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# Prevalence and risk factors of pneumonia among under- five children attending Dangila Primary Hospital, northwest Ethiopia

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**BAHIRDAR UNIVERSITY**

**GRAGUATE STUDIES OFFICE**

**COLLEGE OF SCIENCE**

**DEPARTMENT OF BIOLOGY**

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# Prevalence and risk factors of pneumonia among under- five children attending Dangila Primary Hospital, northwest Ethiopia

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**A Thesis submitted to the Department of Biology for the partial fulfillment of the requirements for the degree of Master of Science in Biology (Biomedical sciences)**

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## Declaration

This paper that submitted to the School of post graduate Studies of Bahir -Dar University in partial fulfillment to the requirement for Master of Sciences in Biology (Biomedical sciences) is my original work conducted by my own, under the supervision of Dr. Abaineh Munshea and it has not been presented for a degree in this or other universities. All the sources of the materials used for this thesis and all people who gave support for this work are fully referenced and acknowledged.

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## LIST OF ABBREVIATIONS|ACRONYMS

| | |
|---|---|
| ALRI | Acute lower respiratory infections |
| AOR | Adjusted Odds Ratio |
| CAP | Community-acquired pneumonia |
| CI | Confidence of interval |
| CO2 | carbon dioxide |
| COPD | chronic obstructive pulmonary disease |
| COR | Crude Odds Ratio |
| CSA | central statistical agency |
| CXR | Chest X-Ray |
| DWRDAO | Dangila Woreda Rural Development and Agricultural Office |
| EDHS | Ethiopia Demographic and Health Survey |
| ETS | Environmental tobacco smoke |
| FDRE | federal democratic republic of Ethiopia |
| HIB | *Homophiles influenza* type b |
| HIV | Human immune deficiency virus |
| LMICs | low and middle-income countries |
| MPS | Maternal prenatal smoking |
| MS | Main stream smoke |
| PM | particulate matter |
| RSV | Respiratory syncytial virus |
| SHS | Secondhand smoke |
| SPSS | Statistical Package for Social Sciences software |
| SS | Side stream smoke |
| UN | United Nation |
| UNICEF | United nation children's Emergency fund |
| VOC | Volatile organic compounds |
| WHO | World Health Organization |

# ABSTRACT

Pneumonia is the biggest single cause of childhood morbidity and mortality under the age of five years in developing countries, including Ethiopia. A hospital based cross- sectional study was conducted with the objective of determining the prevalence of pneumonia and its associated risk factors among under-five children admitted to Dangila primary hospital, northwest, Ethiopia. Socio-demographic, environmental, nutrition and past co-morbidity related characteristics, and other clinical variables were collected from 384 caregivers/mothers and of their under-five children using structured questionnaire and patient records. Statuses of pneumonia was detected using rapid x-ray diagnostic detection method. Data were analyzed using statistical package software for social sciences (SPSS) version 20. Bivariate and multivariate logistic regression analyses were used to identify the possible risk factors of pneumonia among under-five children. Variables having p-value < 0.05 were considered as statistically significant. From the total of 384 under five children included in this study, 68(17.7%) were found to be pneumonia positive. A higher prevalence (31%) of pneumonia positive in this finding was observed in age range of 37-59 months. Under–five children from from parents who used firewood and charcoal as source of fuel for cooking were the most pneumonia affected as compared to children whose families use other items as a source of fuel for cooking food. No pneumonia cases were detected among households who were using electric power for food cooking. Under -five years old children who lived in urban area and located on mothers back during cooking were more likely associated with pneumonia than children who lived in rural area and outside the cooking house. Children from low educational status of parents were more affected by pneumonia than Children from high educational status of parents. In this study high prevalence of pneumonia was observed in children from smoker households than children from non-smoker households. Keeping cattle in the living room was an important risk factor for pneumonia positivity among under-five children. Partial breast feeder under-five children were more infected in pneumonia than those who were exclusive breast fed. Children were breast fed less than six months were the most affected in pneumonia than children were breast fed 6 to 12months. Relatively higher prevalence rates of pneumonia were found among children who had history of cough, fast breathing and difficulty in breathing, than those who did not report these clinical manifestations. Children who had tonsillitis in the last two weeks were more likely to develop pneumonia than Children who had no tonsillitis.



**Keywords:** Dangila, Ethiopia, Pneumonia, Prevalence, Risk factors, Under-five children

# 1. INTRODUCTION

## 1.1. Back ground of the Study

Pneumonia is a serious disease that affects alveoli and the bronchioles and resulting difficulty in breathing. It is usually caused by bacteria, viruses, or fungi. In virus and bacteria's it may occur up to 45% in children and 15% in adults. Bacteria are the most common cause of community-acquired pneumonia (CAP), with *streptococcus pneumonia* isolated in nearly 50% of cases, *Homophiles influenza* in 20%, and *Mycoplasma pneumonia* in 3% of cases.( Nair *et al.,* 2011). Common viral infection agents of pneumonia include rhinoviruses, coronaviruses, influenza virus, respiratory syncytial virus (RSV), adenovirus, and Para influenza. Fungal pneumonia is uncommon, but occurs more commonly in individuals with weakened immune systems or other medical problems (Hortal *et al.,* 2014).

The infection of pneumonia causes inflammation in the air sacs of the lungs ,this result a buildup of fluid that makes it hard to breath and it can be a medical emergency, especially among high risk groups like people over 65 and under five years old. Once the infection gets into the lungs, inflammation causes air sacs (alveoli), to fill-up with fluid or pus that can lead to trouble breathing, coughing and coughing up yellow or brown mucus. If the infection fluid buildup get sever enough, it can stop the lungs from doing their job. When the lungs are un able to add oxygen to the blood and remove carbon dioxide at the correct levels, respiratory failure can occure.Typically it affects the lungs, but complication can lead to problems in circulatory system, when the infection spread from the lungs into the blood stream that result septic shock and it causes very low blood pressure and a reduced blood flow to the major body organs. When the organs don't get enough blood and oxygen, they become damaged and eventually shout down (organ failure). It also affects the muscular system of the body in such a way that, as the body tries to fight an infection, weakness of muscle may also occur (Nair *et al.,* 2011; Tramper-Stranders, 2018).

Globally Pneumonia is the leading cause of child mortality from infectious diseases, accounting for approximately 16% of under-five years' old children died and causing more deaths (Walker *et al*., 2013). From this 90–95% of deaths occur in the developing world. Most cases occur in India (43 million), China (21 million) and Pakistan (10 million), with additional high numbers in Bangladesh, Indonesia and Nigeria (6 million each (Rudan *et al.,* 2010). The African Region has the highest burden of global child mortality, 50% of worldwide deaths from pneumonia in this age group. By contrast, less than 2% of these deaths take place in the European Region and less than 3% in the Region of the Americas. More than

90% of all deaths due to pneumonia in children age less than 5 years take place in 40 countries. The incidence and severity of childhood pneumonia was highest in Africa and south East Asia, which accounted for 30% and 39% respectively of the global burden of severe cases. More than 490,000 children under-five died by pneumonia in sub-Saharan Africa (Rudan *et al.*, 2010).

Based on the place and ways of occurrence, pneumonia can be community-acquired, hospital-acquired (nosocomial) and ventilator associated pneumonia and also it can classified by the area of lung affected: lobar, bronchial and acute interstitial pneumonia. Based on signs and symptoms it can classified as non-severe, severe, or very severe. People with infectious pneumonia often have a productive cough, fever accompanied by shaking chills, shortness of breath, sharp or stabbing chest pain during deep breaths, and an increased rate of breathing (WHO, 2017). Deferent risk factors are associated with childhood pneumonia in developing countries including malnutrition, low birth weight, nonexclusive breast feeding for the first 6 months of age and lack of immunization. Besides the above factors, housing condition, passive smoking, maternal education, day care attendance, birth order, and environmental factors such as indoor air pollution, overcrowding, humidity, and outdoor air pollution are also associated with pneumonia infection (Rudan *et al.,* 2010).

The cornerstones of effective treatment for childhood pneumonia are antibiotics and supportive care. Breastfeeding practices, including exclusive breastfeeding during the first six months of life and continued breastfeeding until 24 months of age are critical for reducing the burden of under-five Pneumonia. The protective effect of human milk also against respiratory infection is attributed to its numerous immune-biological component (Lambert, 2013). Community case management of childhood pneumonia reduces pneumonia mortality by 70%. Accumulating evidence suggests that community based use of oral antibiotics for pneumonia may be a feasible and effective strategy for reducing mortality (Rashid *et al.,* 2017). Improved access to health care, immunization, better nutrition, promotion of breast feeding, and improved living conditions contribute to the reduction in incidence of pneumonia and decline in case fatality rates. Improved home ventilation and reduction in exposure to indoor air pollution and cigarette smoke are important strategies to reduce the severity and incidence of childhood pneumonia. Prevention of pneumonia has also been expedited by the introduction of *Homophiles influenza* type b (HIB), pneumococcal conjugate vaccines (PCV) and respiratory syncytial virus (RSV). Effectiveness of *Homophiles influenza type b* (HIB) vaccine in low and middle income countries indicates a reduction of 18% in radiological pneumonia, of 6% in severe pneumonia and of 7% in pneumonia-associated mortality (Gray and Zar, 2010).

## 1.2 Statement of the problem

Pneumonia is a global health concern with high mortality rate among children under- five year's old. It causes nearly 1.2 million in earlier age and it is the most common infectious cause of death in that age group, causing more deaths per year than malaria HIV and measles. The incidence and severity of under-five years old children pneumonia is highest in low income and middle income countries (Jean Monod *et al.,* 2018). In developing countries the greatest burden of the diseases is among under- five year old children. Pneumococcal vaccines (PCVS) could prevent most bacterial pneumonia cases, but 170 million children -under five years in developing countries are unimmunized. One third of children with pneumonia like symptoms do not seek appropriate care. According to UNICEF 2018 report, pneumonia was the biggest killer of children under-five in 2017 and 17% of child deaths in 2018 in Ethiopia (UNICEF, 2018). In Ethiopia, pneumonia is a leading single disease killing under-five years' old children and it is estimated that 3,370,000 children encounter pneumonia annually which contributes to 18% of all causes of deaths killing over 40,000 under-five years old children every year(Walker *et al*., 2013).

The epidemiology of childhood pneumonia varies widely between different regions of the world related to prevalence of risk factors and causative pathogens (Rudan *et al*., 2008). Likewise, varied prevalence rates of under-five pneumonia were reported across different parts of Ethiopia. It was 5.5% in Debre-Berhan district, northeast Ethiopia (Gebretsadik Shibre, 2015), 16.1% in Este town, northwest Ethiopia (Gedefaw Abeje *et al.*, 2014), 17.6% in Boloso Bombe Woreda, southern Ethiopia (Astehun Lenda , 2018), 28.1% in Jimma zone, west Ethiopia (Kenenisa Tegenu ,2018) and 33.5% in Wondo Genet district, Sidama zone, southern Ethiopia (Teshome Abuka *et al*., (2016). As stated in different studies, local factors that are associated to under five pneumonia are comorbidities, maternal age, current parental smoking, over crowdedness, indoor air pollution, maternal education and non- exclusive breast feeding during the first six month of life (Gedefaw Molla and Berhe Resom, 2015).

The majority of studies on pneumonia carried out in developed nation, with only insignificant studies were conducted in Ethiopia. Some variables that was found to be risk of pneumonia in one study may not necessary to be a risk factor of pneumonia in other study, that possible risk factors of under- five years old pneumonia vary across the geographical location. It might be difficult to generalize the result to the other regions outside of the study area. Among under- five years old children, Burden and severity of pneumonia was high in Ethiopia, due to less attention of effective preventive involvements like immunization of a child, lack of good access to care a child and less availability of effective treatment

approaches of pneumonia. The most important cultural gaps about pneumonia infection or other health 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. Pneumonia disease burden a direct health costs related to medical utilizations and the use of prescription drugs, also indirect costs that was related to absenteeism of care givers from their own day to day activity while the patients used more medical care services, particularly inpatient services than non-patient services. Pneumonia is not only the problems of individuals, but it is also equally the problem of health institution and communities at large. Even though improvements were done to prevent pneumonia, little is known about pneumonia and risk factors among under-five children in Ethiopia including study area at the community level. 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).

The study was carried out to fill the above mentioned gaps by assessing the prevalence of pneumonia among under- five year's old children and risk factors in this hospital, and to update the previous knowledge on the same problem.

## 1.3 Significance of the study

The significance of this study was to describe the prevalence of pneumonia and risk factors among under-five year's old children in the study area. It may serves as source information for concerned health care officials to prioritize this health related problem and prevent it. In addition, the information obtained from this study may also important for the governmental and nongovernmental organization to widen their scope on prevention and intervention of under-five years' old pneumonia in order to improve the health status of the community. The result of this study was also thought to give a baseline information for further large scale studies on the same problem and also used to ensure the continuity of variety of care so that healthy pre-school under five years age children were transformed to healthy adolescent.

## 1.4 Objectives of the Study

### 1.4.1 General Objective

- To determine the prevalence of pneumonia and associated risk factors among under-five children in DangilaWoreda, northwest of Ethiopia.

### 1.4.2 Specific Objectives

- To determine the prevalence of pneumonia among under-five children in Dangila primary hospital, northwest Ethiopia.
- To assess the association of pneumonia and potential risk factors among under-five children in Dangila Woreda, northwest Ethiopia.

# 2. LITERATURE REVIEW

## 2.1. Pneumonia

Pneumonia is an acute inflammation of the lower respiratory tract infection and it characterized by an inflammation of the lung, which is caused by bacteria, virus and fungi. It is an acute infection of the lungs when the alveoli are filled with pus and fluid, which makes breathing painful and limits oxygen intake. The most common pathogens that causes pneumonia are *Streptococcus pneumonia*, *Homophiles influenza* type b (Hib), and respiratory syncytial virus (RSV).*Streptococcus pneumonia* is the most common cause of bacterial pneumonia in under five year old children in the developing world. The second most common cause of bacterial pneumonia in children is *Homophiles influenza* type b (Hib), followed by respiratory syncytial virus( RSV) which is the most common cause of viral pneumonia in children under two years (Astehun Lenda, 2018). The populations most at risk for pneumonia are children under five years old, people aged 65 or over, and people with pre-existing health problems.

Pneumonia remains the leading cause of death in children under five worldwide. It accounts for about 1.6 million deaths a year in this age group - 18% of all deaths among children under five. More than 99% of all pneumonia deaths occur in low- and middle-income countries. South Asia and sub-Saharan Africa bear the burden of more than half of the total number of cases of suspected pneumonia among children under five years old worldwide (Rudan *et al., 2015).* Children in low-income countries are nearly 18 times more likely to die before the age of five than children in high-income countries due to pneumonia and other acute infections. For both European regions and the world, the disease burden for pneumonia (caused by pneumococcus, Hib, and respiratory syncytial virus (RSV) is highest in children aged under one year. About 434 779 pneumonia deaths occur in this age group - over 74% of all pneumonia deaths in children aged under five( Lozano, 2012).In Europe, mortality rates for pneumonia are substantially higher in children up to the age of four and in adults aged 75 and over than in most other age groups. In Western Europe the highest mortality rates for pneumonia are in elderly people aged 80 and over (279 deaths per 100 000 people), while in Eastern Europe similar mortality rates for pneumonia exist in infants aged 0 to 6 days (278 deaths per 100 000).

Many effective treatments are available for bacterial pneumonia in children and adults (Kabra *et al.*, 2010). Antibiotics are effective in treating bacterial pneumonia and cannot treat viral pneumonias such as respiratory syncytial virus (RSV) that mainly occurs in infants. However, There are currently no available rapid point-of-care diagnostics to differentiate between bacterial and viral pneumonia. This is a key gap in monitoring the spread of both bacterial and viral pneumonia and in providing appropriate treatment. Pneumococcal vaccines, such as *Homophiles influenza* type b (Hib), conjugate vaccines and polysaccharide vaccines are highly effective in preventing most bacterial pneumonias (Lucero, 2009).

## 2.2 Global Epidemiology and Prevalence of under- five years old pneumonia

Over 100 years ago, William Osler described pneumonia as 'the old man's friend', allowing elderly patients a relatively rapid death. In high-income countries, increasing age is the dominant risk factor for community acquired pneumonia. In the United States, overall incidence in adults is around 2.5 per 1000 persons however, it rise 6.3 and 16.4 per 1000 person per year in adults aged 65–79 and 80 years or older, respectively. Although improved nutrition, social welfare and the availability of immunizations and antibiotics has reduced the burden dramatically. Lung infection remains a significant cause of morbidity and mortality in developed countries, particularly in elderly people and those with chronic disease. International data propose approximately 30% of patients with pneumonia require hospitalization. Pneumonia is the most common associated cause of death in patients with chronic obstructive pulmonary disease (COPD). 50% of children and 20% of adults have colonization of the nasopharynx with *streptococcus pneumonia*(*S. pneumonia*). Organisms are aspirated or aerosolized from the oropharynx or nasopharynx to the alveoli, where they cross the respiratory epithelium and begin the infective process. Influenza remains the predominant viral cause of pneumonia and also predisposes to superimposed bacterial infection, particularly with *streptococcus pneumonia* (*S. pneumonia*) but also with *Staphylococcus aureus* (Grau *et al*., 2014).

Pneumonia is the single largest contributor to child mortality, accounting for almost 28–34% of all under-five deaths globally. Annually, approximately 120–156 million cases of acute lower respiratory infections (ALRI) occur globally, with approximately 1.4 million resulting in death. Of these, pneumonia kills an estimated 1 million children under the age of 5 every year and accounts for 15% of deaths in children less than 5 years of age, with 90–95% of these deaths occurring in the developing world. The majority (2 thirds) of pneumonia episodes in children less than 5 years of age occurs in just 15 countries, with South Asia and Sub-Saharan Africa collectively those accounting the largest burden of more than

half the worldwide total cases of pneumonia in children (Walker *et al*., 2013).India, Pakistan, Nigeria, democratic republic of Congo and Ethiopia are the five highest children pneumonia mortality burden countries in the world. In India, pneumonia killed about 397 million children younger than five years which equates to 23.6% of all deaths. In china, pneumonia is the single leading cause of childhood mortality, contributing to 17.4% of deaths in children less than five years. In Ruanda 18%,Sierra Leone16%, Somali 19%, South Sudan20% and South Africa17%, under five children deaths due to pneumonia (Walker *et al*., 2013).

Pneumonia incidence are highest in South-East Asia (0.36 episodes per child-year), closely followed by Africa (0.33 episodes per child-year) and by the Eastern Mediterranean (0.28 events per child-year (Theodoratou *et al.,* 2010).A study done at Southeast Nigeria indicate that the prevalence of pneumonia was 31.6% and risk factors identified in the study include; inadequate breast feeding, poor immunization status, attendance to day care centers, large family size, poor parental educational statues, parental smoking, living in the urban area and use of biofuels ( Ujunwa and Ezeonu , 2014).

## 2.3 Associated Factors to under-five pneumonia

### 2.3.1 Socio Demographic Characteristics

The risk of pneumonia in children in developing countries is 3 to 6 times higher than other children. Not only outbreak of pneumonia, but also the mortality rate of this disease is higher in developing countries. Mortality due to childhood pneumonia is strongly linked to poverty-related factors such as under nutrition, lack of safe water and sanitation, indoor air pollution, inadequate access to health care, inadequate knowledge, educational status of care givers, age of the child, sex of the child and smoking of cigarette that make worse the problem (Ramezani *et al.,* 2015).A study conduct in Egypt shows that a low family income and residence were significant independent predictive risk factors for community acquired pneumonia (CAP) among under five children (Fathy *et al.,* 2014). Similarly study carried out in Al-Zahraa and Al-Hakeem Hospital, in Iraq showed that high percentage of pneumonia patients (86) was observed in low income (Muhsin *et al.,* 2015).

## 2.4. Environmental Risk Factors

### 2.4.1 Indoor air pollution

Indoor air pollution caused by the use of solid fuel for cooking and heating in households is a major problem in developing countries, particularly in the Sub-Saharan Africa, Asia and South America. In contrast, Indoor air pollution (IAP) is not as such a major problem in the developed countries as they currently use cleaner energy sources. Under- five children exposed to household air pollution caused by burning of unprocessed solid fuels such as wood, charcoal, crop waste and animal dung had double the risk of pneumonia infections compared to children who are not exposed or those from families using cleaner fuels such as electricity(WHO, 2017).

Burning or fuel combustion is the main source of many air pollutants harmful to human health. The most harmful air pollutant for health is fine particulate matter, particles less than 2.5 microns in diameter (PM2.5). The use of alternate fuel sources for cooking and heating is an important contributor to indoor air pollution (IAP) particularly in low and middle-income countries (LMIC). The multiplicative effects of air pollution, from both indoor and outdoor sources and environmental tobacco smoke (ETS) exposures carry the highest burden of child respiratory diseases (Gordon *et al.*, 2014). Environmental tobacco smoke (ETS) combined with other indoor air pollution (IAP), particularly antenatal exposure, affects lung growth that persists through adulthood. There are numerous by-products of combustion, particulate matter (PM), carbon dioxide (CO2), sulfur dioxide (SO2), nitrogen dioxide (NO2), and volatile organic compounds (VOC) are the most commonly assessed by-products of environmental tobacco smoke (ETS) and other combustions (Voynow and Auten , 2015).

The health effect of air pollution is generally dependent on the type of pollutant (Particulate Matter, gas or vapor), concentration of these pollutants in the breathing zone, duration of exposure, and demographic characteristics of the recipients. There are two mechanisms by which Indoor air pollution( IAP) causes diseases such as pneumonia, these are Non-specific mechanisms( air pollutants passing through the air ways adversely affect the mucosal epithelial lining thereby affecting the host mucociliary defensive mechanism against foreign bodies which include filtration and removal of particles by the upper air way), such effects include paralysis of cilia and also irritation of respiratory linings further causes inflammation that could be entry point for viral and bacterial infection. Specific mechanisms (destruction of

immunoglobulin sponsored phagocytosis and cell mediated immunity required to kill organisms capable of living within alveolar macrophages) (Sharma *et al.,* 2015).

Premature deaths in low income countries are due to pneumonia caused by indoor air pollution from solid fuel use. The effect of indoor air pollution on under five children found that the risk of pneumonia among children who are exposed to indoor air pollution from solid fuel combustion increased by 80%. Similarly world health organizations (WHO) study indicate that indoor air pollution strongly associated with pneumonia-related mortality in children. A systematic review of indoor air pollution and pneumonia risk among under five children in developing countries found a significant association with pneumonia morbidity and mortality after adjustment for possible confounders including socioeconomic status, parental education, breastfeeding, malnutrition and cigarette smoke exposure(Sonego *et al.,* 2015).A study was conducted in Rasuwa district of Nepal, indicate that 31.4% of the children under five years of age who lived in household using biomass fuels and use of traditional/open type of cooking stove was suffered from acute lower respiratory infection (ALRI) (Sharma *et al.,* 2015).

**Figure.1** Burning of wood for charcoal production (Photo taken by Solomon Gedif, 2012)

## 2.4.2 Inappropriate sanitation and overcrowded

Most large African cities are overcrowded, due to urban attraction. Little controlled urban growth leads to poor management of solid and liquid wastes produced by cities. This leads to many problems of sanitation. The sanitation in these cities is generally dominated by self-purification works. They often repress wastewater that trickles down in living quarter streets emitting strong foul odors. Moreover, water intended for consumption are very often contaminated because of drinking water connection with the sewage. This fact can cause high health risks and environmental pathologies arising from it are very important (Ramezani *et al.,* 2015). In fact, poor quality waters, poor environmental sanitation (excreta

management, drainage) and poor sanitation contribute much to deteriorating population health. Conditions of poverty include inappropriate sanitation, overcrowded living conditions, lack of clean water and irregular hand washing, they contribute to child pneumonia. Studies suggest that in impoverished communities, regular hand washing can reduce the incidence of child pneumonia (KenenisaTegenu, 2018).

### 2.4.3 Environmental tobacco smoke (ETS) and maternal prenatal smoking (MPS)

Environmental tobacco smoke (ETS) or Secondhand smoke (SHS) occurs in home, at work places, and public places. It is originated from the fuming end of the tobacco product in between puffs, as aside stream smoke (SS), and the smoke that the smoker inhales as a main stream smoke (MS). Other contributors to environmental tobacco smoke (ETS) include minor amounts of smoke that scape during the puff drawing from the burning cone and some vapor phase components that diffuse through the cigarette paper into the environment (Sonego *et al*., 2015). Early life environmental tobacco smoke (ETS) exposure affects lung development and later develops respiratory disease, with the origins of certain adult chronic respiratory conditions beginning in childhood. Life-long lung function paths are influenced by both prenatal and postnatal environmental tobacco smoke (ETS) exposures (Stevenson *et al*., 2016).

Health-damaging exposure to air pollution can start in the womb, when pregnant mothers are exposed. Exposure continues after birth, throughout childhood and into adulthood. Babies born to mothers exposed to high levels of pollution during pregnancy are more likely to experience reduced growth, low birth weight, and preterm birth (Schieve, 2016). Exposure to air pollution throughout infancy and childhood is associated with negative respiratory effects, including greater vulnerability to acute lower respiratory Infections like pneumonia as well as more severe childhood asthma. Half of pneumonia deaths are linked to air pollution. The impact of air pollution at early child hood includes decreased lung growth, reduced lung function, lower respiratory infections including pneumonia and developmental effects, which are sustained through the child's lifetime (Barakat *et al.,* 2012). Long-term exposure to air pollutants are also linked to chronic respiratory effects in adulthood like COPD (chronic obstructive pulmonary disease) and lung cancer as well as cardiovascular disease, cerebrovascular disease, and death (Cohen *et al.*,2017). More studies show that pregnant mothers exposed to elevated levels of particulate matter from either outdoor or household air are more likely give birth to smaller and lighter babies and deliver preterm (Bruce,2013).

Children in homes where solid fuels are burned for cooking and/or heating are more likely to be born at a low birth weight and have stunted growth throughout childhood (WHO, 2017). In Western Pacific region, house hold cigarette smoke exposure is common (70.5%) with 28.7% of childhood pneumonia cases and 44,000 hospitalization events attributed to passive cigarette smoke exposure. According to a study from Ho Chi Minh City, 81% of children hospitalized for pneumonia had household cigarette smoke exposure (Nguyen *et al.,* 2017).

### 2.4.4. Delays in seeking health care

The main delays to get health care services for pneumonia among under five children are due to a lack of their caregiver's recognition of signs and symptoms associated with pneumonia, combined with delay by health care workers in reaching the correct diagnosis and starting appropriate treatment at lower health center, in addition to these, Lack of money, distance, and perception of the illness not being serious were the major reasons for not seeking care. Residence and knowledge were identified as the major predictors of health care seeking practices from health facilities. Maternal behavior 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).

### 2.4.5. Lack of Breast Feeding

Breastfeeding is the biological norm for infant feeding. It is a way for providing ideal and clean food for the purpose of healthy growth and development of infants. Mature breast milk contains nutritional components (protein, fat, carbohydrate, vitamins, minerals and fluid), and on-nutritional components (antimicrobial factors, growth factors, cytokines, anti-inflammatory factors, digestive enzymes, hormones, transporters, and nucleotides. It is also safe and clean that contains many functional components, including live cells and antibodies, which help to protect the infant against many common childhood illnesses. (Lamberti *et al*., 2013). The risk of acute respiratory infection (ARI) is increased by approximately 60% in children who are never breastfed (Lamberti *et al.,* 2013).Suboptimal breastfeeding elevated the risk of pneumonia morbidity and mortality outcomes across age groups. In particular, pneumonia mortality was higher among not breastfed compared to exclusively breastfed infants 0-5 months of age and among not breastfed compared to breastfed infants and young children 6-23 months of age (Lamberti *et al.,* 2013). A study in Northwest Ethiopia indicate that those children who had no

chance to be breast feed were 83 times more likely to be pneumonia than those who were exclusively breast feed(Gedefaw Molla and Berhe Resom ,**2**015**).**

## 2.5 Prevalence Under five Pneumonia in Ethiopia

The prevalence of acute respiratory infection (ARI) among children visited health center were high, from this pneumonia occupied high percent. It is the single leading cause of death among children younger than five years. The world health organization (WHO) report were 389,000 under five deaths, of which 22% were due to (WHO,2017).At Wondo Genet district, Sidama zone, Ethiopia, the prevalence of pneumonia among under-five children was 33.5%. Absence of separate kitchen, absence of window in the kitchen, breast feeding less than one year and children at age range of 2-12 months were identified as determinates of pneumonia (Teshome Abuka, 2016). At Este town Northwest Ethiopia, the overall two weeks prevalence of pneumonia among under-five children was 16.1%. Using charcoal for cooking, carrying the child on mothers back during cooking, keeping cattle inside the main house and living in crowded house were the most important variables found associated with pneumonia among under-five children in the study conducted by (Fekadu Getahun *et al*., 2014.

## 2.6 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, haematogenous 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.*, 1994)

## 2.7 Diagnosis of pneumonia

Currently, the best available method for diagnosing pneumonia is radiography. The chest x-ray is the most commonly performed diagnostic x-ray examination. It produces images of the heart, lungs, airways, blood vessels and the bones of the spine and chest. Since there is very less sensitivity and specificity in physical findings is really necessary to differentiate Pneumonia from other conditions by using chest radiograph for the availability of rapid diagnosis and treatment. Chest x-ray was conducted and it works when a small amount of ionizing radiation passed through the body to create an electronic image on pneumonia patients. The radiographer was instruct patients in positioning from the x-ray; also place patients between the x-ray machine and the imaging device that captures the x-rays was transmitted through specific body parts of patients and their body shield by a lead apron to reduce the risk of unnecessary exposure to radiation. In radiography, the anatomical orientation of the patient is variable and therefore relies on correct anatomical markers on the resultant image to make image interpretation possible. The entry and exit point of the radiation beam depends on whether a projection is antero - posterior (AP) or poster- anterior (PA). When an X-ray beam enters the patient anteriorly and exits posteriorly, this is an AP projection and when an X-ray beam enters the patient posteriorly and exits anteriorly, this is a PA projection. Chest x-ray were performed to show a white patch area on the lung which indicates pneumonia and clinical features also apply as a method of diagnosis (Cherian *et al*., 2005)

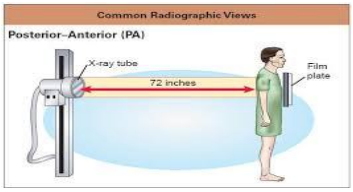


Figure 2. Posterior Anterior Projection Of Chest X-Ry (PA)

### 2.7.1. Some common uses of the procedure of chest x-ray

The chest x-ray is performed to evaluate the lungs, heart and chest wall. A chest x-ray is typically the first imaging test used to help diagnose symptoms such as, breathing difficulties a bad or persistent cough chest pain or injury fever. Physicians use the examination to help diagnose or monitor treatment for conditions such as: pneumonia heart failure and other heart problems emphysema lung cancer positioning of medical devices fluid or air collection around the lungs other medical conditions. A chest x-ray requires no special preparation. Simply by remove the clothes and wear a gown during the exam, by

remove jewelry, eye-glasses and any metal objects or clothing that might interfere with the x-ray images. The equipment typically used for chest x-rays consists of a wall-mounted, box-like apparatus containing the x-ray film, or a special plate that records the image digitally. An x-ray producing tube is positioned about six feet away. The equipment may also be arranged with the x-ray tube suspended over a table on which the patient lies. X-rays are a form of radiation like light or radio waves. X-rays pass through most objects, including the body. Once it is carefully aimed at the part of the body being examined, an x-ray machine produces a small burst of radiation that passes through the body, recording an image on photographic film or a special detector. Different parts of the body absorb the x-rays in varying degrees. Dense bone absorbs much of the radiation while soft tissue, such as muscle, fat and organs, allow more of the x-rays to pass through them. As a result, bones appear white on the x-ray, soft tissue shows up in shades of gray and air appears black. On a chest x-ray, the ribs and spine will absorb much of the radiation and appear white or light gray on the image. Lung tissue absorbs little radiation and will appear dark on the image. Most x-ray images are digital files that are stored electronically. These stored images are easily accessible for diagnosis and disease management (Cherian *et al*., 2005).

There were procedures applied in the study hospital typically, two views of the chest are taken, one from the back and the other from the side of the body as the patient stands against the image recording plate. Patients who cannot stand were positioned lying down on a table for chest x-rays. The technologists were walk into the next room to activate the x-ray machine. When the examination is complete, you may be asked to wait until the radiologist determines that all the necessary images have been obtained. The entire chest x-ray examination, from positioning to obtaining and verifying the images, is usually completed within 15 minutes. Additional views may be required within hours, days or months to evaluate any changes in the chest. A radiologist, a physician specifically trained to supervise and interpret radiology examinations, were analyze the images and send a signed report to the primary care or referring physician. The results of a chest x-ray can be available almost immediately for review by the physician. Follow-up exams were needed, because a potential abnormality needs further evaluation with additional views or a special imaging technique (Cherian *et al*., 2005).

Figure 3.X-ray machine (Adopted from Dangila Primary Hospital X-ray room, 2012)

## 2.7.2. Interpretation of chest x-ray during diagnosis of under-five years' old pneumonia infection

The chest X-ray were the most available and common imaging modality for the diagnosis of childhood pneumonia. Computerized approaches to the interpretation of pediatric chest X-ray had the potential to overcome the barriers for the interpretation of chest X-ray findings in under five children with pneumonia. The most important Systematic approach during reading x-rays were represented by six letters with their description( ABCDEF) Airway ,Bones and soft tissue ,Cardiac silhouette, Diaphragms, Effusions, Fields(Lung fields). There are important radiological findings (appearance) useful for interpretation of chest x-ray in relation to under five pneumonia, these are:

**1. Pleural effusion:** This refers to the presence of fluid in the pleural space between the lung and chest wall. In most cases those were seen at the costo-phrenic angle adjacent to the lateral chest wall (Cherian *et al*., 2005).

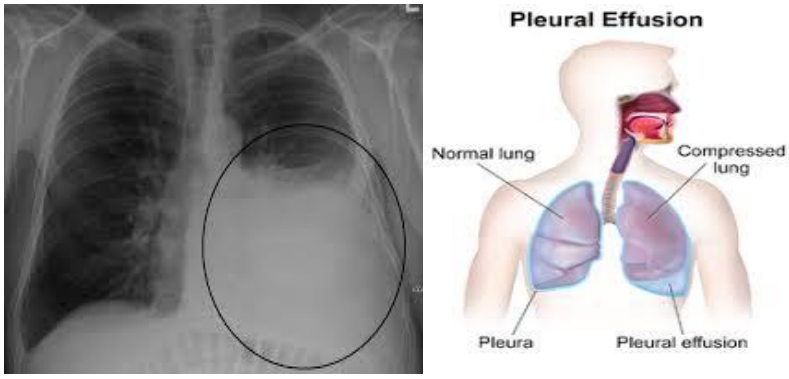


Figure 4 .Pleural Effusion (Adopted from Dangila Primary Hospital X-Ray Room)

**2.Consolidation**: These refers to alveolar infiltrate encompass an entire lobe or large segment, fluffy, mass-like, cloud-like density, erases heart and diaphragm borders (silhouette sign). The loss of clarity of a structure, such as the hemi diaphragm or heart border, suggests that there were adjacent soft tissue shadowing, such as consolidated lung. Different densities and colors were seen on chest x-ray, air (black), fat or a layer between soft tissue (bright black), soft tissue (shades of gray),bone (white) and metal(bright white) (Cherian *et al*., 2005).

**3. Air bronchogram**: This appear on a CXR(chest x-ray), when something other than air present in the alveoli adjacent to the bronchus making the air filled bronchus more visible than normal that something is usually fluid and this most commonly due to pneumonia (Cherian *et al*., 2005).

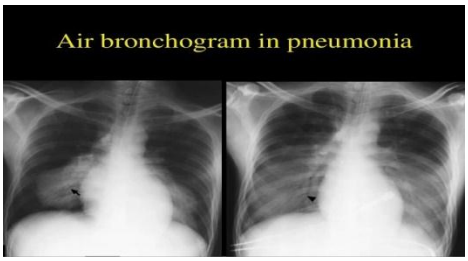


Figure 5. Air bronchogram in pneumonia

**4. Lung collapse:** This refers to collapse of the lung due to decrease in the amount of air in the alveoli. The remaining air was gradually absorbed, and the lung loses its volume. Mucous plugging (mucus accumulates in the lungs can plug up or reduce air flow in the larger or smaller air ways. In the smallest air ways, mucus plugs lead to collapsed air sacs or alveoli. If enough alveoli were blocked a child oxygen levels were negatively impacted over time. If the mucus plugs were in the larger, upper air ways, a child may feel short of breath or like they are shocking), fluid retention in major airways, inhaled foreign body were the most common reasons for a lung collapse(UNICEF,2018).

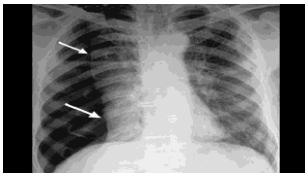

Figure 6 **.**Lung Collapsed Represented by Arrows (Adopted from Dangila Primary Hospital X-Ray Room, 2012)

## 2.8 Treatment of under- five children with pneumonia

### 2.8.1 Antibiotic treatments

Children suffering from pneumonia were treated properly and effectively with antibiotics. The most common antibiotics currently recommended for under five children were, Azithromycin, Amoxicillin, Ampicillin, Ceftriaxone, Antipyretic and Gentamicin. (Cherian *et al*., 2005).

Figure 7.Pneumonia infected children treated with antibiotics (Photo taken by Solomon Gedif, 2012

### 2.8.2 Oxygen therapy

Oxygen is essential for all vital organs in our body. It is the first treatment be given in any emergency condition. Different types of oxygen delivering systems were available and necessary to choose depending on condition of individual patients. As each drug has its own adverse effect, oxygen therapy also had some risks (High concentrations of oxygen might suppress their respiratory drive) and Patients with chronic obstructive disease might reduce the respiratory drive, resulting in respiratory depression. However in any crisis condition, it is the lifesaving drug, therefore should never prevent oxygen administration since lifesaving were the first priority for health professionals. Health workers at pediatric room were understood important Emergency signs as indications for oxygen administration include, obstructed or absent breathing, patients in respiratory or cardiac arrest, Respiratory distress, Chest pain, when oxygen saturation is less than 94%, convulsions, sunken eyes, coma or seriously reduced level of consciousness, and major multiple system shock or isolated chest trauma. Respiratory failure is one of the main indications for oxygen therapy. Respiratory failure is the inability to maintain adequate gas exchange and is characterized by abnormal arterial blood concentrations of oxygen and, in certain cases, carbon dioxide (CO2) (Thomson *et al*., 2002).

Nasal prongs were the preferred method of delivering oxygen to children under five years of age with hypoxemia who require oxygen therapy. Nasal prongs are a device that ends in two short tapered tubes (about 1 cm in length) designed to lie just within the nostrils, Standard flow rates through nasal prongs are 0.5–1 L/min for neonates, 1–2 L/min for infants and 1–4 L/min for older children. When nasal prongs were not available, nasopharyngeal catheters could be used as alternative delivery methods. A nasal catheter is a thin, flexible tube that is passed into the nose and ends with its tip in the nasal cavity Better oxygenation were achieved with a lower oxygen flow than with nasal prongs (Thomson *et al*., 2002).

Figure 8 .Pneumonia infected children treated with Oxygen therapy (Photo taken by Solomon Gedif, 2012)

Oxygen administration were stopped, at least once each day, children who were clinically stable (have no emergency signs and oxygen saturation greater than 90%) should be disconnected from oxygen for 10–15 min and carefully examined for changes in clinical signs and oxygen saturation, to assess whether supplemental oxygen is still required. Supplemental oxygen were best interrupted first thing in the morning, when there were likely to be adequate pediatricians to observe the child throughout the day. If supplemental oxygen were discontinued in the late afternoon, the presence of few overnight staff and the oxygen desaturation that sometimes occurs during sleep might increase the risk for unrecognized hypoxemia during the night (Thomson *et al*., 2002).

## 2.9 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).

# 3. MATERIALS AND METHODES

## 3.1 Study Design and study period

A cross-sectional study design was applied to determine prevalence of pneumonia and associated risk factors among under- five years old children attending Dangila primary Hospital, Dangila, north west Ethiopia. This hospital based study was conducted from September 2019 to June 2020.

## 3.2 Description of the Study Area

Dangila is one of the $10^{th}$ Woredas in Awi zone, northwestern Ethiopia. It is 486km away from capital city of Ethiopia, Addis Ababa and 78 km away from the administrative center of the region, Bahir- Dar. This town has latitude and longitude of 11°16′N and 36°50′E respectively, coordinates with an elevation of 2137 meters above sea level. It is bordered on the south by Faggeta- Lekoma, on the southwest by Guangua, on the northwest by the Jawi, and on the northeast by the Mirab -Gojjam Zone. It has one primary hospital (Dangila Primary Hospital), six health centers, 31health posts and seven private clinics [Dangila City Health Bureau, Health infrastructure in Dangila city, unpublished data). The total number of health professionals in Dangila primary hospital was 78, among these 34 males and18 female were nurses, 14 males and 3 females were general practitioners, 2 males were specialists and 7 males were laboratory technologists,(Source Dangila primary hospital Human resource administration bureau, 2012). The topography of Dangila- woreda contains various land forms, like mountainous (11%), plains (58%) and valleys and caves (1%), swampy areas (0.05%) and others (29.95%). It has altitude ranging from 1700m to 2370m above sea level (Dangila Woreda Rural Development and Agricultural Office, 2017). The annual average temperature of the Woreda ranges between $16^{o}$C and $30^{o}$C and it receives about 1700mm annual rain fall. This shows that the Woreda is entirely located in woina -dega climatic zones (Dangila-Woreda Agricultural office and Rural Development office and Dangila Branch Meteorology Agency, 2017).The total population of Dangila -Woreda is about 231,210 of which 112,619 are males and 118, 591 are females. 37,603 males and 40,000 females (total 77,603) are urban residents and 75,016 males and 78,591 females (total 153,607) rural inhabitants (Source Dangila woreda Agricultural and Rural development Office (2017).

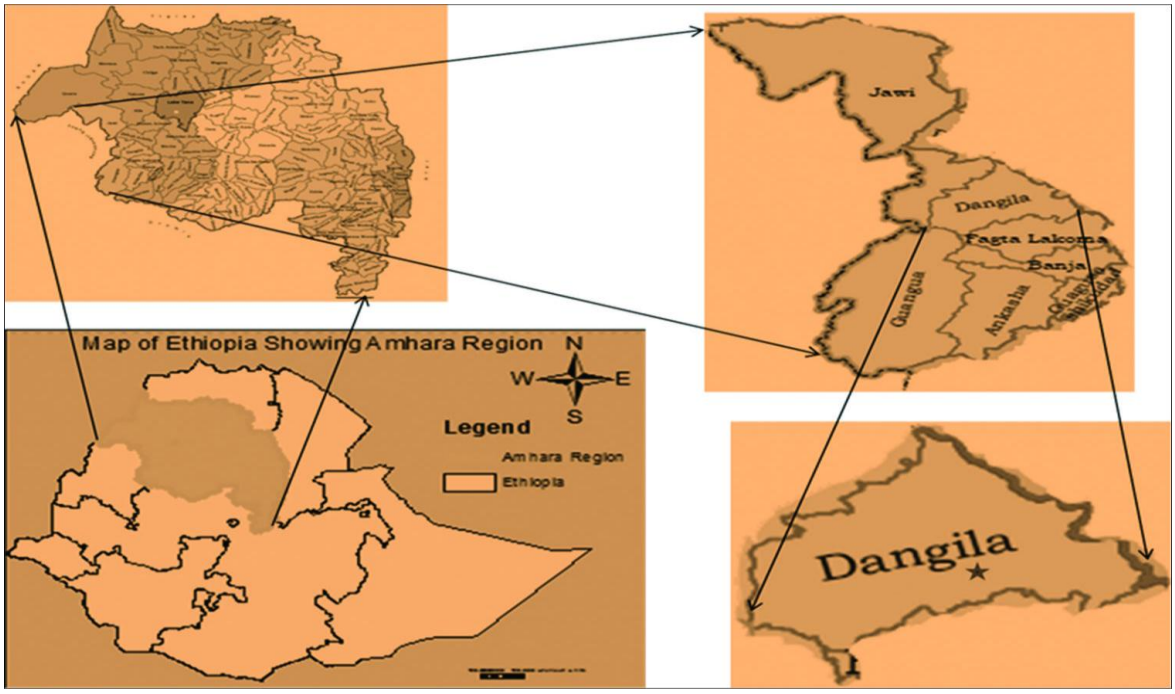


Figure.9 The Map of study area (source; FDRE CSA, 2007)

## 3.3 Source and the study population

The source of population of this study were all under five children who visited Dangila primary Hospital during the study period while under five children who visited the hospital during data collection period were considered as the study populations.

## 3.4 . Inclusion and Exclusion criteria

All under-five children whose mothers/caregivers/ consented to participant in this study were included whereas severely sick children and those whose mothers or caretakers refused to participate were excluded from this study.

## 3.5. Variables

### 3.5.1 Independent variables

Educational status, family size, income, residence, occupation, type of fuel used for cooking, age, indoor air pollution, poor ventilation, overcrowded, tobacco smoke exposure, immunization and breast feeding status of the child were considered as independent variables

### 3.5.2 Dependent Variable

Under five years old children Pneumonia infection (Positive/ Negative) was the dependent variable in this study.

### 3.5.3 Operational Definitions

**Air bronchogram**-This appear on a CXR(chest x-ray), when something other than air present in the alveoli adjacent to the bronchus making the air filled bronchus more visible than normal that something is usually fluid and this most commonly due to pneumonia.

**Alveolar infiltrate**- is alveoli filled with fluid.

**Atelectasis**- is volume loss as air is absorbed from lung tissue, usually the lung tissue collapses.

**Consolidation-**are especially dense, often homogeneous, confluent alveolar infiltrate sometimes may encompass an entire lobe or large segment, fluffy, mass-like, cloud-like density, erases heart and diaphragm borders (silhouette sign); often contains air bronchograms.

**Infiltrate**- is any pathologic density in the lung.

**Pleural effusions-** are fluid collecting in the pleural space around the lung, seen as a dense rim (the same density as the chest-wall muscles) interposed between the lung and the ribs (diagram).

## 3.6. Sampling method and Sample size determination

The study participants were selected using simple random sampling method from a registry of under five year old children admitted to Dangila primary hospital at the time of data collection. The sample size of the study was determined using single population proportion formula as described in Daniel, (1999): n= $z^2p\ (1\text{-}p)/d^2$ where, n; sample size, Z; statistics for the level of confidence of 95% =1.96, p; expected prevalence for 0.5 and d; precision or smaller error of estimate 0.05. So n= $(1.96)^2(0.5*0.5)/(0.05)^2$=384. Since similar study was not done and reported from Dangila the study area, hence prevalence (P) was taken as 0.5 (50%). To compensate the possible dropouts, 5% was added to the calculated sample size thus the total sample size was 403.

## 3.7. Data collection procedures

### 3.7.1 Questionnaire survey

A well-structured questionnaire was fist prepared in English language and then translated in to local language Amharic. Prior to administration of the questionnaire, the main purpose of the study was explained to the participants. Then, every child's mother / caregiver was invited to take part in this study and those who agreed and voluntary signed on the prepared consent form. Finally, the structured questionnaire was used to collect data from every mothers/caregivers of the children through an interview on different variables. The type of data gathered included socio-demographic, environmental characteristics, nutrition and past co-morbidity related and signs and symptom related characteristics of the study subjects. Each participant was assigned with a specific code number.

## 3.8. Detection methods of Pneumonia

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

### 3.8.1 Clinical Diagnosis

Clinically under five years old 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.

### 3.8.2 The procedure of radiological diagnosis

- Opening (warm up) of the x-ray machine.
- The machine will be made ready before children enter to the x-ray room.
- Collimation the machine to restrict the x-ray beam to a given area of interest.
- The patients will be instructed to remove objects that are metal in nature like jewelry, necklaces, eye-glasses that may interfere with the x-ray images or to avoid an artifact (an unobstructed view of the area of interest).
- Removing clothes and wearing a gown or protective garment like lead apron during the exam.
- The patient will standing up Posterior Anterior (PA) position to the detector to view image from the front, face-to-face.

- The patients (children) will be asked to perform deep inspirations to display more of the lungs and as it result in better overall image.
- If a child is unable to respond to instruction to perform inspiration, radiologist waits until a child performs.
- If child is unable to stand by her or himself, parents/guardian holds them by wearing lead apron.
- People will be freed from the x-ray room and the door will be closed.
- When the radiologist confirms that all the above steps are properly followed, then part patient's body-the chest will be exposed to the x-ray and image will be taken.
- If poor images were taken out of the interest, it could be cut in the computer that the image displays.

## 3.9. Data processing and analysis

The data gathered though questionnaire and laboratory diagnosis were first checked for completeness and then coded and entered into computer and analyzed using SPSS 20.0 version statistical package. Descriptive statistics were performed to describe the study population in relation to dependent and independent variables. The strength of association between dependent and independent variables was assessed using binary logistic regression analysis. Independent variables showing statistically significant associations with the outcome variable in univariate analysis at $p < 0.25$ were selected and subjected to stepwise multiple logistic regression models to determine independent risk factors of pneumonia. A $p$ value < 0.05 was considered statistically significant (Bursac *et al.,* 2008).

## 3.10. Ethical Consideration

Ethical clearance for the study was obtained from Research Ethical Committee of Postgraduate, Research and community service office, Science College, Bahir-Dar University. A letters of support was written to Dangila primary Hospital for data collection. The participants were informed that their failure to participate in the study were not result in any form of penalty and assured that they can quit from the study at any time they want.

## 3.11. Reliability and Validity

In order to make this study more reliable and valid, semi structured questionnaires used in formerly conducted epidemiological studies were adopted after minor amendment for data collection in this study. Uncertainty and problem expressed by participants in understanding of any of the items in the questionnaire, their comments and feedbacks were noted and considered in the modification of the final questionnaire.

# 4. RESULT

## 4.1. Socio demographic characteristics of the study subjects

A total of 384 under five children attending pediatric ward at Dangila primary hospital were included in the study so as to determine the prevalence of under-five pneumonia and risk factors. Their care givers was interviewed and the remaining 19 (5% of 384)of study subjects were excluded from the study because they were involuntary to participate and to give information during interview. Among the 384 study subjects the majority of the study participants 275 (71.6%) were rural dwellers whereas only 109 (28.4%) were urban dwellers. Concerning the educational status, 42(10.9%) of mothers and 23(6.0%) of fathers were illiterate. Among the interviewed mothers, the majority 62(16.1%) were housewives. In terms of paternal occupation, 85(22.1%) mothers were daily laborers and 106 (27.6%) of fathers were government employees, 59(15.4%) were farmers, 85 (22.1%) were merchants and 87 (22.7%) were daily laborers. More than half 234 (60.9% %) of the children were males and 150(39.1 %) were females and majority of mothers, 113(29.4 %) and fathers, 149 (38.8%) attended technical (vocational) education respectively. One hundred eighty four (47.9%) of children in this study were in the age group of 13-36 months, 152(39.6%) and 48 (12.5%) were in the age group of 1-12 months and 37-59 months respectively (Table 1).

**Table. 1** Socio demographic characteristics of study subjects, visiting pediatric ward Dangila primary hospital north west of Ethiopia (N =384)

| Variables | Category | Frequency | Percent (%) |
|---|---|---|---|
| **Sex of children** | Male | 234 | 60.9% |
| **Age of children** | Female | 150 | 39.1% |
| | Total | 384 | 100% |
| | 1-12 month | 152 | 39.6% |
| | 13-36 month | 184 | 47.9% |
| | 37-59 month | 48 | 12.5% |
| **Residence** | Rural | 275 | 71.6% |
| | Urban | 109 | 28.4% |
| | Total | 384 | 100% |
| **Educational status of mother** | Illiterate | 42 | 10.9% |
| | Primary | 60 | 15.6% |
| | Secondary | 88 | 22.9% |
| | Technical (Vocational) | 113 | 29.4% |
| | Higher Level | 81 | 21.1% |
| | Total | 384 | 100% |
| **Educational status of father** | Illiterate | 23 | 6.0% |
| | Primary | 39 | 10.2% |
| | Secondary | 73 | 19.0% |
| | Technical(Vocational) | 149 | 38.8% |
| | Higher Level | 100 | 26.0% |
| | Total | 384 | 100% |
| **Occupation of mother** | House Wife | 71 | 18.5% |
| | Merchant | 74 | 19.3% |
| | Government Employee | 113 | 29.4% |
| | Private Employee | 41 | 10.7% |
| | Daily Laborer | 85 | 22.1% |
| | Total | 384 | 100% |
| **Occupation of father** | Farmer | 59 | 15.4% |
| | Merchant | 85 | 22.1% |
| | Government Employee | 106 | 27.6% |
| | Private Employee | 47 | 12.2% |
| | Daily Laborer | 87 | 22.7% |
| | Total | 384 | 100% |

## 4.2 The association of Socio-demographic factors and pneumonia prevalence among under- five children attending Dangila primary hospital

From the total of 384 under five children who attended Dangila primary hospital, 68(17.7%) were pneumonia-positive, among these, the majority 15(31%) were in the age group of 37-59 months followed by 35 (19%) in the age groups of 13-36 months old and 18(12%) in the age groups of 1-12 months old were pneumonia positive. Concerning residence, more (23%) under-five pneumonia cases were observed in children from urban setting than children from rural residence (16%). The residence of the children was not statistically significant.

Pneumonia positivity was significantly associated with the educational status of mothers and fathers ($\chi^2$=10.785, 14.228/, p=0.029, 0.007) respectively. Significantly higher 19%, 21% and 26% under-five pneumonia were recorded among the children whose mothers' educational statuses were vocational, illiterate and secondary, respectively. Similarly, higher rates, 22% and 29%, of pneumonia were observed among children whose fathers attended higher and secondary education, respectively. In Chi square analysis, age of the children was also significantly associated with the status of pneumonia among under-five children ($\chi^2$=9.847/, p=0.007). The highest (31%) percentage of pneumonia was observed among children of 37-59 months age category as compared to younger age categories. However, the other socio-demographic variables including, sex, residence, and occupational status of children's fathers and mothers did not demonstrate significant association with pneumonia positivity (Table 2).

**Table 2**. The association between Socio-demographic factors and pneumonia prevalence among under- five children in Dangila hospital, September 2019-june, 2020

| Variables | Category | Total n (%) | Pneumonia prevalence Positive n(% ) | negative n(% ) | $\chi^2$ | P-value |
|---|---|---|---|---|---|---|
| **Sex of child** | Male | 234(60.9%) | 36(15%) | 198(85%) | 2.220 | 0.14 |
| | Female | 150(39.1%) | 32(21%) | 118(79%) | | |
| **Age of child in months** | 1-12 months | 152(39.6%) | 18(12%) | 134(88%) | 9.847 | 0.01* |
| | 13-36 months | 184(47.9%) | 35(19%) | 149(81%) | | |
| | 37-59 months | 48(12.5%) | 15(31%) | 33(69%) | | |
| **Residence** | Rural | 275(71.6%) | 43(16%) | 232(84%) | 2.854 | 0.091 |
| | Urban | 109(28.4%) | 25(23%) | 84(77%) | | |
| **Educational status of mother** | Illiterate | 42(10.9%) | 9(21%) | 33(79%) | 10.785 | 0.03* |
| | Primary | 60(15.6%) | 6(10%) | 54(90%) | | |
| | Secondary | 88(22.9%) | 23(26%) | 65(74%) | | |
| | Technical | 113(29.4%) | 22(19%) | 91(81%) | | |
| | Higher level | 81(21.1%) | 8(10%) | 73(90%) | | |
| **Educational status of father** | Illiterate | 23(6.0%) | 1(4%) | 22(96%) | 14.228 | 0.01* |
| | Primary | 39(10.2%) | 3(8%) | 36(92%) | | |
| | Secondary | 73(19.0%) | 21(29%) | 52(71%) | | |
| | Technical(vocational ) | 149(38.8%) | 21(14%) | 128(86%) | | |
| | Higher level | 100(26.0%) | 22(22%) | 78(78%) | | |
| **Occupation of mother** | House wife | 71(18.5%) | 11(15.5%) | 60(84.5%) | 8.443 | 0.133 |
| | Merchant | 74(19.3%) | 7(9%) | 67(91%) | | |
| | Government employee | 113(29.4%) | 27(24%) | 86(76%) | | |
| | Private employee | 41(10.7%) | 7(17%) | 34(83%) | | |
| | Daily laborer | 85(22.1%) | 16(19%) | 69(81%) | | |
| **Occupation of father** | Farmer | 59(15.4%) | 10(17%) 8(9%) | 49(83%) | 8.965 | 0.110 |
| | Merchant | 85(22.1%) | | 77(91%) | | |
| | Government employee | 106(27.6%) | 22(21%) | 84(79%) | | |
| | Private employee | 47(12.2%) | 6(13%) | 41(87%) | | |
| | Daily laborer | 87(22.7%) | 22(25%) | 65(75%) | | |

## 4.3 Environmental factors and pneumonia prevalence among under- five children attending Dangila primary hospital

In this analysis, only the type of fuel used for cooking food by the households was significantly associated with the prevalence of pneumonia ($p< 0.5$). Under–five children belonging to households who used wood as source fuel for cooking were the most (23%) pneumonia affected followed by 19% and 13% pneumonia cases in children of users of charcoal and animal dung, respectively. However, no pneumonia cases were detected among households who were using electric power for food cooking. However, the variables place of cooking food, presence or absence of cigarette smoker in the family, presence or absence of window in the kitchen, location of the child during cooking, keeping cattle in the living room and family size were not significantly associated with the prevalence of pneumonia (Table3).

**Table 3**. Environmental factors and pneumonia prevalence among under- five children

| Variables | Category | Total | - Pneumonia prevalence | | | |
|---|---|---|---|---|---|---|
| | | n (%) | Positive n(% ) | negative n(% ) | $\chi^2$ | P-value |
| **Type of fuel** | Wood | 200 (52.1%) | 45(23%) | 155(77%) | 12.835 | 0.012* |
| | Charcoal | 80(20.8%) | 15(19%) | 65(81%) | | |
| | Animal dung | 53 (13.8%) | 7(13%) | 46(87%) | | |
| | Kerosene | 20 (5.2%) | 1(5%) | 19(95%) | | |
| | Electricity | 31(8.1%) | 0 | 31(100%) | | |
| **Place of cooking** | kitchen | 278 (72.4%) | 50(18%) | 228(82%) | 0.098 | 0.952 |
| | Living room | 106(27.6%) | 18(17%) | 88(83%) | | |
| **Is there any cigarette smoker in the family?** | Yes | 23(6.0%) | 6(26%) | 17(74%) | 1.179 | 0.278 |
| | No | 361(94.0%) | 62(17%) | 299(83%) | | |
| **Kitchen has window** | Yes | 202(52.6%) | 30(15%) | 172(85%) | 2.387 | 0.122 |
| | No | 182(47.4%) | 38(21%) | 144(79%) | | |
| **Where do you keep your child during cooking** | On mother's back | 183(47.7%) | 38(21%) | 145(79%) | 2.242 | 0.134 |
| | Outside the cooking house | 201(52.3%) | 30(15%) | 171(85%) | | |
| **Do you keep cattle in the living room** | Yes | 64(16.7%) | 14(22%) | 50(78%) | 0.915 | 0.339 |
| | No | 320(83.3%) | 54(17%) | 266(83%) | | |
| **Family size** | <5 | 129(33.6%) | 20(16%) | 109(84%) | 0.648 | 0.421 |
| | ≥5 | 255(66.4%) | 48(19%) | 207(81%) | | |

## 4.4. Nutrition, immunization and past co-morbidity related factor and pneumonia prevalence among under- five children attending Dangila primary hospital

Slightly higher 8(22%) pneumonia positive cases were observed among partial breast fed under five children than those who were exclusive breast feeders 60(17%), but the association between prevalence of pneumonia and breast feeding status was not statistically significant. Besides, under- five children who were breast fed for less than six months were the most (22%) affected by pneumonia than those who were breast fed for six to 12 months (16%) and for more than one year (18%). Comparatively higher prevalence (18%) of pneumonia was detected among vaccinated children than unvaccinated ones (13%). Children who had tonsillitis in the previous last two weeks were more infected than those who did not present tonsillitis. Overall, pneumonia positivity was not significantly associated with the status and duration of breastfeeding, statuses of vaccination and tonsillitis in the studied under-five children ($\chi 2$=0.430, 0.521, 0.152, 1.368), p=0.512, 0.771, 0.697, 0.242) respectively (Table 4).

**Table 4.** The association between Nutrition, immunization and past co-morbidity related factor and pneumonia prevalence in Dangila hospital, September 2019-june, 2020

| Variables | Category | Total n(%) | Pneumonia-prevalence | | $\chi^2$ | P-value |
|---|---|---|---|---|---|---|
| | | | Positive n(% | n(%)negative | | |
| **Breast feeding status during the first 6-months of life** | Partial breast feeding | 37(9.6%) | 8(22%) | 29(78%) | 0.430 | 0.512 |
| | Exclusive breast feeding | 347(90.4%) | 60(17%) | 287(83%) | | |
| **Duration of breastfeeding** | < 6 months | 37(9.6%) | 8(22%) | 29(78%) | 0.521 | 0.771 |
| | 6 to 12 months | 104(27.1%) | 17(16%) | 87(84%) | | |
| | > a year | 243(63.3%) | 43(18%) | 200(82%) | | |
| **Has your child vaccinated for pentavalent (penta 1, penta 2, penta3, polio, vitamin A, measles)?** | Yes | 376(97.9%) | 67(18%) | 309(82%) | 0.152 | 0.697 |
| | No | 8(2.1%) | 1(13%) | 7(87%) | | |
| **Did your child develop tonsillitis in the last two weeks?** | Yes | 61(15.9%) | 14(23%) | 47(77%) | 1.368 | 0.242 |
| | No | 323(84.1%) | 54(17%) | 269(83%) | | |

## 4.5. The association of Signs and symptom related characteristics of study subjects and pneumonia prevalence in the study area.

Relatively higher prevalence rates of pneumonia, (18%), (19%) and (20%) were found among children who had history of cough, fast breathing , and difficulty in breathing, respectively than those who did not report these clinical manifestations. Similarly, slightly elevated cases of pneumonia were detected in under five children who complained vomiting (22%), loss of appetite (23%), and convulsion (25%) than those who did not present these sign symptoms. However, no statistically significant associations were demonstrated between the prevalence of pneumonia and all of the potential sign and symptom related variables analyzed (P> 0.05) (Table 5).

**Table 4** Signs and symptom related characteristics of study subjects and pneumonia prevalence in Dangila hospital, September 2019-june, 2020

| Variables | Category | Total n (%) | Pneumonia Prevalence | | $\chi^2$ | P-Value |
|---|---|---|---|---|---|---|
| | | | Positive n(%) | negative n(% | | |
| **History of cough** | Yes | 272(70.8%) | 50(18%) | 222(82%) | 0.291 | 0.590 |
| | No | 112(29.2%) | 18(16%) | 94(84%) | | |
| **Difficulty of breathing** | Yes | 263(68.5%) | 52(20%) | 211(80%) | 2.439 | 0.118 |
| | No | 121(31.5%) | 16(13%) | 105(87%) | | |
| **Fast breathing** | Yes | 299(77.9%) | 58(19%) | 241(81%) | 2.646 | 0.104 |
| | No | 85(22.1%) | 10(12%) | 75(88%) | | |
| **Vomiting** | Yes | 37(9.6%) | 8(22%) | 29(78%) | 0.430 | 0.512 |
| | No | 347(90.4%) | 60(17%) | 287(83%) | | |
| **Chest wall in drawing** | Yes | 247(64.3%) | 44(18%) | 203(82%) | 0.005 | 0.942 |
| | No | 137(35.7%) | 24(18%) | 113(82%) | | |
| **Convulsion** | Yes | 32(8.3%) | 8(25%) | 24(75%) | 1.274 | 0.259 |
| | No | 352(91.7%) | 60(17%) | 292(83%) | | |
| **Loss of appetite** | Yes | 43(11.2%) | 10(23%) | 33(77%) | 1.023 | 0.312 |
| | No | 341(88.8%) | 58(17%) | 283(83%) | | |

## 4.6. Binary logistic regression analysis of Socio-demographic factors and pneumonia prevalence among under- five children

The risk of under-five pneumonia was elevated among the male than the female subjects (COR=1.49). The age group 1-12 months was 3.38 times (COR=3.38, 95%CI, 1.545, 7.411, p< 0.001) at high risk of pneumonia than age 37-59 months. The risk of developing of pneumonia was 6.20, 3.38 and 1.71 times higher among under-five children whose fathers were illiterate, attained primary and vocational school, respectively. Likewise, under-five children with occupationally farmer, daily laborer, and merchant fathers were at 1.65, 2.31 and 3.25 times more likely to develop pneumonia as compared to children whose fathers were government employee (Table 6).

**Table 6.** Binary logistic regression analysis of Socio-demographic factors and pneumonia prevalence among under- five children

| Variables | category | Pneumonia Status | | Total | COR | 95% CI | | p-value |
|---|---|---|---|---|---|---|---|---|
| | | +ve | -ve | | | Lower | Upper | |
| **Sex of child** | Male | 36 | 198 | 234 | 1.49 | 0.880 | 2.529 | 0.13 |
| | Female | 32 | 118 | 150 | 1:00 | | | |
| **Age in** | 1-12 | 18 | 134 | 152 | 3.38 | 1.545 | 7.411 | 0.001* |
| **months** | 13-36 | 35 | 149 | 184 | 1.93 | 0.949 | 3.947 | 0.06 |
| | 37-59 | 15 | 33 | 48 | 1:00 | | | |
| **Residence** | Rural | 25 | 84 | 109 | 0.62 | 0.358 | 1.082 | 0.09 |
| | Urban | 43 | 232 | 275 | 1:00 | | | |
| **Educational** | Illiterate | 9 | 33 | 42 | 0.40 | 0.142 | 1.134 | 0.08 |
| **status of** | Primary | 6 | 54 | 60 | 0.98 | 0.323 | 3.009 | 0.98 |
| **mothers** | Secondary | 23 | 65 | 88 | 0.31 | 0.130 | 0.740 | 0.001* |
| | Vocational | 22 | 91 | 113 | 0.45 | 0.191 | | 0.07 |
| | Higher education | 8 | 73 | 81 | 1:00 | 1.077 | | |
| **Educational** | Illiterate | 1 | 22 | 23 | 6.20 | 0.792 | 48.642 | 0.08 |
| **status of** | Primary | 3 | 36 | 39 | 3.38 | 0.951 | 12.043 | 0.06 |
| **fathers** | Secondary | 21 | 52 | 73 | 0.69 | 0.349 | 1.397 | 0.31 |
| | Vocational | 21 | 128 | 149 | 1.71 | 0.888 | 3.329 | 0.10 |
| | Higher education | 22 | 78 | 100 | 1:00 | | | |
| **Occupation** | House wife | 11 | 60 | 71 | 1.26 | 0.545 | 2.936 | 0.58 |
| **of mother** | Merchant | 7 | 67 | 74 | 0.73 | 0.369 | 1.480 | 0.39 |
| | Private | | 34 | 41 | 2.21 | 0.859 | 5.737 | 0.10 |
| | employee | 7 | 69 | 85 | 1.35 | 0.676 | 2.712 | 0.81 |
| | Daily laborer | 16 | 86 | 113 | 1:00 | | | |
| | Gov.t employee | 27 | | | | | | |
| **Occupation** | Farmer | 10 | 49 | 59 | 1.65 | 0.720 | 3.820 | 0.23 |
| **of father** | Merchant | 8 | 77 | 85 | 3.25 | 1.359 | 7.807 | 0.001* |
| | Private employ | 6 | 41 | 47 | 1.29 | 0.659 | 2.535 | 0.45 |
| | Daily laborer | 22 | 65 | 87 | 2.31 | 0.865 | 6.185 | 0.09 |
| | Gov.t employee | 22 | 84 | 106 | 1:00 | | | |

## 4.7. Binary logistic regression analysis of Environmental factors and pneumonia prevalence among under- five children

In this analysis, all of the environmental factors including the presence or absence of cigarette smoker in the family, window in kitchen , location of the child during cooking and family size were not significantly associated with the risk of under- five pneumonia (Table 7).

**Table.5** Binary logistic regression analysis of Environmental factors and pneumonia prevalence among under- five children

| Variables | category | Pneumonia Status | | Total | COR | 95% CI | | p-value |
|---|---|---|---|---|---|---|---|---|
| | | +ve | -ve | | | Lower | Upper | |
| **Cigarette smoker** | Yes | 6 | 17 | 23 | 0.58 | 0.223 | 1.550 | 0.28 |
| **in the house** | No | 62 | 299 | 361 | 1:00 | | | |
| **Type of fuel used** | Wood | 45 | 155 | 200 | - | - | - | - |
| **for cooking** | Charcoal | 15 | 65 | 80 | - | - | - | - |
| | Animal | | | | - | - | - | - |
| | dung | 7 | 46 | 53 | - | - | - | - |
| | Kerosene | 1 | 19 | 20 | | | | |
| | Electricity | 0 | 31 | 31 | 1:00 | | | |
| **Place of cooking** | kitchen | 50 | 228 | 278 | 1.07 | 0.592 | 1.938 | 0.81 |
| | Living room | 18 | 88 | 106 | 1.00 | | | |
| **Presence of window** | Yes | 30 | 172 | 202 | 1.51 | 0.893 | 2.564 | 0.12 |
| **in kitchen** | No | 38 | 144 | 182 | 1:00 | | | |
| **Usual location of** | On mothers | 38 | 145 | 183 | 0.66 | 0.395 | 1.134 | 0.13 |
| **the child during** | back | 30 | 171 | 201 | 1:00 | | | |
| **cooking** | Outside cooking room | | | | | | | |
| **Do you keep cattle** | Yes | 14 | 50 | 64 | 0.72 | 0.374 | 1.404 | 0.34 |
| **in the living room?** | No | 54 | 266 | 320 | 1:00 | | | |
| **Family size** | <5 | 20 | 109 | 129 | 1.26 | 0.714 | 2.237 | 0.42 |
| | ≥ | 48 | 207 | 255 | 1:00 | | | |

## 4.8 Binary logistic regression analysis of Nutrition, immunization and past co-morbidity related factor and ppneumonia prevalence among under- five children

Binary logistic regression analysis in this study revealed that the variables, status of breast feeding, vaccination, presentation of tonsillitis, and duration of breast feeding were not significant and not found to be risk factors of under- five pneumonia (Table 8).

**Table 6.** Binary logistic regression analysis of Nutrition, immunization and past co-morbidity related factor and pneumonia prevalence among under- five children

| Variables | category | Pneumonia Status +ve | - | Total | COR | Lower | 95% CI Upper | p-value |
|---|---|---|---|---|---|---|---|---|
| **Breast feeding status** | Partial | 60 | 287 | 347 | 1.32 | 0.575 | 3.028 | 0.51 |
| | Exclusive | 8 | 29 | 37 | 1.00 | | | |
| **For how long have you** | < 6 | 8 | 29 | 37 | 0.77 | 0.333 | 1.822 | 0.56 |
| **breast feed your child?** | months | 17 | 87 | 104 | 1.10 | 0.595 | 2.036 | 0.76 |
| | 6 to 12 months | 43 | 200 | 243 | 1:00 | | | |
| | > a year | | | | | | | |
| **Has your child vaccinated for pentavalent? (penta 1, penta 2, penta 3,polio,vitamin A, measle)** | Yes | 67 | 309 | 376 | 0.65 | 0.080 | 5.445 | 0.69 |
| | No | 1 | 7 | 8 | 1:00 | | | |
| **Did your child develop tonsillitis in the last two weeks?** | Yes | 14 | 47 | 61 | 0.67 | 0.347 | 1.310 | 0.24 |
| | No | 54 | 269 | 323 | 1:00 | | | |

## 4.9 Binary logistic regression analysis of Signs and symptom related characteristics of study subjects and Pneumonia prevalence

In univariate analysis , none of the studied clinical presentations: cough, difficulty of breathing, fast breathing, chest wall in drawing, vomiting , loss of appetite and convulsion were not significant with and found to be risk factors of under-five pneumonia(table 9).

**Table 7** Binary logistic regression analysis of Signs and symptom related characteristics of study subjects and pneumonia prevalence in Dangila hospital, September 2019-june, 2020.

| Variables | category | Pneumonia Status | | Total | COR | 95% CI | | p-value |
|---|---|---|---|---|---|---|---|---|
| | | +ve | -ve | | | Lower | Upper | |
| Does your child have cough? | Yes | 50 | 222 | 272 | 0.85 | 0.471 | 1.534 | 0.59 |
| | No | 18 | 94 | 112 | 1:00 | | | |
| Does your child have difficulty of breathing? | Yes | 52 | 211 | 263 | 0.61 | 0.337 | 1.135 | 0.12 |
| | No | 16 | 105 | 121 | 1:00 | | | |
| Does your child have fast breathing? | Yes | 58 | 241 | 299 | 0.55 | 0.270 | 1.138 | 0.10 |
| | No | 10 | 75 | 85 | 1:00 | | | |
| Does your child have vomiting? | Yes | 8 | 29 | 37 | 0.75 | 0.330 | 1.739 | 0.51 |
| | No | 60 | 287 | 347 | 1:00 | | | |
| Does the child have lower chest wall in drawing? | Yes | 44 | 203 | 247 | 0.98 | 0.566 | 1.695 | 0.94 |
| | No | 24 | 113 | 137 | 1:00 | | | |
| Does the child have convulsion? | Yes | 8 | 24 | 32 | 0.61 | 0.264 | 1.438 | 0.26 |
| | No | 60 | 292 | 352 | 1:00 | | | |
| Does the child have loss of appetite? | Yes | 10 | 33 | 43 | 0.67 | 0.316 | 1.449 | 0.31 |
| | No | 58 | 283 | 341 | 1:00 | | | |

## 4.10 Multivariate logistic regression analysis of selected variables and pneumonia positivity

Majority of Socio- demographic variables showed that significant associations with the prevalence of pneumonia in binary logistic regression analysis at $p < 0.25$ were selected and entered for multivariate logistic regression analysis to identify the most important predictors of under five years old pneumonia . In multivariate analysis, none of the expected possible risk factors were statistically significant with pneumonia positivity (P-value >0.05). Thus, discussion of the results was made mainly on variables which are significant in chi-square analysis (table 10).

Table 8. **Multivariate analysis of risk factors**

| Variables | category | Pneumonia Status | | Total | COR | P-value | AOR | p-value | 95% CI | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | +ve | -ve | | | | | | Lower | Upper |
| **Sex of child** | Male | 36 | 198 | 234 | 1.49 | 0.13 | 1.49 | 0.48 | 0.489 | 4.556 |
| | Female | 32 | 118 | 150 | 1:00 | | | | | |
| **Age in months** | 1-12 | 18 | 134 | 152 | 3.38 | 0.00 | 6.82 | 0.12 | 0.593 | 78.597 |
| | 13-36 | 35 | 149 | 184 | 1.93 | 0.06 | 1.67 | 0.29 | 0.640 | 4.352 |
| | 37-59 | 15 | 33 | 48 | 1:00 | | | | | |
| **Residence** | Rural | 25 | | 109 | 0.62 | 0.09 | 0.43 | 0.23 | 0.113 | 1.693 |
| | Urban | 43 | | 275 | 1:00 | | | | | |
| **Educational status of mothers** | Illiterate | 9 | 33 | 42 | 0.40 | 0.08 | 0.36 | 0.27 | 0.061 | 2.191 |
| | Primary | 6 | 54 | 60 | 0.98 | 0.98 | 0.92 | 0.92 | 0.191 | 4.466 |
| | Secondary | 2 | 365 | 88 | 0.31 | 0.00 | 0.90 | 0.90 | 0.175 | 4.686 |
| | Vocational | 2 | 291 | 113 | 0.45 | 0.07 | 1.37 | 0.70 | 0.268 | 7.050 |
| | Higher education | 8 | 73 | 81 | 1:00 | | | | | |
| **Educational status of fathers** | Illiterate | 1 | 22 | 23 | 6.20 | 0.08 | 1.87 | 0.61 | 0.166 | 21.125 |
| | Primary | 3 | 36 | 39 | 3.38 | 0.06 | 1.11 | 0.90 | 0.165 | 7.588 |
| | Secondary | 21 | 52 | 73 | 0.69 | 0.31 | 0.21 | 0.09 | 0.035 | 1.324 |
| | Vocational | 21 | 128 | 149 | 1.71 | 0.10 | 0.50 | 0.30 | 0.137 | 1.865 |
| | Higher education | 22 | 78 | 100 | 1:00 | | | | | |
| **Occupation of father** | Farmer | 10 | 49 | 59 | 1.65 | 0.23 | 0.42 | 0.53 | 0.029 | 6.243 |
| | Merchant | 8 | 77 | 85 | 3.25 | 0.00 | 0.47 | 0.55 | 0.040 | 5.648 |
| | Private employee | 6 | 41 | 47 | 1.29 | 0.45 | 0.12 | 0.23 | 0.004 | 3.799 |
| | Daily laborer | 22 | 65 | 87 | 2.31 | 0.09 | 1.41 | 0.65 | 0.318 | 6.277 |
| | Gov.t empl | 22 | 84 | 106 | 1:00 | | 0.61 | 0.55 | 0.128 | 2.986 |
| **Presence of window in kitchen** | Yes | 30 | 172 | 202 | 1.51 | 0.12 | 0.66 | 0.12 | 0.390 | 1.120 |
| | No | 38 | 144 | 182 | 1:00 | | | | | |
| **Usual location of the child during cooking** | On mothers back | 38 | 145 | 183 | 0.66 | 0.13 | 1.49 | 0.13 | 0.882 | 2.531 |
| | Outside cooking room | 30 | 171 | 201 | 1:00 | | | | | |
| **Did your child develop Tonsillitis in the last two weeks?** | Yes | 14 | 47 | 61 | 0.674 | 0.24 | 1.48 | 0.24 | 0.763 | 2.884 |
| | No | 54 | 269 | 323 | 1:00 | | | | | |
| **Does your child have difficulty of breathing?** | Yes | 152 | 211 | 263 | 0.618 | 0.12 | 1.61 | 0.12 | 0.881 | 2.968 |
| | No | 16 | 105 | 121 | 1:00 | | | | | |
| **Does your child have fast breathing?** | Yes | 58 | 241 | 299 | 0.554 | 0.11 | 1.805 | 0.11 | | |
| | No | 10 | 75 | 85 | 1:00 | | | | | |

# 5. Discussion

The prevalence of pneumonia among under-five children in this study was 68 (17.7%). The finding of our study is comparable with the prevalence reports of 16.1% of community based cross sectional study conduct at Este town Northwest Ethiopia by Gedefaw Abeje *et al.* (2014), 16.34% in under- five children living in slums of Dibrugarh town, India ((Nirmoliaa *et al.,* 2018) and that of 17.6% in the study conducted by Astehun Lenda (2018) in Boloso Bombe woreda, southern Ethiopia. However, it is almost three fold higher than the findings of 5.5% in a study conducted by Gebretsadik Shibre (5.5%) (2015)in DebreBerhan district,north east Ethiopia. On the other hand, the prevalence of under-five pneumonia in this study was much lower than the report in a study conducted at public hospitals in Jimma zone by KenenisaTegenu (28.1%) (2018) and 33.5% in a study conduct by Teshome Abuka (2017) in Wondo Genet district, Sidama zone, SNNPR, Ethiopia. This difference in the prevalence across studies might be due to the difference in study setting, sociodemographic factors, and seasonal variation.

Pneumonia positivity among male children was 1.49 times higher than their female counter parts. In this study, an increase in the prevalence of under- five pneumonia was observed as age of children increased and older children (37-59 and 13-36 months old) were the most (31%) infected while the younger, 1-12 months old children, were the least infected (12%) with pneumonia. About seven and two times higher odds of pneumonia was found in children in the age categories of 1-12 and 13-36 months old as this might be due to limited exposure of the younger children to the risk factors of pneumonia. Contrary to the findings of this study earlier findings of Meissner (2003) and Weisman (2003) demonstrated that the risk of pneumonia or bronchiolitis caused by respiratory syncytial virus is highest among children aged less than 2 years with the most severe disease occurring in infants aged 3 weeks to 3 months (Meissner, 2003; Weisman.2003). Lack of awareness and education of the mothers may adversely have an impact on the outcome of the illness in children (Fonseca *et al*., 1996). Several studies reported the higher frequency of pneumonia among children with low degree of maternal and paternal education. A study by Tiewsoh and colleagues noted significant association of lack of maternal education with occurrence of pneumonia. Educated mothers recognize the signs and symptoms of pneumonia early and so accesses health care earlier and so their children have a better outcome than illiterate parents (Tiewsoh *et al.,* 2009). A study conducted in Nigeria also revealed that poor parental educational status is significantly associated with pneumonia (Ujunwa and Ezeonu, 2014). In agreement with these reports, the chi-square analysis of present study also revealed a statistically significant association of pneumonia positivity with the

educational status of mothers (p=0.03) and fathers (p=0.01), respectively. Significantly higher 19%, 21% and 26% under-five pneumonia were recorded among the children whose maternal educational statuses were technical (vocational), illiterate and secondary, respectively. Similarly, higher cases of pneumonia, 22% and 29%, were recorded among under-five children whose fathers attained secondary and higher education, respectively.

In this study, under–five children from households who use firewood and charcoal as source of fuel for cooking were the most pneumonia affected as compared to children whose families use other items as a source of fuel for cooking food. However, no pneumonia cases were detected among households who were using electric power for food cooking (p=0.012). This is in accordance with findings of studies of Ekaru *et al* (2012), Fekadu *et al* (2014) and Kelly *et al* (2015) who reported use of firewood for cooking as a significant environmental risk factor for pneumonia among under five children. This might be associated with the higher emission of indoor air pollutant, particulate matter, carbon monoxide, and a number of other hazardous substances, when firewood and charcoal used for cooking. Under-five children particularly infants and the young ones may receive the highest exposures to inhaled pollutants as they spend more time within the home or carried or close to their mothers during food preparation. Therefore, these children are at greater chances of being affected and polluting fuels may adversely affect their defenses of the respiratory tract against pathogens. According to the present study, keeping cattle in the living room was an important risk factor for pneumonia positivity among under-five children; this result was in line with a study conducted in Northwest Ethiopia (Gedefaw Abeje *et al*., 2014). This might be when cattle are kept in the main house, the house is more likely to have suffocation and poor sanitation. This, in turn, may influence children to diseases, including pneumonia.

Slightly higher (22%) pneumonia positive cases were observed among partial breast fed under five children than those who were exclusive breast feeders (17%), but the association between prevalence of pneumonia and breast feeding status was not statistically significant. Besides, under- five children who were breast fed for less than six months were the most (22%) affected by pneumonia than those who were breast fed for six to 12 months (16%) and for more than one year (18%).This study noted that partially breast fed children during the last 6 months had 1.320 times chance of developing pneumonia than children with exclusive breast Feeding. It was widely recognized that, breast milk contains the nutrients, antioxidants, hormones, lymphocytes and antibodies secretory Immunoglobulin A (IgA) needed by the child to survive and develop, and specifically for a child's immune system to function properly , this in line with the study conducted by Lambert (2013).

Relatively higher prevalence rates of pneumonia, (18%), (19%) and (20%) were found among children who had history of cough, fast breathing and difficulty in breathing, respectively than those did not report these clinical manifestations. The odds of the disease was about two times higher in children who presented fast breathing and the odds of pneumonia was also more than 1.5 fold higher in children who had difficulty of breathing. Similarly, slightly elevated cases of pneumonia were detected in under five children who complained vomiting (22%), loss of appetite (23%), and convulsion (25%) than those who did not present these sign symptoms. However, no statistically significant associations were demonstrated between prevalence of pneumonia and all of the potential sign and symptom related variables analyzed (P> 0.05).The present study illustrated that children who had tonsillitis in last two weeks were 1.48 times more likely to develop pneumonia than children who had no tonsillitis; this was supported by study conducted by Gebretsadik Shibre (2015).

In our study, pneumonia positivity was not statistically significant with the place of cooking; but we cannot rule out the role of place of cooking as one of the potential risk factors of under-five pneumonia as kitchens too near to the living room could enhance the entrance of the smoke to the living room that likely increase the occurrence of under-five pneumonia, this is similar with the study conducted by Astehun Lenda (2018).Children who were carried on their mother's back during cooking were about 1.5 times more likely to develop pneumonia compared to children who were kept outside the cooking room. This finding was supported by a study conducted in northwest Ethiopia (Gedefaw Abeje *et al*., 2014). This might be due to high indoor air pollution from biomass fuels. As a child stays in the cooking room, air pollutants associated with biomass fuel may affect host defenses of the respiratory tract against pathogens.This, in turn, makes the children vulnerable to respiratory tract infections, including pneumonia. Several studies conducted earlier found out that factors like residence, maternal and parental educational status , economic status of parents , sex of child , child age , nutritional status of child , history of past morbidity, statues of child's vaccination , smoking habits of parents , housing , and environmental factors are significantly associated with under-five pneumonia. However, in our study we did not find any significant association between under-five pneumonia and most of these potential risk factors in multivariate logistic regression analyses as those studies by Fatmi and Franklin (2002), Abeje *et al.* (2014), Gebretsadik Shibre (2015), and Astehun Lenda (2018).

# 6. Conclusion and Recommendation

## 6.1. Conclusion

The overall prevalence of pneumonia infection among under- five children in the present finding was 17.7%. The present study identified use of wood as fuel source, educational status of parents' and age of children in months as factors that account for under-five pneumonia positivity. Higher frequency of pneumonia was found among children with low degree of maternal and paternal education. Under- five children from urban residence, smoker family member were more likely to be pneumonia positive compared to children from nonsmoker house hold family. Children from non-educated parents were more infected with pneumonia compared to children with educated parents. Higher prevalence rate of pneumonia was found among children with 37-59 months of age categories than children with, 1-2 and 13-36 age categories. In the present study under five Children with cough, difficulty of breathing, fast breathing and lower chest wall in drawing were more accounts pneumonia than children that did not manifest the above sign and symptom related factors. Keeping cattle inside the living house was an important risk factor for pneumonia positivity among under-five children. During the first 6 months of life, Children with partial breast fed were slightly higher infected with pneumonia than children with exclusive breast fed. Place of cooking were one of the potential risk factor of under-five pneumonia. Children who were carried on their mother's back during cooking were more pneumonia positive than children who were kept outside the cooking room. This study was found that higher prevalence rate of pneumonia among under- five children than most studies conducted in Ethiopia.

## 6.2. Recommendation

Based on the results of the present study the following recommendations were forwarded.

- Use of wood as fuel source should be discouraged but instead alternative reasonable methods which produce less smoke be used.
- More attention should be given by mothers/caregivers to keep children away from kitchen.
- Increase the awareness of parent education about pneumonia diseases and prevention methods should be carried out.
- More attention should be provided to health education about the health benefits of using the separated house for keeping cattle.
- Promote exclusive breastfeeding and vaccination for the first six months of life is necessary.
- Promote assessment for nutritional status and nutritional counseling for all children attending health facilities.

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# Appendix I

## Participant's Information Sheet and Informed Consent Form (English Version).

Good morning | after noon;

My name is Solomon Gedif I am studying master's degree at Bahir Dar university, college of science in Biomedical science stream and I am working as a data collector for study being conducted in Dangila Primary Hospital by me .I kindly request you to lend me your attention to explain you about the study and being selected as the study participants.

**Title of the study:**

Prevalence of Pneumonia and risk Factors among under-Five Children in Dangila Primary Hospital, Amara Ethiopia, 2019.

**Purpose:**

The purpose of this study is to write a thesis as a partial requirement for the fulfillment of master's degree in Bio medical science for the principal investigator eventually ,the study results on the magnitude of under-five pneumonia and factors associated with under five pneumonia in Dangila woreda Primary Hospital ,Amara ,Ethiopia will contribute to the progress of future practices in areas under five pneumonia in health settings ,researches ,and programs in the public health.

**Procedure:**

I will interview you using questionnaire to provide me with relevant data that is help full for the study. So I kindly request you to spend this time for this interview.

**Risk and benefit:**

The risk of being participated in this study is minimal, but only taking a few minutes of your time. There would not be any direct payment for participating in this study .however, the findings from this thesis may reveal important in formation for Dangila woreda health office.

**Confidentiality and anonymity:**

The information that will collect from this study will be kept confidential. Information about you that will be collected from the study will be stored in a file, which will not have an individual name on it, and it will not be revealed to anyone except the principal investigator.

**Rights:**

Participation in this study is on voluntary basis. You have the full right to refuse from participating in this thesis (you can choose not to respond some or all of the questions) If you do not wish to participate, and

this will not affect you. You have also the full right to with draw from this study at any time you wish to, without losing any of your benefits which you otherwise are entitled.

**Persons to contact:**

If you have any question about the study, you can contact and ask at any time you want by using the following addresses.

-Solomon Gedif: mobile number 0920773035

-E-mail:gedifsolomon@gmail.com

**Declaration of informed voluntary consent:**

I have read the participate information or was read to me. I have clearly understood the purpose of research procedures, the rights, benefits, issues of confidentiality, the right of participating and contact address for any queries. I have been given the opportunity to ask questions about things that are not clear. I was informed my rights whether to continue or stop from answering. Therefore, I declare my voluntary consent to participate in this study to be conducted with my signature as indicated below.

Participants Name _____ signature _____

Data collector Name_____ signature_____

## የተሳታፊ መረጃ መስጫ እና የፈቃደኝነት መግለጫ ቅጽ

እንደምን አደሩ /ዋሉ፤

እኔ ሰለሞን ገድፍ በባህርዳር ዩኒቨርስቲ ሳይንስ ኮሌጅ በባዮሜዲካል ሳይንስ ስትሪም የማስተርስ ተማሪ ስሆን በዳንግላ የመጀመሪያ ደረጃ ሆስፒታል ለማካሂደዉ ጥናት መረጃ ሰብሳቢነኝ፡፡ እርስዎ በዚህ ጥናት ተሳታፊ እንዲሆኑ ስለተመረጡ ስለጥናቱ ትኩረትእንዲሰጡኝ በትህትና እጠይቃለሁ፡፡

**የጥናቱ ርዕስ፡** በዳንግላ የመጀመሪያ ደረጃ ሆስፒታል ከአምስት አመት በታች ህጻናት የሚከሰተዉን የሳንባምችና ተየያዥ ችግሮችን ሁኔታ ለማጥናት ነዉ፡፡

**አላማ፡**የጥናቱ አላማ ለዋና አጥኚ በባዮሜዲካል ሳይንስ የማስተርስ ትምህርት የመመረቂያ ጽሁፍ ለመጻፍነዉ፡፡በዳንግላ የመጀመሪያ ደረጃ ሆስፒታል ከአምስት አመት በታች ህጻናት የሚከሰተዉን የሳንባምችና ተየያዥ ችግሮች ሁኔታ ጥናት ዉጠት ቀጣይ ከአምስት አመት በታች የሳንባ ምች በሽታ ተግባር ለማሻሻል ለሚደረጉ ጥናቶች ይጠቅማል፡፡

**ሂደት፡**ለጥናቱ የሚጠቅመዉን መረጃ የምሰበስበዉ እርስዎን ቃለመጠየቅ በማድረግነዉ፡፡ስለዚህ ቃለመጠየቁን እንድጠይቅ ጊዜ እንዲሰጡኝ በትህትና እጠይቃለሁ፡፡

**ጉዳት እና ጥቅም፡** በዚህ ጥናት መሳተፍ ጊዜ ስለሚወስድ ትንሽ ጉዳት ሊደርስብዎት ይችላል፡፡በጥናቱ ስለተሳተፉ ቀጥታ የሆነ ጥቅም ላገኙ ይችላሉ፡፡ ነገር ግን የጥናቱ ዉጤት ለዳንግላ ወረዳ ጤና ጥበቃ ጽ/ቤት ጠቃሚ የሆነ መረጃ ያስገኛል፡፡

**ምስጥር ስለመጠበቅ** በዚህ ጥናት የሚሰበሰበዉ መረጃ በሚስጥርነት ይጠበቃል፡፡ ከእርስዎ የሚሰበሰበዉ መረጃ በፋይል የሚቀመጥ እንጂ የግለሰብ ስም ለማንም የሚገለጽ አይደለም፡፡ ይህንንም መረጃ ከዋና አጥኚ በስተቀር ማንም አይጠቀምም፡፡መረጃ የማን እንደሆነ ማንም ሊያዉቅ አይችልም፡፡

**መብት፡**በዚህ ጥናት መሳተፍ በፍቃደኝነት ነዉ፡፡ በጥናቱ መሳተፍ ካልፈለጉ ሙሉ በሙሉ ወይም የተወሰነዉን ክፍል እምቢ የማለት መብት አለዎት፣እንደዚህ በማድረግ የሚደርስብዎት ችግር የለም፡፡

**ጥያቄሲኖር፡**ጥናቱን በሚመለከት ማንኛዉንም አይነት ጥያቄ ካለዎት በማንኛዉም ሰዓት በተቀመጠዉ አድራሻ ማግኘት ይችላሉ፡፡**ሶሎሞንገድፍ**..0920773035 ወይም Email —gedifsolomon@gmail.com

**በፍቃደኝነት ስለ መሆኑ ማረጋገጫ፡** ጥናቱን በሚመለከት የተሳታፊ መረጃ አምብቤአለሁ ወይም ተነቦልኛል፡፡ ስለጥናቱ ዓላማ፤ ሂደት፤ ጉዳትናጥቅም ፤ሚስጥር ስለመጠበቅ፤ የመሳተፍ መብትና ጥያቄ ቢኖር የሚጠየቅበት አድራሻ ግልጽ ሁኖልኛል፡፡ ግልጽ ያልሆኑ ነገሮች ካሉ እንድጠይቅ እድል ተሰጥቶኛል፡፡ ስለዚህ በዚህ ጥናት ስሳተፍ በፍቃደኝነት መሆኑን በፊርማየ አረጋግጣለሁ፡፡

የተሳታፊ ስም_____ ፊርማ _____

መረጃ ሰብሳቢ ስም_____ ፊርማ _____

# Appendix II

## English version questionnaire

Questionnaire to assess prevalence of pneumonia and risk factors among under -five children in Dangila primary hospital Amara, Ethiopia.

Data collector name_____ signature _____Date_____

Supervisor name _____ signature _____Date_____

**Part one: Socio-demographic characteristics**

1. Residence___1, Rural 2, Urban
2. What is the highest level of schooling you attended?
   1. Illiterate 2.Primary 3. Secondary
   4. Technical/vocational 5. Higher level
3. What is the highest level of schooling your husband attended?
   1. Illiterate 2. Primary 3. Secondary
   4. Technical/vocational 5. Higher level
4. Occupation of mother (care giver).
   1, house wife 4, privet employee
   2, merchant 5, daily laborer
   3, government employee
5. Occupation of your husband.
   1, farmer 4, privet employee
   2, merchant 5, daily laborer
   3, government employee
6. Sex of child __ 1, male 2, female
7. Age of child_____ (in month).

**Part II Environmental characteristics**

8. What type of fuel is used for cooking in your home mostly?
   1. Wood 2.charcoal 3, animal dung 4. Kerosene 5. Electricity
9. Where is the cooking usually done?
   1, living room 2, kitchen
10. Does the kitchen have a window? 1, yes 2, no

11. Is there any cigarette smoker in the house? 1, yes 2, no

12. Where do you keep your child during cooking?

    1, on mothers back or besides the mother

    2, outside of the cooking house

13. Do you keep cattle in the living room? 1, yes 2, no

14. How many siblings (members) are there in your house? _____(in number).

**Part three: Nutrition and past co-morbidity related characteristics**

15. What was breast feeding status of the child during the first 6-months of life?

    1, Exclusive breast feeding 2, Partial breast feeding

16. For how long have you breast feed your child?

    1, less than 6 months 2, 6 to 12 months 3, more than a year

17. Has your child vaccinated for pentavalent (penta 1, penta 2, penta 3, polio, vitamin A, measle)? 1, yes 2, no

18. Did your child have tonsillitis in the last two weeks? 1, yes 2, no

**Part four: Signs and symptom related characteristics**

19. Does your child have cough? 1, yes 2, no

20. Does your child have difficulty of breathing? 1, yes 2, no

21. Does your child have fast breathing? 1, yes 2, no

22. Does your child have vomiting? 1, yes 2, no

23. Does the child have chest wall in drawing? 1, yes 2, no

24. Does the child have convulsion? 1, yes 2, no

25. Does the child have loss of appetite? 1, yes 2, no

**Thank you!!**

**በአማረኛ የተዘጋጀ ቃለ- መጠየቅ፡**

**በዳንግላ የመጀመሪያ ደረጃ ሆስፒታል ከአምስት አመት በታች ህጻናት የሚከሰተዉን የሳንባ ምችና ተያያዥ ችግሮች ሁኔታ ለማጥናት የሚያግዝ ቃለመጠየቅ፡፡**

መረጃ ሰብሳቢ ስም_____ ፊርማ _____ቀን _____

ተቆጣጣሪ ስም_____ፊርማ _____ቀን_____

**ክፍል አንድ-የተጠያቂዉ / ዋ/ አጠቃላዩ ማህበራዊ ናግላዊ መረጃን በተመለከተ**

1.የእርስዎመኖሪያ_____1, ገጠር 2, ከተማ

2. የእርስዎ ትምህርት ደረጃ 1. አንደኛ ደረጃ 2. ሁለተኛ ደረጃ 3. ቴክኒክና ሙያ 4. ከፍተኛተቋም

3.የባለቤትዎ ትምህርት ደረጃ 1 .አንደኛደረጃ 2. ሁለተኛ ደረጃ 3. ቴክኒክናሙያ 4. ከፍተኛተቋም

4.ስራዎ ምንድን ነዉ? 1.የቤትእመቤት2.ነጋዴ 3.የመንግስትሰራተኛ

4.የግልመስሪያ ቤት ሰራተኛ 5.የቀንሰራተኛ

5.የባለቤትዎ ስራ ምንድን ነዉ ? 1. አርሶአደር 2. ነጋዴ3. የመንግስት ሰራተኛ

4. የግልመስሪያ ቤት ሰራተኛ 5.የቀን ሰራተኛ

6. የህጻኑ/ዋ/ጾታ 1.ሴት 2.ወንድ

7. የህጻኑ/ዋ/ ዕድሜ_____ (በወር)

**ክፍልሁለት- አካባቢያዊ ሁኔታን በተመለከተ**

8. ብዙዉን ጊዜ ምግብ ለማብሰል /ለማዘጋጀት/ የሚጠቀመዉበት ነዳጅ ምንድን ነዉ?

1. ከሰል 2. እንጨት 3.ኮረንቲ 4.ነጭጋዝ 5.ኩበት

9. በብዛት ምግብ የምታበስሉት /የምታዘጋጁት/ የትነዉ? 1.ከመኖሪያዉ ቤት 2. ኩሽና

10. ኩሽናዉ መስኮት አለዉ? 1.አዎን 2 .የለም

11. በቤተሰብ ዉስጥ ሲጋራ የሚያጨስ አለ ? 1. አዎ 2.የለም

12. ምግብ በሚዘጋጅበት ጊዜ ልጁ /ልጅታ/ የትነዉየሚቆየዉ /የምትቆየዉ/?

1.ምግብ ከምታበስለዉ እናት ጀርባ ላይ/አጠገብ/ 2.ምግብ ከሚበሰልበት ቤት ዉጭ

13. በዋናዉ ቤት ዉስጥ ከብቶች አሉ? 1.አዎ 2.የለም

14. ቤታችሁ ዉስጥ ስንት ሰዉ አለ? _____ (በቁጥር)

**ክፍል ሶስት- የአመጋግብ ና የአለፉ ተጋዳኝ በሽታዎችን በተመለከተ**

15. በመጀመሪያዎቹ 6 ወራት የልጁ /የልጅታ/ የእናት ጡት አመጋግብ ሁኔታ ምን ይመስላል?

    1. ለ 6ወር የእናት ጡት ብቻ 2. ጡት ና ሌላ ምግብ

16. በአጠቃላይ ልጁ/ልጅታ/ ለምን ያህል ጊዜ ጡት ጠባ/ጠባች/?

    1.ከ 6ወር በታች 2.ከ6-12 ወር 3.ከ 1ዓመት በላይ

17. ልጅዎት ጸረ-አምስት ክትባት ተከትቦ /ተከትባ/ ያዉቃል/ታዉቃለች/ 1. አዎን 2.አይደለም

18. ባለፉት ሁለት ሳምንታት ልጅዎን ቶንሰል አሞት/ማት/ ነበር 1. አዎን 2. የለም

**ክፍል አራት-የሳንባ ምች በሽታ ምልክትን በተመለከተ**

19. ልጅዎ ሳል አለዉ /አላት/? 1.አዎን 2. የለም

20. ልጆዎ የአተነፋፍስ ችግር አለዉ /አላት/? 1.አዎን 2.የለም

21. ቶሎ ቶሎ መተንፈስ አለዉ /አላት/? 1.አዎን 2.የለም

22. ማስመለስ አለዉ /አላት/? 1.አዎን 2.የለም

23. የደረት ግድግዳ ወደ ዉስጥ ወይም ወደ ዉጭ የሚያደርገዉ ያልተለመደ እንቅስቃሴ አለዉ /አላት/? 1. አዎን 2.የለም

24. የሰዉነት መንቀጥቀጥ አለዉ /አላት/? 1.አዎን 2. የለም

25. መጠጣት ወይም መብላት አለመቻል አለዉ /አላት/? 1.አዎን 2. የለም

**አመሰግናለሁ**