%) were rural dwellers. Two hundred-nine (51.9%) were from four up to five, 125(31%) from above 5, and 69 (17.1%) from below three family sizes. One hundred seventy-one (42.4%) of the respondents came from families with monthly income sizes of 1000-2500 birr, 151 (37.5%) from below 1000 birr, and 81 (20.1%) from above 2500-birr. 193 (47.9%) of the mothers and 180 (44.7%) of the fathers were illiterate. Sixty-two (15.4%) of mothers and 60 (14.9%) of the fathers were diploma and above holders. More than half of mothers 254 (63%) were housewives and 13 (3.2%) were students. The highest proportion of the fathers (n= 227, 56.3%) were farmers, followed by daily laborers (n = 44, 10.9%), and 20 (5%) of them being civil servants.

Table 1: Socio-demographic characteristics of the respondents in Goncha Siso Enesie District, Northwest Ethiopia, (n=403)

Independent variables	Coding categories	Frequency	Percent
Sex	Male	199	49.4
	Female	204	50.6
Age	<1 year	146	36.2
	1-3 year	201	49.9
	4-5 year	56	13.9
Residence	Urban	158	39.2
	Rural	245	60.8
Size of the Family	≤3	69	17.1
	4-5	209	51.9
	Above 5	125	31.0
Monthly income of the family	Below 1000 birr	151	37.5
	1000-2500 birr	171	42.4
	Above 2500 birr	81	20.1
Maternal education	Illiterate	193	47.9
	Primary (1-8)	92	22.8
	Secondary (9-12)	56	13.9
	Diploma and above	62	15.4
Paternal education	Illiterate	180	44.7
	Primary (1-8)	109	27.0
	Secondary (9-12)	54	13.4
	Diploma and above	60	14.9
Maternal occupation	Farmer	254	63.0
	Daily laborers	27	6.7
	Merchant	82	20.3
	Student	13	3.2
	Civil servant	27	6.7
Paternal occupation	Farmer	227	56.3
	Daily labor	44	10.9
	Merchant	63	15.6
	Student	49	12.2
	Civil servant	20	5.0

4.2. Living conditions of the respondents

In Table 2 the living conditions of the respondents are presented. Higher number of respondents (n = 352, 87.3%) had dung plastered and 51 (12.7%) had cemented house floors. The majority of study participants (n = 352, 82.1%) use tap water, 39 (9.7%) pond/river water, 33 (8.2%) spring water for drinking purposes. Respondents (n = 231, 57.3%) used an unimproved latrine, followed by 146 (36.2%) improved pit latrine, and 26 (6.5%) open field defecators. The number of rooms per family of the respondents were; three (n =187, 46.4%), two (n = 119, 29.5%), four (n = 89, 22.1%), and more than four (n = 8, 2%). Regarding to fuel source (n = 239, 59.3%) of the respondents were from wood users, 155 (38.5%) from charcoal users, and 9(2.2%) from electric current users. Concerning to cooking area (n = 239, 59.3%) were from families who used kitchen, 127 (31.5%) were from outdoor users, and 37 (9.2%) were from living room users. Regarding to place of children during cooking (n = 341, 84.6%) were from families who put outside cooking place and (n =62, 15.4%) were from carried on mothers back. Two hundred thirty (57.1%) were from families who had separated kitchen while 173 (42.9%) hadn't. Concerning the windows in the kitchen (n = 215, 53.3%) were from families who hadn't windows, 188 (46.7%) were from families who had one window. Regarding to the number of windows in the main house 140 (34.7%) were from families who had one window, 110 (27.3%) had two windows, 88 (21.8%) had more than three windows and 65 (16.1%) hadn't windows.

Table 2: Environmental characteristics of the respondents in Goncha Siso Enesie District, Northwest Ethiopia, (n=403)

Independent variables	Coding categories	Frequency	Percent
Floor	Dung plastered	352	87.3
	Cemented	51	12.7
Source of water for drinking	Tap water	331	82.1
	Spring water	33	8.2
	Pond/ river water	39	9.7
Toilet facility	Improved latrine	146	36.2
	Unimproved latrine	231	57.3
	Open field	26	6.5
Number of rooms in the main house	Two	119	29.5
	Three	187	46.4
	Four	89	22.1
	More than four	8	2.0
Source of fuel for cooking	Wood	239	59.3
	Charcoal	155	38.5
	Electric current	9	2.2
Cooking area	Living room	37	9.2
	Kitchen	239	59.3
	Outdoor	127	31.5
Place of children during cooking	Carried on mother back	62	15.4
	Outside the cooking place	341	84.6
Separated kitchen	Yes	230	57.1
	No	173	42.9
Number of windows in the Kitchen	Three	-	-
	Two	-	-
	One	188	46.7
	No window	215	53.3
Number of windows in the Kitchen	More than three	88	21.8
	Two	110	27.3
	One	140	34.7
	No window	65	16.1

4.3. Health care facility and children care characteristics of respondents

The health care facility and children care characteristics of respondents are presented in Table 3. From 403 participants, 336 (83.4%) were from families who had knowledge on vaccines and 67 (16.6%) were from who hadn't. 383 (95%) were from families who understood the unusual behavior of the children. Regarding vaccination status 223 (55.3%) were fully vaccinated, 120 (29.8%) were unvaccinated and 60 (14.9%) were partially vaccinated. During six months of life (n = 267, 66.3%) children were exclusively breast feeder and 136 (33.7%) were mixed breast feeder. One hundred sixty-two (40.2%) children breastfeed Up to Date, 126 (31.3%) up to two years, 74 (18.4%) above two years, and 41 (10.2%) up to one year. Regarding to starting complementary food (n = 164, 40.7%) were before six months, 140 (37.4%) were after six months, and 99 (24.6%) were not started.

Table 3: Health care facility and children care characteristics of respondents in Goncha Siso Enesie District, Northwest Ethiopia. (n=403)

Independent variables	Coding categories	Frequency	Percent
Knowledge on vaccine	Yes	336	83.4
	No	67	16.6
understand unusual behavior of children?	Yes	383	95.0
	No	20	5.0
take sick child immediately to a nearby health institute?	Yes	397	98.5
	No	6	1.5
Vaccination Status	Fully vaccinated	223	55.3
	Partially vaccinated	60	14.9
	Unvaccinated	120	29.8
Breastfeeding status	Exclusive breast feeding	267	66.3
	Mixed breast feeding	136	33.7
Time of breastfeeding	Up to 1 year	41	10.2
	Up to 2 years	126	31.3
	Above 2 years	74	18.4
	Up-to-date	162	40.2
complementary feeding start	After 6 months	140	34.7
	Before 6 months	164	40.7
	Not started	99	24.6

4.4. Pre-existing medical or co-morbid conditions of respondents

Table 4 showed that the pre-existing medical or co-morbid conditions of respondents (n = 169, 41.9%) had a history of diarrhea and (n = 234, 58.1%) hadn't. Two hundred thirty-three (57.8%) had a history of ARTI in children in the last two weeks while 170 (42.2%) hadn't. 81 (20.1%) had chronic disease and 322 (79.9%) hadn't. Eighty-seven (21.6%) had a history of house hold ARTI and 316 (78.4%) hadn't.

Table 4: Pre-existing medical or Co-morbid conditions characteristics of respondent's, Goncha Siso Enesie District, Northwest Ethiopia, (n=403)

Independent variables	Coding categories	Frequency	Percent
Diarrhea	Yes	169	41.9
	No	234	58.1
ARTI in children in last two weeks	Yes	233	57.8
	No	170	42.2
Chronic disease	Yes	81	20.1
	No	322	79.9
House hold ARTI	Yes	87	21.6
	No	316	78.4

4.5. Prevalence of Pneumonia and Signs and symptoms of pneumonia

The overall prevalence of under-five children's pneumonia in the study area is presented in Table 5. Out of the 403 examined under-five pneumonia case (n = 98, 24.3% 95%CI: 20.1, 28.3) were positive for pneumonia. The gender distributions of under-five pneumonia positive were 46 (23.1%) males and 52 (25.5%) females. Based on these result female children were independently associated with under-five pneumonia (P = 0.000). Among the study participants the Age distribution of pneumonia cases high positivity were occurred in male children below one year age group (n = 17, 27%) and female children with one up to three age group (n = 32, 61.5%).

Table 5: prevalence of pneumonia among under-five children by age and sex

Sex and Age (year)		Number of examined (%)	Pneumonia Positive (%)	Pneumonia Negative (	X^2	p-value
Male	Below 1 year	63 (31.7)	17 (27)	46 (73)	0.832	0.66
	1-3 years	110 (55.3)	23 (20.9)	87 (79.1)		
	4-5 years	26 (13.1)	6 (23.1)	20 (76.9)		
	Total	199 (	46 (23.1)	156 (76.9)		
Female	Below 1 year	29 (14.2)	15 (28.8)	14 (9.2)	15.72	0.000*
	1-3 years	129 (63.2)	32 (61.5)	97 (63.8)		
	4-5 years	46 (22.5)	5 (9.6)	41 (27)		
	Total	204 (	52 25.5)	152 (74.7)		
Both sex	Below 1 year	92 (22.8)	32 (34.8)	60 (65.2)	19.57	0.000*
	1-3 years	239 (59.3)	55 (23)	184 (77)		
	4-5 years	72 (17.9)	11 (15.3)	61 (84.7)		
	Total	403 (100)	98 (24.3)	305 (75.7)		
Overall		403 (100)	98 (24.3)	305 (75.7)	19.57	0.000*

4.6. Potential risk factors associated with pneumonia among under-five children in Goncha Siso Enesie district 2020/2021.

4.6.1. Chi-square Association of the different risk factors with Under-five pneumonia

Table 6. The chi-square association of the different risk factors with under-five pneumonia showed that from a total of 403 under-five children who attended Ginde Woyin health center, (n = 98, 24.3%) were pneumonia positive. Among these, higher positivity occurred in age group below one year (n = 49, 33.6%), in urban dwellers (n= 48, 30.4%), children from families with monthly income below 1000 Birr (n = 42, 27.8%), children with secondary school mothers (n = 15, 27.3%), with primary school fathers (n = 31, 28.4%), children from families with daily labor mothers (n = 11, 40.7%), and with daily labor fathers (n = 13, 29.5%).

High positivity rates happened among children with the following living conditions; those who live in houses with cemented floors (n = 13, 25.5%), those from families with two rooms in the main house (n = 11, 36.6%), respondents from families who hadn't separate kitchen (n = 42, 25.6%), from families who had windowless kitchen (n = 61, 28.4%), and those from houses which lack windows (n = 27, 41.5%). Respondents who taken mixed breast feeding (n = 60, 44.1%) and did not start complementary food (n = 36, 36.4%) had higher positivity.

Age (x^2 =11.299, p= 0.004), residence (X^2=5.19, P= 0.023), maternal occupation (χ^2=16.335, p=0.003),source of fuel (χ^2= 7.88, p= 0.019), number of windows in the kitchen (χ^2= 4.117, p= 0.0042), number of window in the main house (χ^2= 13.104, p = 0.004), breast feeding status (χ^2=23.727, p $\leq$ 0.001), starting age of complementary food (x^2 = 10.36, p = 0.006), history of ARTI in (χ^2= 26.118, p $\leq$ 0.001) was significantly associated with under-five pneumonia.

Table 6: Chi-square analyses of different risk factors associated with pneumonia among under-five attending Ginde Woyin health center, Northwest, Ethiopia, 2020/2021

Variables	Category	Pneumonia		X^2	P value
		Positive (%)	Negative (%)		
Sex	Male	46 (23.1%)	153 (76.9%)	0.309	0.579
	Female	52 (25.5%)	152 (74.5%)		
Age	0-1 year	49 (33.6%)	97 (66.4%)	11.29	0.004*
	1-3 year	36 (17.9%)	165 (82.1%)		
	4-5 years	13 (24.1%)	43 (75.9%)		
Residence	Urban	48 (30.4%)	110 (69.6%)	5.19	0.023*
	Rural	50 (20.4%)	195 (79.6%)		
Number of family	≤3	22 (31.8%)	47 (68.2%)	3.413	0.181
	4-5	51 (24.4%)	158 (75.6%)		
	Above 5	25 (20%)	100 (80%)		
Monthly income of family	Below 1000 birr	42 (27.8%)	109 (72.2%)	2.494	0.287
	1000-2500 birr	41 (23.9%)	130 (76.1%)		
	Above 2500 birr	15 (18.5%)	66 (81.5)		
Maternal education	Illiterate	49 (25.4%)	144 (74.6%)	0.957	0.812
	Primary (1-8)	21 (22.8%)	71 (77.2%)		
	Secondary (9-12)	15 (27.3%)	40 (72.7%)		
	Diploma and above	13 (20.6%)	50 (79.4%)		
Paternal education	Illiterate	42 (23.3%)	138 (76.7%)	2.345	0.504
	Primary (1-8)	31 (28.4%)	78 (71.6%)		
	Secondary (9-12)	14 (25.9%)	40 (74.1%)		
	Diploma and above	11 (18.3%)	49 (81.7%)		
Maternal occupation	House wives	51 (20.1%)	203 (79.9%)	16.335	0.003*
	Daily labor	11 (40.7%)	16 (59.3%)		
	Merchant	21 (25.6%)	61 (74.4%)		
	Student	8 (61.5%)	5 (38.5%)		
	Civil servant	7 (25.9%)	20 (74.1%)		
Paternal occupation	Farmer	52 (22.9%)	175 (78.1%)	2.364	0.669
	Daily labor	13 (29.5%)	31 (70.5%)		
	Merchant	16 (25.4%)	47 (74.6%)		
	Student	14 (28.6%)	35 (71.4%)		
	Civil servant	3 (15%)	17 (85%)		
Floor of main house	Dung plastered	85 (24.1%)	267 (75.9%)	0.044	0.835
	Cemented	13 (25.5%)	38 (74.5%)		
Source of drinking water	Tap water	78 (23.6%)	253 (76.4%)	1.592	0.451
	River	11 (33.3%)	22 (66.7%)		
	Pond /Spring water	9 (23.1%)	30 (76.9%)		

Toilet facility	Unimproved latrine	31 (21.2%)	115 (78.8%)	1.325	0.516
	Improved latrine	61 (26.4%)	170 (73.6%)		
	Open field	6 (23.1%)	20 (76.9%)		
Number of rooms in the main house	Two	11 (36.6%)	19 (63.4%)	4.488	0.213
	Three	60 (23.7%)	193 (76.3%)		
	Four	27 (23.7%)	87 (76.3%)		
	Above four	0 (0.00%)	6 (100%)		
Source of fuel for cooking	Wood	69 (28.9%)	170 (71.1%)	7.882	0.019*
	Charcoal	26 (16.7%)	129 (83.3%)		
	Electric current	3 (33.3%)	6 (66.7%)		
Food cooking area	Living room	14 (37.8%)	23 (62.2%)	5.174	0.075
	Kitchen	59 (24.7%)	180 (75.3%)		
	Outdoor	25 (19.7%)	102 (80.3%)		
Place of children during cooking	Carried on mother back	16 (25.8%)	46 (74.2%)	0.088	0.766
	Outside the cooking area	82 (24.0%)	259 (76.0%)		
Separated kitchen	Yes	56 (23.4%)	183 (76.6%)	0	0.987
	No	42 (25.6%)	122 (74.4%)		
Number of windows in the kitchen	More than three	-	-	4.117	0.042*
	Two	-			
	One	37 (19.7%)	151 (80.3%)		
	No window	61 (28.4%)	154 (71.6%)		
Number of windows in the main house	More than three	21 (23.8%)	67 (76.2%)	13.104	0.004*
	Two	23 (20.9%)	87 (79.1%)		
	One	27 (19.3%)	113 (80.7%)		
	No window	27 (41.5%)	38 (58.5%)		
Knowledge on vaccine	Yes	82 (24.4%)	254 (75.6%)	0.008	0.927
	No	16 (22.5%)	51 (77.5%)		
Understand unusual behavior of children	Yes	92 (24.0%)	291 (76.0%)		
	No	6 (30.0%)	14 (70.0%)		
Taking children to health center during cooking immediately	Yes	97 (24.9%)	300 (75.1%)	0.194	0.66
	No	1 (16.7%)	5 (83.3%)		
Vaccination status of children	Fully vaccinated	49 (22.0%)	174 (78.0%)	1.552	0.46
	Partially vaccinated	17 (28.3%)	43 (71.7%)		
	Unvaccinated	32 (26.7%)	88 (73.3%)		

Condition of breast feeding	Exclusive breast feeding	38 (14.2%)	229 (85.8%)	43.73	0.000*
	Mixed breast feeding	60 (44.1%)	76 (55.9%)		
	Not breast feed	-	-		
Age of breast feeding	Up to 1 year	12 (29.3%)	29 (70.7%)	7.651	0.054
	Up to 2 years	25 (19.8%)	101 (80.2%)		
	Above 2 years	12 (16.2%)	62 (83.8%)		
	Up to date	49 (30.2%)	113 (69.2%)		
Complementary feeding starts	After 6 months of life	29 (20.7%)	111 (79.3%)	10.36	0.006*
	Before 6 months of life	23 (14.0%)	131 (86.0%)		
	Not started	36 (36.4%)	63 (63.6%)		
Diarrhea	Yes	38 (22.4%)	131 (77.6%)	0.531	0.466
	No	60 (25.6%)	174 (74.4%)		
History of ARTI in children	Yes	64 (27.5%)	169 (72.5%)	26.12	0.000*
	No	34 (20.0%)	136 (80.0%)		
Chronic disease	Yes	19 (23.5%)	62 (76.5%)	0.041	0.841
	No	79 (24.5%)	243 (75.5%)		
House hold ARTI	Yes	32 (36.8%)	55 (63.2%)	9.366	0.02*
	No	66 (20.9%)	250 (79.1%)		

4.6.2 Logistic regression analysis of most risk factors

The strength of the association of under-five pneumonia with their risk factors is presented in Table 6. The results from the univariate analysis showed that children in the age groups of below one year were 1.4 times more likely to be infected by pneumonia (COR= 1.427; 95% CI: 0.295-3.216; P = 0.156) than four up to five years. Children who were living in rural area were 1.7 times at higher risk of pneumonia (COR= 1.702; 95% CI: 1.074- 2.695; P= 0.023) than urban dwellers. Children who lived in family size greater than five were 1.45 times (COR= 1.450; 95% CI: 0.799 - 2.633; P = 0.222) and family size four up to five were 1.8 times (COR= 1.872; 95% CI: 0.958 -3.658; P = 0.066) more infected by pneumonia than Children who lived in family size less than three. Children whose family monthly income below 1000 Birr were 1.59 times to develop pneumonia (COR= 1.590; 95% CI; 0.904 -3.146; P = 0.119) than monthly income above 2500 birr. Children from student mothers were 1.2 times at higher risk of pneumonia (COR=1.219; 95% CI; 0.453 –2.896; P = 0.035) than children from civil servant mothers.

Children from families who used charcoal for cooking were 2.48 times more likely to be infected by pneumonia (COR= 2.481; 95% CI: 0.583- 10.560; P = 0.240) than electric users. Children from families who had windows in the kitchen were 94% less likely to develop pneumonia (COR= 0.619; 95% CI: 0.388- 0.986; P = 0.023) than those who hadn't windows in the kitchen. Children from families who hadn't windows in the main house were 4.4 times more likely infected by pneumonia (COR= 4.41; 95% CI: 2.201- 8.842; P = 0.021) than those who had more than three windows.

Children who were breast-feed for less than two years were 1.67 times at higher risk of pneumonia (COR=1.672; 95% CI: 0.749- 3.73; P < 0.0001) compared to children who were breast-feed for more than two years. Children who had a history of ARTI in the last two weeks were 0.66 times more likely to be infected by pneumonia (COR= 0.660; 95% CI: 0.411: 1.060; P = 0.085) than those who hadn't.

Children from families who used wood for cooking were 3.5 times more likely to be infected by pneumonia (AOR=3.535; 95% CI: 0.829-9.724; P= 0.047) than electric users. Children from families who hadn't windows in the kitchen were 3.4 times at higher risk of pneumonia (AOR= 3.419; 95% CI: 0.140-10.253; P= 0.020) than

those who had windows in the kitchen. Children who took mixed breast-feeding were 1.2 times at higher risk of pneumonia (AOR= 1.213; 95% CI: 0.071- 0.641; P= 0.006) as compared to exclusive breast feeders. This finding indicates that children who started complementary food before six months of life were 1.5 times at higher risk of pneumonia (AOR= 1.513; 95% CI: 0.67- 4.482; P= 0.003) than started after six months of life.

Table 7: Univariate and multivariate logistic regression analysis of potential risk factors associated with under-five pneumonia in Goncha Siso Enesie district, Northwest Ethiopia, 2020/2021

Independent variables	Coding categories	Pneumonia status		Univariate logistic regression		multivariate logistic regression	
		Positive (percent)	Negative (percent)	COR (95% CI)	P-value	AOR (95% CI)	P- value
Age	below 1 year	49 (33.6)	97 (66.4)	1.427(0.295, 3.216)	0.156*	1.540 (0.175, 13.550)	0.697
	1-3 years old	36 (17.9)	165 (82.1)	1.386 (0.676, 2.840)	0.373	2.716 (0.364, 20.244)	0.330
	3-5 years old	13 (24.1)	43 (75.9)	1			
Residence	Rural	48 (30.4)	110 (69.6)	1.702 (1.074, 2.695)	0.023*	1.308 (0.419, 4.082)	0.644
	Urban	50 (20.4)	195 (79.6)	1			
Size of family	>5	22 (31.8)	47 (68.2)	1.450 (0.799, 2.633)	0.222*	0.882 (0.220, 3.544)	0.860
	4-5	51 (24.4)	158 (75.6)	1.872 (0.958, 3.658)	0.066*	1.223 (0.266, 5.633)	0.796
	≤3	25 (20)	100 (80)	1			
Monthly Income of the Family (birr)	Below 1000	42 (27.8)	109 (72.2)	1.590 (0.904, 3.146)	0.119*	0.544 (0.128, 2.301)	0.408
	1000-2500	41 (23.9)	130 (76.1)	0.721 (0.372, 1.396)	0.332	0.787 (0.183, 3.388)	0.748
	Above 2500	15 (18.5)	66 (81.5)	1			
Maternal occupation	House wives	51 (20.1)	203 (79.9)	1.393 (0.559, 3.474)	0.477	1.274 (0.158, 10.296)	0.820
	Daily labor	11 (40.7)	16 (59.3)	0.509 (0.161, 1.613)	0.261	0.168 (0.014, 2.061)	0.163
	Merchant	21 (25.6)	61 (74.4)	1.017 (0.377, 2.745)	0.974	0.784 (0.086, 7.114)	0.829
	Student	8 (61.5)	5 (38.5)	1.219 (0.453, 2.896)	0.035*	1.011 (0.972, 3.643)	0.061
	Civil servant	7 (25.9)	20 (74.1)	1			

Independent variables	Coding categories	Pneumonia status		Univariate logistic regression		multivariate logistic regression	
		Positive (percent)	Negative (percent)	COR (95% CI)	P-value	AOR (95% CI)	P- value
Source of fuel for cooking	Wood	69 (28.9)	170 (71.1)	1.232 (0.3, 5.065)	0.773	3.535 (0.829, 9.724)	0.047*
	Charcoal	26 (16.7)	129 (83.3)	2.481 (0.583,10.56)	0.240*	0.688 (0.034, 13.818)	0.807
	Electric	3 (33.3)	6 (66.7)	1			
Cooking area	Kitchen	59 (24.7)	180 (75.3)	1			
	Out door	25 (19.7)	102 (80.3)	0.748 (0.441, 1.267)	0.280	4.849 (0.908, 25.900)	0.065
	Living room	14 (37.8)	23 (62.2)	1.403 (0.823, 3.892)	0.025*	4.321 (0.907, 20.585)	0.066
Number of windows in the kitchen	No window	61 (28.4)	154 (71.6)	0.619 (0.388, 0.986)	0.023*	3.419 (0.140, 10.253)	0.020*
	One window	37 (19.7)	151 (80.3)	1			
Number of windows in the main house	More than three	21 (23.8)	67 (76.2)	1			
	Two	23 (20.9)	87 (79.1)	1.186 (0.606, 2.321)	0.619	2.247 (0.468, 10.790)	0.312
	One	27 (19.3)	113 (80.7)	1.312 (0.688, 2.501)	0.410	2.285 (0.505, 10.338)	0.283
	No window	27 (41.5)	38 (58.5)	4.41 (2.201, 8.842)	0.021*	0.553 (0.096, 3.188)	0.507
Breast feeding status of child	Mixed breast feeding	60 (44.1)	76 (55.9)	2.108 (0.730, 5.402)	0.000*	1.213 (0.071, 0.641)	0.006*
	Exclusive breast feeding	38 (14.2)	229 (85.8)				
For how long have you breastfed your child?	Up to one year	12 (29.3)	29 (70.7)	2.138 (.857, 5.33)	0.103*	1.403 (0.100, 19.651)	0.801
	Up to two years	25 (19.8)	101 (80.2)	1.672 (0.749, 3.73)	0.270	1.699 (0.179, 16.101)	0.644

Independent variables	Coding categories	Pneumonia status		Univariate logistic regression		multivariate logistic regression	
		Positive (percent)	Negative (percent)	COR (95% CI)	P-value	AOR (95% CI)	P- value
	Up to Date	49 (30.2)	113 (69.2)	0.954 (0.450, 2.023)	0.903	1.652 (0.194, 14.087)	0.646
	Above two years	12 (16.2)	62 (83.8)	1			
At which age did complementary feeding start?	After 6 months of life	29 (20.7)	111 (79.3)	1			
	before 6 months of life	23 (14.0)	131 (86.0)	1.037 (0.593, 1.814)	0.898	1.513 (0.67, 4.482)	0.003*
	Not started	36 (36.7)	63 (63.3)	0.457 (0.256, 0.815)	0.008*	0.678 (0.190, 2.410)	0.548
History of children ARTI in the last two weeks?	Yes	64 (27.5)	169 (72.5)	0.660 (0.411, 1.060)	0.085*	0.410 (0.122, 1.373)	0.148
	No	34 (20.0)	136 (80.0)	1			

5. DISCUSSION

The overall prevalence of pneumonia among under-five children who attended Ginde Woyin health center was 24.3%. It was in line with findings from Bangladesh (21.3%) (Azad, 2009), Tanzania (22%) (Lugangira and Kalokola, 2017), in Sheka zone of SNNPR (Ethiopia) (23.8%) (Tesfaledet Tesgaye and Worku Biyadgie, 2018), and in Gondar city (Ethiopia) (26.3%) (Mekuriaw Alemayehu *et al.*, 2014). It was higher than that of studies in Debre Birhan (Ethiopia) (5.5%) (Gebretsadike Shibre, 2015), in Vienna (Austria) 4.1% (Kurz *et al.*, 2013), in Mali (6.7%) (Bénet *et al.*, 2015), in Uganda (6.9%) (Tuhebwe *et al.*, 2014), and Kenya (6.9%) Hammitt *et al.*, 2012). However, it was lower than the findings in Nigeria (31.6%) (Ujunwa and Ezeonu, 2014), in Sudan (65%) (Gritly *et al*., 2018), in Kenya (74%) (Ndungu *et al*., 2018), in Uganda (56%) (Lindstrand *et al*., 2016), and in Sidama zone Wondo genet district (Ethiopia) (33.5%) (Teshome Abuka, 2017). The difference in the prevalence could be due to differences in Socio demographic, seasonal variation, socio-economic difference, environmental change (Ramezani, 2015), and immunization inaccessibility and provision (Tong, 2013).

Children who were from families who used wood for cooking were 3.5 times more likely to be infected by pneumonia (AOR=3.535; 95% CI: 0.829, 9.724; P= 0.047) than electric users. This result was in line with studies in India (AOR= 4.73; 95% CI: 1.67, 13.45) (Kankaria *et al.*, 2014), in Gondar city (Northwest Ethiopia) (AOR= 3.89; 95%CI: 1.54, 28.25) (Mekuriaw Alemayehu *et al*, 2014), in Sheka Zone (Southwest Ethiopia) (AOR= 0.134; 95%CI: 0.029, 0.618) (Tesfaledet Tsegaye and Worku Biadgie, 2018), and in Jimma zone (Southwest Ethiopia) (AOR= 3.41; 95%CI: 1.5, 7.7; P= 0.003) (Kenenisa Tegenu *et al*, 2018). The possible reason for these differences might be using wood as a source of fuel results in the release of wood smokes containing major air pollutants like carbon monoxide and particulate matter cause indoor air pollution. When firewood was used for cooking, there was the highest emission of indoor air pollutants, particulate matter, carbon monoxide, and other harmful compounds. When children spend more time inside the home or carried on to their mothers during food preparation were exposed to the highest levels of inhalation contaminants. As a result, these children have a better chance of infection,

and polluting fuels may adversely affect their defenses of the respiratory tract against pathogens (Chafe *et al.*, 2015).

Likewise, the likelihood of being infected by pneumonia among under-five children from families who hadn't window in the kitchen was 3.4 times (AOR= 3.419; 95% CI: 0.140-10.253; P = 0.020) more than that from families who had a window in the kitchen. A similar association between under-five pneumonia and the number of windows in the kitchen were reported from Debre Birhan referral hospital (Northwest Ethiopia) (AOR= 3.662; 95%CI: 1.659, 8.08) (Gizachew Nisabu, 2019) and in Wondo Genet (Southern Ethiopia) (AOR= 3.4; 95%CI: 1.52, 7.8) (Teshome Abuka, 2017). The possible reason might be the accumulation of smoke in space cause indoor air pollution, which increases the risk of pneumonia by affecting the structure and function of the respiratory tract (Cardani *et al.*, 2017).

Additionally, the starting time of complementary food was strongly associated with under-five pneumonia. The likelihood of being infected by pneumonia was increased by 1.5 times (AOR = 1.513; 95% CI: 0.67- 4.482; P = 0.003) more among children who started complementary food before six months of age compared to children who have started after six months of age. This finding was agreed with studies conducted in Ethiopia (AOR= 0.81; 95%CI: 0.72, 0.92) (Kedir Yimam Ahmed *et al.*, 2020). The possible reason might be starting complementary food before six months of age reduce the intake of breast milk and susceptible to different diseases (WHO, 2020).

Children who taken mixed breastfeeding were 1.2 times at higher risk of pneumonia (AOR= 1.213; 95% CI: 0.071- 0.641; P = 0.006) than exclusively breast feeders. This finding was agreed with studies conducted in India (AOR= 1.92; 95%CI: 0.79, 4.68) (Lamberti *et al.*, 2013) and in the Jimma zone (AOR= 3.3; 95%CI: 1.266, 8.3) (Kenenisa Tegenu *et al.*, 2018). The reason might be breast milk contains the nutrients, antioxidants, hormones, lymphocytes, and antibodies secretary Immunoglobulin A (IgA). These had been suggested to protect against infection by neutralizing pathogens at mucosal (Lambert *et al.*, 2013).

Several studies conducted earlier found out that factors like residence, maternal and parental educational status, gender of the child, child age, history of past morbidity, the condition of child's vaccination, housing, and environmental factors are significantly associated with under-five pneumonia (Gedefaw Abeje *et al.*, 2014;

Gebretsadik Shibre, 2015; and Kenenisa Tegenu, 2018). However, the present study did not show any significant association between under-five pneumonia and most of these potential risk factors in the multivariate logistic regression analyses.

6. CONCLUSION

A relatively high prevalence of under-five pneumonia was observed in the study area (24.3%). Using wood as source of fuel for cooking, cooking in windowless kitchen, children who started complementary food before six months of age, and mixed breastfeeding conditions were risk factors associated with under-five pneumonia in the study area.

7. RECOMMENDATIONS

Owing to the high prevalence of under-five pneumonia in the present study, awareness creation to the societies, monitoring the breastfeeding habit, promoting using kitchen with windows, increasing using non-smoked materials as a fuel source are recommended.

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APPENDICES

APPENDIX: A - INFORMATION SHEET

Title of the Research Project: To assess the prevalence and associated factors of pneumonia among under -five children at Ginde Woyin health center, North West of Ethiopia, 2021.

Name of researcher: Bizualem Abebaw

Name of the Organization: Ginde Woyin public health center

Name of the Sponsor: Bahir Dar University

Introduction: This information sheet is prepared for Ginde Woyin Public Health administration office. The aim of the form is to make the above concerned office clear about the purpose of research, data collection procedures and get permission to conduct the research.

Purpose of the Research Project: To assess the prevalence and associated factors of pneumonia among under -five children at Ginde Woyin Public Health, Northwest of Ethiopia, 2021.

Procedure: In order to achieve the above objective, information which is necessary for the study will be taken from under -five children mother or care giver and child medical record.

Risk and /or Discomfort: Since the study will be conducted by taking appropriate information from under -five children mother or care giver and child medical record it will not inflict any harm on the patients. The name or any other identifying information will not be recorded on the questionnaire and all information taken was

kept strictly confidential and in a safe place. The information retrieved will only be used for the study purpose.

Benefits: The research has no direct benefit. But the indirect benefit of the research for the participant and other clients in the program is clear. This is because if program planners are preparing predicted plan there is a benefit for clients in the program of getting appropriate care and treatment services.

Confidentiality: The information collected was kept confidential and it will not be revealed to anyone except the investigator and it was kept in key and locked system with computer pass ward.

Person to contact: This research project was reviewed and approved by the institutional review board of BDU, College of Science, and Biology department. If you have any question you can contact the Investigator with the following address.

Name: Bizualem Abebaw (Bsc)
Institution: BDU, College of Science, Department of Biology
Cell phone: +251- 922277635
E-mail: abebawbizualem@gmail.com

APPENDIX -B: CONSENT FORM (English version)

Hello. My name is ----------I am Master's student in Bahir Dar University college of Science Biomedical Science Department. I am conducting Thesis on prevalence and associated factor of pneumonia among under-five children in Ginde Woyin health center. The study is intended to benefit the community including the people that was participating in this research and will introduce no risk to the participant. The result that will come out of this study was used by the government and the district health office to base their rational decision to develop appropriate strategies to combat this problem. The questionnaire requires the maximum of 20 minutes to complete. Your child selected randomly through lottery method from all children visit OPD of this health center. Your participation is entirely voluntarily, and you can quit from the study any time you want. You will have no penalty if you fail to show desire to participate. I, hope that you will participate in the study since the data that will come from you was important for us. Your name and other personal identity will not be used and hence the information we will collect from you will completely be kept confidential and will not be disclosed to any third person other than the people participating in this study. For any question you want to ask us, you can use the

contact address here under. May I now begin the interview? If yes, continue interviewing If No, thank and stop interviewing.

Name of the interviewer_____ Sign. _____ Date _____

Name of the supervisor _____Sign _____ Date_____

Addresses

Tel: 0922277635

Email: abebawbizualem@gmail.com

I (the respondent), the undersigned, am told that the researcher is going to conduct study in this health center to determine the prevalence and possible risk factors of under-five children pneumonia, and s/he acquainted with me the first-time s/he meets. I am also informed that the result of the study will be used by both the government and the Ginde Woyin health office to commence appropriate strategies to battle this problem. I am, too, told that the research will benefit the community in general including me, the respondent, and that the research will not inflict any harm to me. I have been told that I have full right to have enough time to understand and then take part in the study on the basis of my interest and besides, I am briefed that I will be interviewed for not more than 20 minutes. I am let know that my child and I was selected randomly by the investigator. Moreover, I am notified that my participation in the study is entirely voluntarily, and that I can quit from the study any time I want. Likewise, I am enlightened that I will not be subjected to any form of punishment following my failure to participate in the study. In the same way, I am explained that the information collected from me will not by any means be disclosed to any people other than those participating in the study unless obtained permission from me. Finally, I am told that I can ask them questions I found difficult.

Name of the interviewed _____

Date _____

Sign _____

Addresses_____

Name of the interviewer_____ Sign _____

Name of the Supervisor _____ Sign _____

APPENDIX C: QUESTIONNAIRE FORM: (English version)

Questions related to the prevalence and determinant factors of pneumonia among under-five Children

Card No. Date_____ Questionnaire code:

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

PART I: SOCIO-DEMOGRAPHIC FACTORS

No	**Socio-demographic factors**	**Coding category**
1	Gender of the child	1. Male 2. Female
2	Age of the child	1.<1year 2. 1-3year 3. 4-5 year
3	Residence of the child?	1. Urban 2. Rural
4	How many members in your Family?	1.≤3 2. 4-5 3. >5
5	Monthly Income of the Family?	1.below 1000 2. 1000 to 2500 3. above 2500
6	Maternal education	1. Illiterate 2. Primary (1-8) 3. Secondary (9-12) 4. Diploma and above
7	Paternal education	1. Illiterate 2. Primary (1-8) 3. Secondary (9-12) 4. Diploma and above

8	Maternal occupation	1. House wife 2. Daily labor 3. Merchant 4. Student 5. Civil servant
9	Paternal occupation	1.Farmer 2. Daily labor 3. Merchant 4. Student 5. Civil servant

PART II: ENVIRONMENTAL FACTORS

N o	Environmental factors	Coding category
10	The floor of the main house?	1.dung plastered 2. Cemented
11	The roofing material of the main house	1.Tin 2. Grass
12	What is the main source of drinking water for the family?	1. Piped water 2. Spring water 3. Pond /River water
13	What kind of toilet facility do you have at home?	1.improved latrine pit 2. un improved pit 3. Open field
14	How many rooms are there in your house (including the sitting room)?	1.two 3. four 2. three 4. More than four
15	With what type of fuel source do you cook at home?	1. Charcoal 2. Wood 3. Electricity 4. Kerosene
16	Where do you usually cook your food?	1. Living room 2. Kitchen 3. Outdoors
17	Where is the usual location of the child during cooking?	1. Carried on the mother's back 2. Away from the cooking site
18	Is the kitchen separated from the main house?	1. Yes 2. No
19	Number of windows in the kitchen	1.-one 3. More than three 2.-two 4. No window
20	Number of windows in the house	1.-one 3. More than three 2.-two 4. No window

Part-III: Nutritional factors, vaccination status and child care factors

No	**Questions**	**Coding category**
21	Do you know the benefit of a vaccine?	1. Yes------ 2. No------
22	Do you understand immediately if your child reflects unusual behavior?	1.Yes 2. No
23	If your child is sick, do you take him/her immediately to a nearby health institute?	1.Yes 2. No
24	What is the Vaccination Status of the child?	1. Fully vaccinated 2. Partial vaccinated 3. Unvaccinated
25	Breastfeeding status of the child during the first 6 months of life	1. Exclusive breastfeeding 2. Mixed Breastfeeding 3. Not Breastfeeding
26	For how long have you breastfed your child?	1.upto date 2. Up to 1 year 3. up to 2 years 4. Above 2 years
27	At which age did complementary feeding start?	1.Before 6 months of life 2.After 6 months of life 3. not started

PART IV: Past morbidity and sign and symptom

No	**Questions**	**Coding category**
28	Is your child having diarrhea?	1. Yes 2. No
29	History of child ARTI in the last two weeks?	1. Yes 2. No
30	History of Chronic diseases like CHD, Asthma?	1. Yes 2. No
31	History of households ARTI in last two weeks?	1. Yes 2. No
32	Is your child having Cough	1. Yes 2. No
33	Is your child has Fast breathing	1. Yes 2. No

34	Is your child having **Chest tightness/indrawing**	1. Yes 2. No
35	Is your child having Difficulty of breathing	1. Yes 2. No
36	Is your child has Vomiting	1. Yes 2. No
37	Is your child having Fever	1. Yes 2. No
38	Is your child having Loss of appetite	1. Yes 2. No

ተቀፅላዎች

ተቀጽላ ሀ- የመረጃ ሉህ

የምርምር ፕሮጀክቱ ርዕስ -በሰሜን ምዕራብ ኢትዮጵያ በግንደ ወይን ጤና ጣቢያ በ 2021 እድሜያቸው ከአምስት በታችባሉ ሕፃናት የሳንባ ምች ስርጭት እና ተዛማጅ ምክንያቶች ለመገምገም፡

የተመርማሪው ስም፡ ብዙዓለም አበባው

የድርጅቱ ስም-ግንደ ወይን ጤና ጣቢያ

የስፖንሰር አድራጊው ስም-ባህርዳር ዩኒቨርሲቲ

መግቢያ-ይህ የመረጃ ወረቀት ለግንደ ወይን የህብረተሰብ ጤና ፅ/ቤት ተዘጋጅቷል፡፡ የቅጹ ዓላማ ስለ ምርምር ዓላማ፣ የመረጃ አሰባሰብ አሠራሮች እና ምርምር ለማካሄድና ፈቃድ ለማግኘት ከላይ የተመለከተውን ጽ/ቤት ግልፅ ለማድረግ ነው፡፡

የምርምር ፕሮጀክቱ ዓላማ- በሰሜን ምዕራብ ኢትዮጵያ በግንደ ወይን ጤና ጣቢያ በ 2021 እድሜያቸው ከአምስት በታች ባሉ ሕፃናት የሳንባ ምች ስርጭት እና ተዛማጅ ምክንያቶች ለመገምገም፡፡

ሥነ ሥርዓት- ከላይ የተጠቀሰውን ዓላማ ለማሳካት አስፈላጊ የሚሆን መረጃ ጥናቱ የሚወሰደው ከአምስት በታች ከሆኑት እናቶች ወይም ከእንክብካቤ ሰጭ እና ከልጆች ህክምና መዝገብ ነው::

አደጋ እና ወይም ምቾት-ጥናቱ የሚካሄደው ተገቢውን መረጃ ከአምስት በታች ልጆች እናት ወይም ተንከባካቢ እና የህፃናት የህክምና መዝገብ መረጃ በመውሰድ ነው፡፡ በታካሚዎቹ ላይ ምንም ጉዳት አያስከትልም፡፡ ስያሜው ወይም ሌላ ማንነቱ የሚታወቅበት መረጃ በመጠይቁ ላይ አይመዘገብም እንዲሁም የተወሰዱት መረጃዎች በሙሉ በሚስጥር እና ደህንነታቸው በተጠበቀ ቦታ እንዲቀመጡ ተደርጓል፡፡ የተገኘው መረጃ ለጥናቱ ዓላማ ብቻ ይውላል፡፡

ጥቅሞች-ምርምሩ ቀጥተኛ ጥቅም የለውም፡፡ ነገር ግን በተዘዋዋሪ ለተሳታፊዎች ና ለሌሎች ግልፅ ነው፡፡ ምክንያቱም የጥናቱ እቅድ አውጭ አካል ተሳታፊዎች ጥሩ የሆነ እንክብካቤ እና አገልግሎት እንደ ሚያገኙ አስቀምጠዋል፡፡

ሚስጥራዊነት-የተሰበሰበው መረጃ በሚስጥራዊነት የተያዘ ከመሆኑም በላይ ከተመርማሪው በስተቀር ለማንም አይገለጽም እንዲሁም በኮምፒተር ማለፊያ ክፍል በቁልፍ እና በተቆለፈ ስርዓት ውስጥ ይያዛል፡፡

የሚገናኝ ሰው-ይህ የምርምር ፕሮጀክት በባህርዳር ዩኒቨርስቲ፣በሳይንስ ኮሌጅ እና በባዮሎጂ ትምህርት ክፍል በተቋማዊ ግምገማ ቦርድ ተገምግሞ ይፀድቃል፡፡ ማንኛውም ጥያቄ ካለዎት በሚከተለው አድራሻ ተመርማሪውን ማነጋገር ይችላሉ፡

ተቀጽላ ለ: የስምምነት ማረጋገጫ ፎርም (የአማርኛዉ ትርጉም)

ጤና ይስጥልኝ. ስሜ ---------- እኔ በባህርዳር ዩኒቨርስቲ ሳይንስ ኮሌጅ ባዮ-ሜዲካል ሳይንስ ትምህርት ክፍል ማስተርስ ተማሪ ነኝ፡፡ በግንደ ወይን ጤና ጣቢያ ከአምስት አመት በታች ባሉ ሕፃናት የሳንባ ምች ስርጭት እና ተጓዳኝ ምክንያቶች ላይ ጥናታዊ ጽሑፍ እየሰራሁ ነው፡፡

ይህ ምርምር በዚህ ጥናት ውስጥ የተሳተፈውን ህዝብ ጨምሮ ህብረተሰቡን ተጠቃሚ ለማድረግ የታሰበ ሲሆን ለተሳታፊው ምንም ስጋት አያመጣም፡፡ ከዚህ ጥናት የሚወጣው ውጤት ይህንን ችግር ለመዋጋት ተገቢ ስልቶችን ለመንደፍ ምክንያታዊ ውሳኔያቸውን ለመንግስትና ለወረዳው ጤና ጥበቃ ጽ/ቤት ይጠቀምበታል፡፡ መጠይቁ ለማጠናቀቅ ቢበዛ 20 ደቂቃዎችን ይፈልጋል፡፡ ልጅዎ የተመረጠው ከዚህ የጤና ማዕከል ካርድ ክፍል ከሁሉም ሕፃናት በሎተሪ ዘዴ በዘፈቀደ መንገድ ሲሆን ተሳትፎዎ ሙሉ በሙሉ በፈቃደኝነት ላይ የተመሰረተ ነው፣ እና በሚፈልጉት ጊዜ ከጥናቱ ማቋረጥ ይችላሉ፡፡ ለመሳተፍ ፍላጎት ማሳየት ካልቻሉ ቅጣት አይኖርዎትም፡፡ እኔ፣ ከእርስዎ የሚመጡት መረጃዎች ለእኔ አስፈላጊ ስለሚሆኑ በጥናቱ ላይ እንደምትሳተፉ ተስፋ አደርጋለሁ፡፡የእርስዎ ስም እና ሌላ የግል ማንነት ስራ ላይ አይውሉም ስለሆነም ከእርስዎ የምንሰበስበው መረጃ ሙሉ በሙሉ በሚስጥር የሚቀመጥ ሲሆን በዚህ ጥናት ውስጥ ከሚሳተፉ ሰዎች በስተቀር ለሌላ ሶስተኛ ሰው አይገለጽም፡፡ እኛን ሊጠይቁን ለሚፈልጓቸው ማናቸውም ጥያቄዎች፣ እዚህ በታች ያለውን የእውቂያ አድራሻ መጠቀምይችላሉ፡፡

አሁን ቃለ መጠይቁን ልጀምር? አዎ ከሆነ ቃለ መጠይቁን ይቀጥሉ

አይሁንም ካሉ አመስግኑ እና ቃለ መጠይቁን ያቁሙ

ስም----------

ፊርማ ----------

መጠይቁ የተደረገበት ቀን----------

የተቆጣጣሪው ስም ----------

ፊርማ----------

ቀን----------

አድራሻ ፡ ስልክ 0922277635

ኢሜል: abebawbizualem@gmail.com

እኔ (ቃለ መጠይቁ የሚደረግልኝ) በዚህ ወረዳ ውስጥ የሚገኙና እድሜያቸው ከ 5 አመት

በታች በሆኑ ህፃናት ላይ የሳንባ ምችን በሽታ ስርጭትና መንስዔዎቹን በተመለከተ የሚካሄደውን ጥናት ዋና አላማ እና የሚያስከትለውን ጉዳት፣ ከእኔ የሚወጣውን መረጃ ከተመራማሪዎቹ ለማንም እንደማይተላለፍ፣ ጥናት ውስጥ በመሳተፍ ቀጥተኛ የሆነ ጥቅማጥቅም የሌለው መሆኑን እኔ የምሰጠው መረጃ ለመንግስት እና ለወረዳው ጤና ፅ/ቤት አስፈላጊ መሆኑን፣ ጥናት ውስጥ መሳተፍ ያለብኝ በእኔ ፈቃደኝነት ላይ ብቻ የተመሰረተ እንደሆነ ፣ ጥናት ውስጥ መግባት ባለመቻሌ ምንም አይነት ቅጣት እንደሌለው፣ ከጥናቱ በማንኛውም ሰአት ማቋረጥ እንደምችል፣ መጠይቁን ለማጠናቀቅ ቢበዛ 20 ደቂቃ እንደ ሚወስድ እና ማንኛውን አይነት ጥያቄ መጠየቅ እንደምችል በሚገባ ከተነገረኝ በኋላ በዚህ ጥናት ውስጥ በፈቃደኝነት መሳተፌን በፊርማዬ አረጋግጣለሁ።

ቃለ መጠይቁ የተደረገለት ሰው

ስም ----------

ፊርማ ----------

ቀን ----------

አድራሻ ፡ስልክ

Email

ተቀፅላ መ: መጠይቅ ቅጽ: የአማርኛ ቅጅ

ከአምስት ዓመት በታች ለሆኑ ሕፃናት የሳንባ ምች ስርጭት እና ወሳኝ ምክንያቶች ጋር የሚዛመዱ ጥያቄዎች

የካርድ ቁጥር ቀን_____ መጠይቅ ኮድ _____

መመሪያ-ለሚከተሉት ጥያቄዎች ለእያንዳንዱ ተገቢውን መልስ ስጡ

ተ.ቁ	ማህበራዊና ስነ-ህዝባዊ ምክንያቶች	የምድብ ኮድ
1	የልጁ ፆታ	1.ወንድ 2. ሴት
2	የልጁ ዕድሜ	ይግለፁ
3	የልጁ መኖሪያ?	1.ከተማ 2.ገጠር
4	በቤተሰብዎ ውስጥ ስንት አባላት ናቸው?	1.≤2 2. 3-5 3. ≥5
5	የቤተሰብ ወርሃዊ ገቢ?	1.ከ 1000ብር በታች 2. 1000 እስከ 2500 3. ከ 2500 በላይ
6	የእናትነት የት/ት ደረጃ	1.ያልተማረች 2. የመጀ/ደረጃ (1-8) 3. ሁለተኛደረጃ (9-12) 4. ዲፕሎማና ከዚያ በላይ
7	የልጁ አባት የት/ት ደረጃ	1.ያልተማረ 2. የመጀ/ደረጃ (1-8) 3. ሁለተኛደረጃ (9-12) 4. ዲፕሎማና ከዚያ በላይ
8	የእናት የአሁኑ ሥራ?	1. የቤት እመቤት 2. የመንግስትሰራተኛ

		3. ነጋዴ4. ተማሪ 5. የዕለት ተዕለት የጉልበት ሥራ
9	የአባት ሥራ?	1. ግብርና 2. ተማሪ 3. የመንግስት ሰራተኛ 4. ነጋዴ 5. የዕለት ተዕለት የጉልበትሥራ

ክፍል 2፡ **አካባቢያዊ ምክንያቶች**

10	የዋናው ቤት ወለል ምንድን ነው	1.በእበት የተለቀለቀ 2. ሲሚንቶ(ሊሾ)
11	የዋናው ቤት ጣሪያ ከምን የተሰራ ነው	1.ከቆርቆሮ 2. ከሳር
12	ቤተሰቡ የመጠጥ ዉሃ የሚጠቀመው ከየት ነው	1.ቧንቧ ውሃ 2. ጉድጓድውሃ 3. አንቦውሃ 4. የወንዝ/ኩሬ
13	መፀዳጃ ቤትዎ ምን አይነት ነው	1.ክፍት ጉድጓድ 2. የተሻሻለ ጉድጓድ 3. ሜዳ ላይ
14	በቤትዎ ውስጥ ስንት ክፍሎች አሉ (የመቀመጫ ክፍሉን ጨምሮ)?	1. አንድ 2. ሁለት 3. ሶስት 4. አራትና በላይ
15	ቤት ውስጥ በምን አይነት የነዳጅ ምንጭ ነው የምታበስሉት	1.ከሰል 2.እንጨት 3.ኤሌክትሪክ
16	ምግብ በሚያበስሉበት ጊዜ የልጁ መደበኛ ቦታ የት ነው?	1.ከእናቱ ጀርባ ላይ 2.ከማብሰያው ቤት ውጭ
17	ብዙውን ጊዜ ምግብዎን የት ያበስላሉ	1. ሳሎን 2. ማድቤት 3. ከቤትውጭ
18	ኩሽና ቤቱ ከዋናው ቤት ተለይቷል?	1.አዎ 2.አልተለየም
19	በኩሽና ውስጥ የመስኮቶች ብዛት	1.አንድ 2. ሁለት 3. ከሶስትበላይ 4.የለውም
20	በቤት ውስጥ የመስኮቶች ብዛት	1.አንድ 2. ሁለት 3. ከሶስትበላይ

		4.የለውም

ክፍል 3: የጤና አገልግሎቶች እና የህፃናት እንክብካቤ ምክንያቶች

21	የክትባት ጥቅም ያውቃሉ?	1. አዎ ------ 2. የለም ----
22	የልጁ የክትባት ሁኔታ?	1. ሙሉ በሙሉ ክትባት 2.በከፊል የበሽታ መከላከያ 3. ክትባት ያልተሰጠ
23	ልጅዎ ያልተለመደ ባህሪን ያንፀባርቃል?	አዎ ------ 2 የለም ------
24	ልጅዎን እንደታመመ ወዲያውኑ ወደጤና ተቋም ይወስዳሉ?	1 አዎን 2 የለም
25	የመጀመሪያዎቹ 6 ወሮች ውስጥ የጡት ማጥባት ሁኔታ	1. ብቸኛ ጡት ማጥባት 2.የተደባለቀጡት መመገብ 3. ጡት አለጠባም
26	የተጨማሪ ምግብ መመገብ መቼ ጀመረሽ?	1.ከ6 ወር በፊት 2. ከ6 ወር በኋላ
27	ለምን ያህል ጊዜ ልጅዎን ጡት ይመገባሉ?	1. እስከ 1 አመት 2. እስከ 2 አመት 3. ከ 2 አመትበላይ 4. እስከአሁኑ

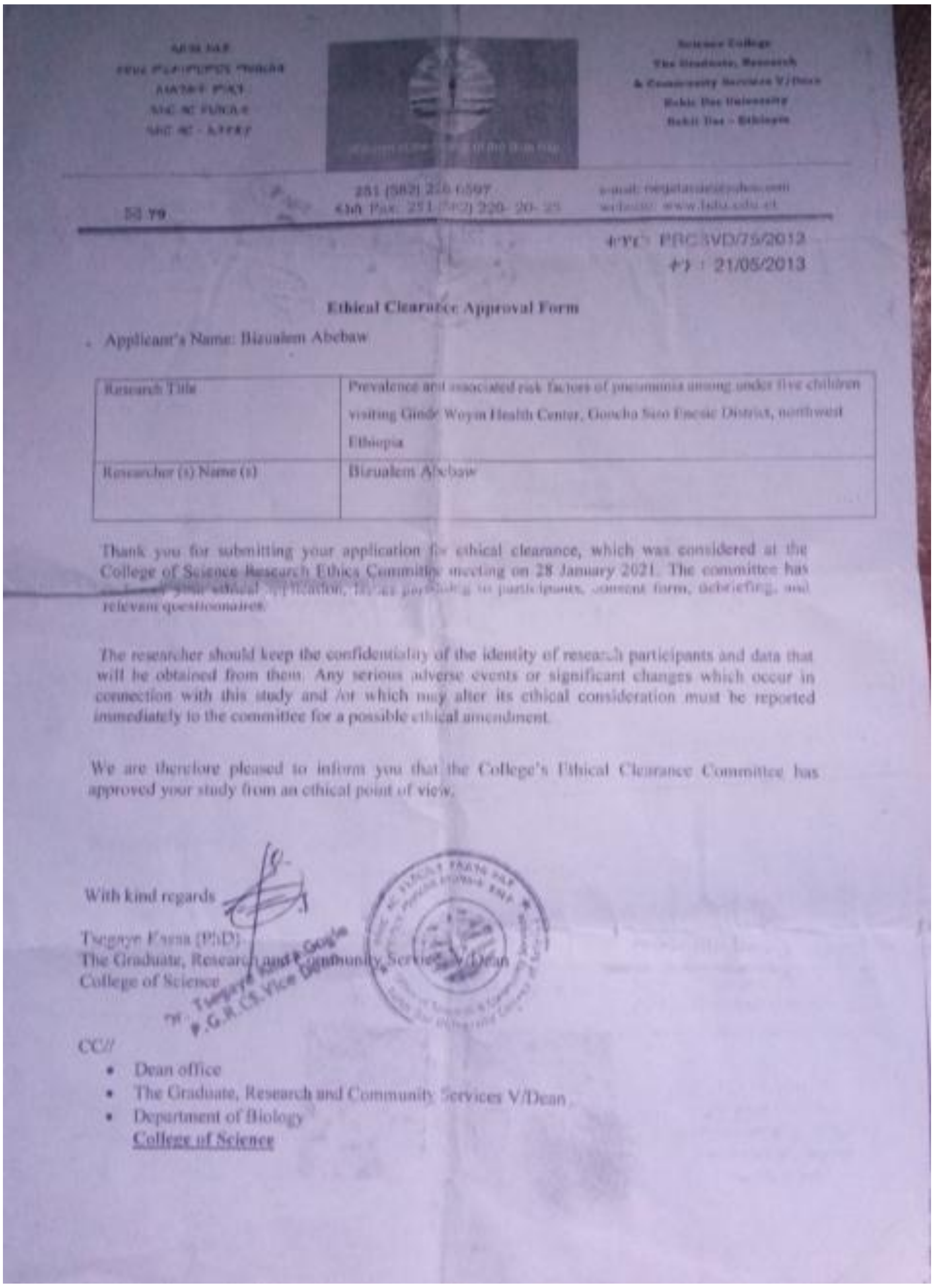
ክፍል 4፡ የሳንባ ምች ምልክቶች እና አብሮ -የሚከሰቱ ሁኔታዎች

28	ልጅዎ ተቅማጥ አጋጥሞት ያውቃል?	1. አዎ 2. አያዉቅም

29	ባለፉት ሁለት ሳምንታት ውስጥ የልጅዎ አጣደፊ የመተንፈሻ አካላት በሽታ ታሪክ አለው?	1. አዎ 2. የለውም
30	እንደ የደም ቧንቧ በሽታ፣አስም ያሉ ሥር የሰደዱ በሽታዎች ታሪክ	1. አዎ 2. የለውም
31	ባለፉት ሁለት ሳምንቶች የአጣደፊ የመተንፈሻ አካላት በሽታ በቤተሰቦች ላይ ነበር?	1. አለ 2. የለም
32	ልጅዎ ሳል ያስለዋል/ታል	1.አዎ 2. የለም
33	ልጅዎ ቶሎ ቶሎ ይተነፍሳል	1.አዎ 2. የለም
34	ልጅዎ የደረት መቧጠጥ ስሜት አለበት	1.አዎ 2. የለም
35	ልጅዎ የመተንፈስ ችግር /ትንፋሽ መቆራረጥ/ አለው	1.አዎ 2. የለም
36	ልጅዎ ያስመልሰዋል	1.አዎ 2. የለም
37	ልጅዎ ትኩሳት አለበት	1.አዎ 2. የለም
38	ልጅዎ የምግብ ፍላጎት መቀነስ ይታይበታል	1.አዎ 2. የለም

ቃለ መጠየቅ የተደረገለት ሰው ስም **ፊርማ** **ቀን**

ETHICAL CLEARANCE PAPER



Science College
The Graduate, Research
& Community Services V/Dean
Bahir Dar University
Bahir Dar - Ethiopia

PRC/VD/75/2012
21/05/2013

Ethical Clearance Approval Form

- Applicant's Name: Bizualem Abebaw

Research Title	Prevalence and associated risk factors of pneumonia among under five children visiting Ginde Woyin Health Center, Goncha Siso Enesie District, northwest Ethiopia
Researcher (s) Name (s)	Bizualem Abebaw

Thank you for submitting your application for ethical clearance, which was considered at the College of Science Research Ethics Committee meeting on 28 January 2021. The committee has [illegible] your ethical application, [illegible] pertaining to participants, consent form, debriefing, and relevant questionnaires.

The researcher should keep the confidentiality of the identity of research participants and data that will be obtained from them. Any serious adverse events or significant changes which occur in connection with this study and /or which may alter its ethical consideration must be reported immediately to the committee for a possible ethical amendment.

We are therefore pleased to inform you that the College's Ethical Clearance Committee has approved your study from an ethical point of view.

With kind regards

Tsegaye Kassa (PhD)
The Graduate, Research and Community Services V/Dean
College of Science

CC//

- Dean office
- The Graduate, Research and Community Services V/Dean
- Department of Biology

College of Science

አመሰግናለሁ!!!