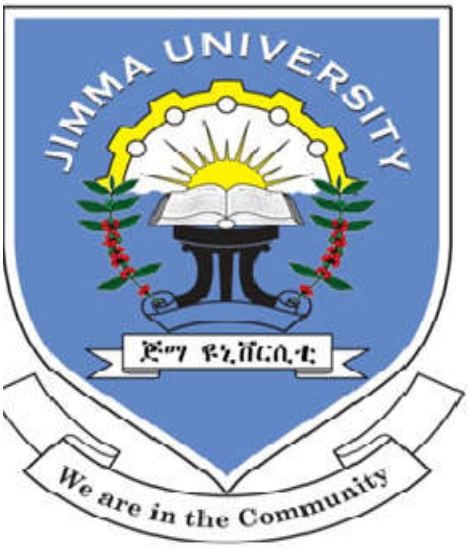
Prevalence and associated factors of Pneumonia among children 2-59 months of age in Gumay district, South-west of Ethiopia, 2017.



By: AntenehTesfaye (BSc)

A thesis submitted to Jimma University Institute of Health, Department of Epidemiology in partial fulfillment for the requirement of the degree of Masters of public Health in Field Epidemiology.

June 2017

Jimma, Ethiopia

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Advisors: Desta Hiko (BSc, MPH, Assi.Professor))

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Thesis summary

Background: Recent estimates from the World Health Organization suggest that pneumonia is responsible for 20% of deaths in the under-five age group, leading to 3 million deaths per year. Of these deaths, two thirds occur during infancy and more than 90% occur in the developing countries. Out of fifteen countries that have the highest death rate from clinical pneumonia in children younger than five-year-old, Ethiopia ranks as number four in the world. Regardless of this fact, efforts to identify the prevalence and associated factors of pneumonia have been limited in Ethiopia**.**

Objective: To determine the prevalence and identify the associated factors of pneumonia among 2 -59 months old children in Gumay district, Jimma zone, 2017.

Methods: Community based cross sectional study was conducted in Gumay district from March 1- 26 /2017. Multi-stage sampling technique was used to proportionally draw 347households from 5 selected kebeles. Pre-tested Interviewer administered structured questionnaire was employed to collect data from households. Health extension workers and diploma nurses and Public health officers have participated in the survey as data collectors and supervisors, respectively. The data was entered in to Epi-Data version 3and then exported to Statistical Package for Social Science (SPSS) version 20 for analysis.

Result: The prevalence of pneumonia in 2 to 59 months old children found to be 7.5%. a child 2-11 months of age(AOR = 3.17;95%CI 1.6,6.3; p-value= 0.024), Cooking place (AOR=5.7; 95% CI 1.83,18; p-value=0.004), living in houses with less than two windows (AOR= 3.18; 95% CI 1.07 ,9.5; p-value =0.034), location of the child during cooking (AOR=5.15; 95%CI 1.6, 16.7; p-value= 0.008) and being unvaccinated(AOR=4.76, 95% CI;1.69, 13.37; p-value=0.003) were found to be significant predictors of pneumonia among children 2 to 59 months of age in this study.

Conclusion and recommendation: -The study pointed out some modifiable risk factors of pneumonia in the study area. Age of the child, cooking in living house, number of windows the house is constructed with, carrying the child on the back during cooking and vaccination status of the child were the risk factors associated with pneumonia. The district health office should raise the awareness of the community on the adverse health effect of indoor air pollution resulting from the use of biomass fuel in the living house, health education to promote acceptability of vaccinating children and proper child cares practices.

Key Words: - ***2 -59 months old children, Pneumonia, cross sectional, under five***

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List of Abbreviation and Acronyms

AIDS-Acquired Immune Deficiency Syndrome

AOR-Adjusted Odds Ratio

ARI - Acute Respiratory tract Infection.

CHERG-Child Health Epidemiology Reference Group

CI-Confidence Interval

COR-Crude Odds Ratio

CSA-Central Statistical Agency

EBF-Exclusive Breast Feeding

EDHS-Ethiopian Demographic and Health Survey

EPIDATA-Epidemiological DATA

HH-Household

IMNCI-Integrated Management of Neonatal and Childhood Illness

K-Kebele

MUAC-Middle upper arm circumference

PBF-Partial Breast Feeding

SPSS-Statistical Package for Social Science

UNICEF-United nations Children's Fund

UNHCR-United Nation High Commissioner for Refugees

WHO-World Health Organization

WoHO-Woreda Health Office

1. Introduction

1.1Background

Pneumonia is the lower respiratory tract infection that exclusively affects the lung. While it attacks every person, children under the age of five years are particularly prone to pneumonia(1).The incidence of pneumonia in children younger than five is 0.29 episodes per year. 151.8 million Cases are recorded annually in developing countries.4 million cases are recorded annually in developed countries. A range of both bacterial and viral pathogens have been recognized to cause pneumonia in children with streptococcus pneumoniae accountable for the vast majority of cases(1).

The determinants of pneumonia are numerous - educational status of parents, smoking habits of any member of the household, nutritional status, age and sex of the child- and widely vary across the regions of the world. The clinical picture of pneumonia differs depending on the micro organism causing the disease and age of a child. Pneumonia in children with high grade fever and difficulty of breathing is usually caused by bacterial pathogens and pneumonia due to viral causes often comes about progressively (1). Timely diagnosis of pneumonia is an essential step in the prevention process of the diseases. X-ray and laboratory identification of the causative agent are the confirmatory tools to certainly establish the diagnosis of pneumonia. However, these are largely unaffordable in the resource poor settings like Ethiopia.

The recommended approach to settle the diagnosis of suspected pneumonia in such regions is, therefore, to rely on the clinical presentation of the disease(2) . To this end, Integrated Management of Neonatal and Childhood Illness (IMNCI) has been launched by the World Health Organization (WHO) and United Nation's Children Fund (UNICEF) to help health workers classify and treat pneumonia and other most common childhood illness based on certain sensitive and specific signs. The core of this innovative prevention and curative strategy is to approach the sick child in an integrated fashion ,instead of targeting on single diseases for which s/he has been brought, the child is assessed holistically for possible common childhood problems such as pneumonia, Diarrhea, Malaria ,Malnutrition and others (2) .

The presence of cough and fast breathing and or difficulty of breathing for specific age clench the classification of suspected pneumonia in children older than 2 months and yet less than 60 months of age (2). Any children older than 2 months of age who presents with one or

more of the following danger sign is classified as having suspected sever pneumonia or diseases: chest in drawing, stridor, convulsion, vomiting everything, inability to breast feed/eat/drink, unconsciousness, and lethargy (2). Its effectiveness in detecting the suspected pneumonia cases, based on these sensitive and specific signs, and hence its aid in prescribing appropriate medication, has been assured to date (2).

1.2 Statements of the problem

Childhood pneumonia has been the commonest cause of suffering worldwide among under-five children, with the developing nations carrying the highest mortality and morbidity pneumonia burden(1). This starkest child survival gap between the most deprived and better off children is known by looking at the unacceptably high child deaths and morbidities in the poorest settings of the world, including Ethiopia. According to the World Health Organization (WHO) in 2013, 6.3 million children under the age of five died in the world and pneumonia is one of the most important causes of child death. 99% of these deaths occur in developing countries and infections are causes 70% of deaths (3). Most children under 5 years in developed and developing countries, 4 to 6 times per year are affected to acute respiratory infections. Annually, approximately 3 million children under 5 years die of pneumonia. Pneumonia that is acute lowers respiratory tract infection and the most fatal infection of respiratory tract, appropriating more than 75 percent of deaths due to acute respiratory infections in children in developing countries(4).

In low and middle-income countries, 6.9 million children died in 2011 and about one in five of these deaths were caused by an acute lower respiratory infection (Pneumonia)(5). Ninety-seven percent of Pneumonia cases occur in the developing world with seventy percent of those cases occurring in south Asia and sub-Saharan Africa alone(5). In terms of mortality, about 90% of all under five Pneumonia deaths burden is reported to occur in these two regions(1). It is the major killer of children under the age of five years than any other diseases known to affect children, and, also, more than the death shares of Acquired Immune Deficiency Syndrome (AIDS), Malaria, and Measles combined(1). The problem -appeared to claim the lives of about 2 million children less than five years of age annually, more than 95% of whom are from the developing countries, notably in Sub-Saharan Africa and South East Asia. Pneumonia, therefore, accounts more than one out of seven of the under five deaths globally(6).

Nearly 50% of pneumonia deaths take place in only five densely populated and poorest countries: India, Nigeria, Democratic republic of Congo, Pakistan and Ethiopia(7). As a result, Ethiopia is the fifth (62 deaths in 1000) among 15 countries having the highest death rate of under five years clinical pneumonia in the world (8).

Similarly, pneumonia is the most prevalent, 20%, acute respiratory infection among two months to five years' children's in urban areas of Oromiya national regional state.(9).

Eighteen percent of all the under-five childhood death in Ethiopia is recognized to be due to pneumonia(7).Childhood pneumonia is mainly a disease of poverty and results from sub-optimal child rearing and care seeking practices compounded by lack of access to healthcare. Active and passive smoking, underlying chronic cardio-pulmonary and neurological illnesses, heavy alcohol intake, major trauma or surgery, long periods of recumbence, indoor air pollution, crowding, poor dental health, old age and institutional habitat or care are recognized risk factors for high incidence and mortality from the disease(10). Pneumonia remains the leading killer of young children despite the availability of simple, safe, effective and inexpensive interventions such as promotion of health service utilization and integrated management of childhood illnesses in our country that contributed to improve child health outcomes in recent years.

2. Literature Review

2.1. Pneumonia Morbidity and Mortality burden among under- five children

2.1.1. Magnitude of Pneumonia

The rate of new pneumonia infections is high among children aged less than five years worldwide. The 2008 -Bulletin of world health organization (WHO) reported that 0.26 episodes per child-year of pneumonia was estimated worldwide with the significant variation in the incidence of pneumonia across WHO regions (6).In 2013 Pneumonia took the lives of over one million children around the world (11), about 15 percent of total deaths for children under age 5 (12). Recent estimates from the World Health Organization suggest that pneumonia is responsible for 20% of deaths in the under-five age group, leading to 3 million deaths per year. Of these deaths, two thirds occur during infancy and more than 90% occur in the developing countries (13).

The incidence of pneumonia infection estimated in developed countries by the same report to be only 0.05 episodes per child-year unlike the 0.29 episodes in developing countries, which can be translated to about 151.76 million deaths annually. However, this figure has reportedly fallen to 0.23 episodes per child-year in 2010, 2012 lancet report(14). More than 60% of such incidence of pneumonia is reportedly concentrated in just two regions, namely Southeast Asia and Africa, each bears 35 and 61 million new infections in a year, respectively(6).In 2011 there were 120 million new pneumonia infections worldwide, 14 million of which were sever enough to require hospitalization(15) . Ethiopia is among 15 top under five pneumonia high burden countries(16).

Pneumonia is the single leading cause of death among children younger than five years in Ethiopia. It was estimated that 3,370.000 children encounter pneumonia annually which contributes to 20%of all causes of deaths killing over 40,000 under five children every year and leading cause of death during postnatal period(17). In Ethiopia, there are very few studies carried out so far on the prevalence of pneumonia and its risk factors and, as well, with one or more methodological weakness. Evidence showed that different factors were associated with occurrence of under-five pneumonia. Factors could be child, maternal, environmental, access to health care, overcrowding, indoor air pollution, Charcoal use for cooking, carrying the child on back during cooking , cooking within the main house, Co

morbid diseases such as HIV/AIDS, Malaria, Exclusive breast feeding, duration of breast feeding as well as nutritional status of the child (9).

The latest nationwide research to date is the 2011 Ethiopian Demographic and Health Survey (EDHS)-which estimated the national prevalence of pneumonia to be 7%-with the significant variation across regions-; the highest and lowest of the two weeks recall based prevalence preceding the survey of the under- five pneumonia was reported in Benishangul-gumuz and Addis Ababa, respectively. The average estimate may hide the probably high prevalence of pneumonia in the rural community. The percentage of children aged less than five years with pneumonia in Amhara regional state reported to reach 6.4% (18).A focused local community based cross sectional study done in Este town in 2014 found that the prevalence was as high as16%(19).

2.1.2. Mortality

2.1.2.1. Global under- five mortality burden of pneumonia

Pneumonia continues to be the global leading killer of children aged less than five years despite the efforts of the international community to control the problem. Approximately 20% of the 9 million estimated deaths in children aged less than five year in- 2007 were ascribed to pneumonia(20). Again, about 19% of all deaths in children aged less than five years in 2008 were attributable to pneumonia (6). This figure has reportedly increased to 21% in the 2012 WHO world health statistics report(21). However, the 2014 estimates of pneumonia mortality by the UNICEF indicate that the disease was responsible for 15% of under-five deaths in 2013(22). And, out of 64.o% of all infectious causes of under- five mortality in 2010, pneumonia still takes the big share of 18.3% worldwide .The contribution of pneumonia to the deaths of older children was estimated to reach 14.1%- with approximately four percent of childhood-pneumonia related death occurred in the first 28 days of life globally(23) . The under- five pneumonia death in 68 countries is almost equal to the global pneumonia mortality in the same age group with more than 98 % child death happen in these regions (24) . In 2011, about 1.3 million children aged less than five years died of pneumonia globally. The same report showed that the case fatality ratio of pneumonia reached up to 8.9% worldwide(15). According to 2012 lancet report, however, the global estimate of childhood pneumonia deaths was 18% (23), which can be translated to approximately 1.4 million childhood deaths, roughly a 100,000 deaths rise from the previous report of 2011.The risk factors for deaths due to pneumonia vary between countries, regions

and communities. Frequently studied factors are young age, low birth weight, under nutrition, anemia, lack of parental education, overcrowding, indoor air pollution, lack of exclusive breastfeeding, lack of measles immunization, co-morbidities such as congenital heart diseases and other congenital anomalies and severity at presentation to hospital(25).

2.1.2.2. Regional mortality burden of pneumonia

Considering the under- five children pneumonia mortality burden on continent basis, Southeast Asia bears the highest, estimated to reach 21.8% followed by Africa where pneumonia is responsible for 17% of deaths (23). According to the 2011 lancet report, however, the highest burden of pneumonia mortality was observed in Sub-Saharan Africa where 43% of all the under- five childhood pneumonia mortality took place (15). Likewise, in 2012, the Eastern Mediterranean and Western pacific each bears the child hood pneumonia mortality burden of 19% and 16%, respectively. By contrast, only ten and 12% of childhood deaths in America and Europe, respectively, are attributable to pneumonia(23) .

2.1.2.3. National picture of childhood pneumonia mortality

India, Pakistan, Nigeria, democratic republic of Congo and Ethiopia are the five highest children pneumonia mortality burden countries in the world (23).In India, pneumonia killed about 0.397 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% to the toll of deaths in children less than five years (23). Seventy four percent of all under- five pneumonia deaths in 2011 was reportedly concentrated in the 15 high burden countries-10 of which are in Africa-, including Ethiopia. As the episodes of pneumonia progress to severity, the highest pneumonia mortality tend to occurred in these 15 high burden countries (15).The latest countdown 2014 report presents the country profile of each of the 75 countdown countries where more than 95% of all childhood pneumonia deaths occurred. The vast majority of countdown countries from Africa experienced disproportionately high load of pneumonia cases. In Ruanda, Sierra Leone, Somali, South Sudan and South Africa, 18%, 16%, 19%, 20% and 17% of all under-five deaths, respectively, in 2012, died of pneumonia. Conversely, Peru, Nepal, Mozambique, and Morocco, carry pneumonia case load of correspondingly 10%, 14%, 14%, and 13% (4). Looking at the situations in Ethiopia, pneumonia is the single leading cause of death among children younger than five years in Ethiopia. The 2008 WHO report showed that there were 389,000 under five deaths, of which 22% were due to pneumonia (20). In 2010, pneumonia was responsible for 21% of all under

five deaths in Ethiopia (26). According to the recent 2014 countdown to 2015 report , however, the toll of under- five pneumonia deaths has supposedly plummeted to 18%(7), which is among the highest even compared to the load in the majority of African countries. Nonetheless, there are only scant source of data on this problem locally. For instance, a case control study in Gilgel Gibe revealed that 42% of post neonatal and 22.6% of neonatal mortality were attributable to pneumonia (27).

2.2. Risk factors of under-five pneumonia

2.2.1. Socio demographic characteristics

Mother's lack of education and inexperience as a caregiver is one more risk factor for childhood pneumonia that may be amenable to public health intervention(10). Teenage pregnancy and lack of essential support by health services add to the impact from this risk. Fertility rates in South Asia range from 71 to 119 births per 1000 women aged 15-19(28). Both the incidence of and mortality from pneumonia widely vary across the age of the child, where children younger than 2 years of age disproportionately bear about 81% of the overall under- five pneumonia morbidity burden (15). In a case control study in Pakistan, younger children were found to be at increased risk of pneumonia compared to older children under the age of five years(29) .There is also evidences on the difference in incidence of pneumonia between boys and girls, with the higher episodes of pneumonia occurred among boys (15). However, this result is in contrary to other finding where gender of the child did not affect the occurrence of child hood pneumonia(29). Being the socio cultural factor, birth order is among the lists of factors that affects the risk of pneumonia in children (30). Children born to younger mothers are likely to develop pneumonia than are children born to older mothers (19). Educational status of parents and that of the father did not affect the probability of their child to acquire pneumonia infection(19). Similarly, a case control study in Pakistan found that educational status of parents was not significantly associated with the development of pneumonia(29).A study found that children living in poor economic conditions are more likely to suffer from acute lower respiratory infections than children living in better off households. This finding is common around the world (31).Globally, poor living conditions present risk factors for illness and are associated with inadequate utilization of primary health care (32). Comparatively, children born from well to do family are less risky to develop pneumonia than are their counterparts from poor family (33). Children whose parents are smoking have 60% probability of developing pneumonia(34) . In a meta-analysis of 38

studies to examine the relationship between parental smoking and acute lower respiratory illness in children, the risk increased by a factor of 1.57 for smoking by either parent and by 1.72 for maternal smoking(35). Occupational status of parents appeared to have no effect on 02 -59 months old pneumonia (19). However, a report from case control study in Pakistan revealed that maternal occupation was significantly associated with pneumonia in under fives(29). In a cross sectional study in India, the prevalence of pneumonia was not affected by the residence of children (36).

2.2.2. Environmental factors

Safe water source for both drinking and other uses including hand washing and improved sanitation facility can for the most part prevent pneumonia (26).Hand and respiratory hygiene are crucial in minimizing the spread of most organisms responsible for acute respiratory infections and pneumonia. Studies have shown that hand washing with soap and water can reduce the incidence of acute respiratory infections and pneumonia by up to 50 percent(37). Indoor air pollution is known to accelerate the risk of pneumonia and pneumonia caused deaths(38) .Air pollution from household use of solid fuels has been identified as one of the strong modifiable risk factors for acute respiratory infections and pneumonia for some time. In the rural and poor urban communities, especially in south Asian countries, traditional open ovens using wood or dried/ dehydrated animal dung as fuels are commonly employed in dwellings for cooking and heating. Children and other family members alike often live and sleep in closed or semi-closed cooking rooms and are thus exposed heavily to particulate matters with carbon monoxide, greenhouse gases, and other pollutants. A semi-quantitative epidemiological study done in Nepal during 1980s showed a direct relation between reported hours per day spent near the stove by infants and children under 2 yr and the episodes of life-threatening acute respiratory infection (ARI)(39). A meta-analysis of 24 studies on exposure to indoor air pollution caused by the use of unprocessed solid fuel concluded that the risk of pneumonia increased by a factor of 1.8 among the exposed young children(34). Dose-response relationship was also demonstrated for pneumonia deaths with the relative risk varying between 1.47 for some exposure and 5.23 for a high level of exposure(40). Globally, 50 per cent of all households and 90 per cent of rural households use solid fuels as the main source of energy at homes(41). A research done on 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%(38). The result that came out of the randomized trial control among participants in rural Guatemala, showed that wood made

stove with chimney did not reduce the risk of pneumonia(42). Charcoal use for cooking, carrying on the back of a child during the time of cooking and place of cooking were statistically significantly associated with pneumonia, after controlling for the possible extraneous variables, but animal dung use for cooking has shown no relationship with the incidence of pneumonia (19). Half of the 2 million premature deaths in low income countries are due to pneumonia caused by indoor air pollution from solid fuel use(26). Living in the crowded household environment enhances the transmission of pneumonia to the health child (15).

2.2.3. Co morbidity

Co morbidity has been found to elevate the risk of pneumonia .Diarrheal diseases is one of the determinants of under-five pneumonia as established by child health epidemiology reference group (CHERG), an academic review group started on by WHO(30) . Diarrhea caused acute respiratory tract infection including pneumonia in a cohort study among children in Ghana and Brazil (43).Measles is an established risk factor for pneumonia. Pneumonia mortality caused by measles reached as high as 86% (33). Measles actually accelerates the fatality rate of pneumonia through immune suppression(44). Pneumonia is the most common complication of both pertussis and measles and its frequency among patients with measles is about 2-27 per cent in a community and 16-77 per cent in hospital settings(42). Case control study in Pakistan supports this finding that children who had history of measles were susceptible to the development of pneumonia compared to those children who reported no history of measles (29).Lack of measles immunization is among the leading risk factors that predispose the 02 -59 months old children to pneumonia (6).The Child Health Epidemiology Reference Group(CHERG) revealed that other co morbid diseases such as HIV/AIDS , Malaria and Malnutrition were identified to be associated with increased occurrence of pneumonia (30).

2.2.4. Nutritional factors

Children who have inappropriate weaning time were found to be at increased risk of pneumonia infection. Both delayed and early weaning are thought to be the risk factor for malnutrition which itself is strong predictor of pneumonia (45). The same case control study identified the nutritional status of the child to be significantly associated with the development of pneumonia in under- fives. Exclusive breast feeding for the first 6 months of child's life has a protective effect on both the incidence and severity of pneumonia (22). Not

exclusively feeding children younger than six months of age is another factor that put them at higher risk of pneumonia(26) .

2.2.5. Primary care taker's knowledge of pneumonia

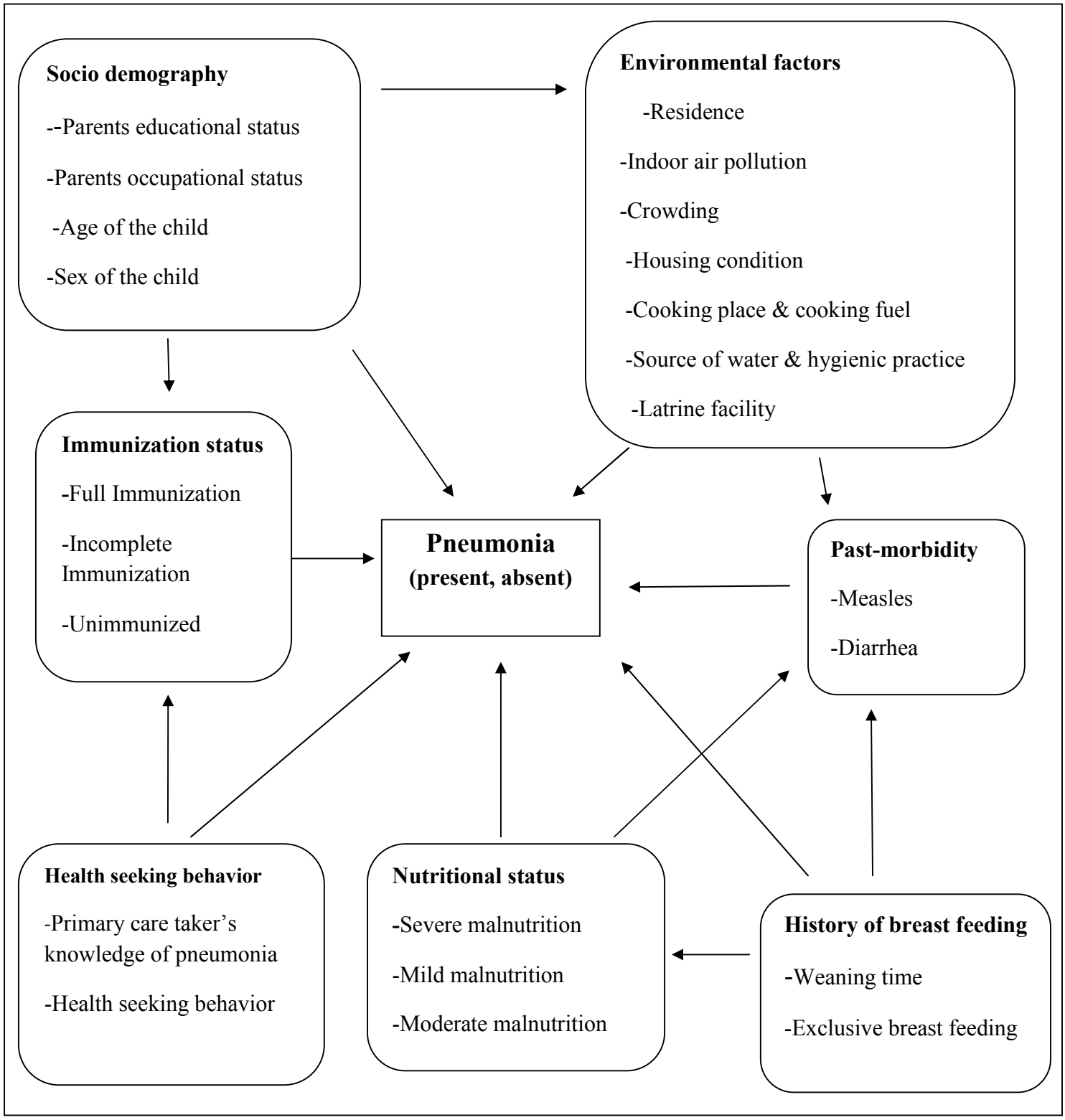
Local health care system namely maternal and pediatric care, access to health care and low birth weight is found to predict pneumonia in under- fives. Altitude, annual rainfall and nature of the seasons and average monthly temperatures are the factors listed by CHERG as factors of under-five pneumonia(30) . The primary care taker's knowledge of pneumonia plays a considerable role in reducing the burden of the problem through helping the child to seeking appropriate care on timely manner (1).The health seeking behavior of primary care taker increases when they are able to diagnose the ill child as having pneumonia, which in turn decreases the morbidity and mortality burden of pneumonia (1). Mothers recognized fast breathing better than chest in drawing, and mothers having prior experience with childhood pneumonia recognized these signs better(46). Parental lack of education was shown to be a significant socio-demographic risk factor for both the incidence of childhood pneumonia and as a determinant of the outcome in India(47)

Morbidity of under-five pneumonia is the greatest impediment to children's health universally though the prevalence varies significantly across various regions, with developing countries bearing the highest burden. The pneumonia studies in developing countries such as Ethiopia, though limited, found the diseases to be the major causes of morbidity and mortality of children under the age of five years. Numerous factors determining the risk of pneumonia in under- fives are reviewed in various literatures across diverse regions of the world. Some risk factors are consistently found to be determinants of pneumonia in all reviewed literatures unlike others, which showed different degree of association with pneumonia across the studies. Certain socio demographic characteristics such as educational status of parents, residence, occupation, age and sex, environmental factors such as types of toilet, indoor air pollution, source of water for drinking and washing and nutritional factors such as weaning time, and also some co morbid illness ,namely diarrhea and Measles, which are prioritized by the Child Health Epidemiology Reference Group (CHERG), are linked to each other to determine the occurrence of under-five pneumonia morbidity .

2.5. Significance of the study

Ethiopia ranks 27th in under-five mortality with 119 deaths per 1,000 live births .Almost one in every ten babies born in Ethiopia does not survive to celebrate the first birthday. Approximately two million children under five die from pneumonia each year, accounting for nearly one in five child deaths globally. Several studies done in different parts of the world showed that pneumonia is major cause of mortality and morbidity among under-five children. In developing countries, low socio-economic status, maternal educational status, malnutrition, low birth weight, non-exclusive breastfeeding, indoor air pollution, crowding, parental smoking, and mother's age were found as possible risk factors associated with pneumonia among children. In Ethiopia, there are studies showing causes of mortality among children aged under-five years. However, little is known about the prevalence and determinants of each cause of mortality. Therefore this study will provide information on prevalence and determinant factors of pneumonia among 2-59 months of age and will try to contribute its part to the improvement of survival of under five year children in our country.

2.4. Conceptual frame work



Source: Harerimana et al. Archives of Public Health (2016)

Figure 1. Conceptual frame work

3. Objectives of the study

3.1 General objective

To assess the prevalence and associated factors of Pneumonia among 2 -59 months old children in Gumay district, Southwest Ethiopia from March1-26/2017.

3.2 Specific objectives

1. To determine the prevalence of pneumonia among 2 -59 months old children in Gumay district.

2. To identify the associated factors of pneumonia among 2 -59 months old children in Gumay district.

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4. METHODS

4.1. Study area and study period

Gumay woreda is one of the 18 woredas of Jimma zone which is located 410 km away from Addis Ababa to south west of Ethiopia. The district has a total population of 75,490 that reside in 13 rural and two urban kebeles with total households of 15,726.The total number of under five year children constitutes 16.43% of the total population of the district. Pneumonia is the single leading cause of death among children younger than five years in Ethiopia. It was estimated that 3,370.000 children encounter pneumonia annually which contributes to 20% of all causes of deaths killing over 40,000 under five children every year. Pneumonia is the second of the top ten causes of OPD visit of pediatrics which constitute more than 26% of the total OPD cases in Gumay district. The study was conducted from March 1-26/2017 in Gumay district, Jimma zone.

4.2. Study design

A community based cross sectional study was conducted.

4.3. Source population

All 2 -59 months old children who are living in Gumay district.

4.4 Study population

The study population were children in the age group of 2 to 59months and mothers/care takers pair who fulfill the inclusion criteria and living in the selected kebeles.

4.5. Inclusion and Exclusion criteria

4.5.1. Inclusion criteria

 Children 2-59 months of age and primary caretaker's pairs who are living in the selected kebeles.

4.5.2. Exclusion criteria.

 Mothers/caretakers who are severely ill, have hearing impairments or unable to talk.

4.6. Study variables and Measurements

4.6.1 Study variables

4.6.1.1 Dependent variable

 Pneumonia status based on clinical diagnosis.

4.6.1.2 Independent variables

 Socio demographic characteristics

-Parents educational status -Age of the child

-Occupational status of parents - sex of the child

 Environmental characteristics

-Residence -Indoor air pollution

-Housing condition -Cooking place and cooking fuel

-Crowding -Water source and Hygienic practice

-Latrine facility

 History of breast feeding

-Weaning time

- Exclusive breast feeding

 Nutritional status of the child

-Severe malnutrition -Moderate malnutrition

-Mild malnutrition

 Immunization status of the child

-Full Immunization -Unimmunized

-Incomplete Immunization

 Past morbidities

-Measles

-Diarrhea

Health seeking behavior

-Primary care taker's knowledge of pneumonia

-Health seeking practice

4.6.2 Measurements

Fast breathing*:* 50 breaths per minute or more for children aged 2 to less than 12 months, 40 breaths per minute or more for children aged 12months to 5 years (2).

Chest in drawing: when the lower chest wall (lower ribs) goes in when a child breathes in. In a child age 2 months up to 5 years, if chest in drawing is clearly visible and present all the time during an examination, it is sign of severe pneumonia or very severe disease.

Cleanliness of a house:- Measured as good based on the sense of the data collector considering if households keep their home clean in a daily basis, windows and doors are widely open enough to provide adequate circulation of fresh air in all of the rooms and no open field defecation in the surrounding area.

Nutritional status: -the degree to which a child shows or does not show certain signs of malnutrition or anemia or low weight.

Anthropometry: - The use of body measurements to assess nutritional status is a practical and immediately applicable technique for assessing children's development patterns during the first years of life.

MUAC: - is the circumference of the left upper arm measured at the mid-point between the tip of the shoulder and the tip of the elbow, using a measuring or MUAC tape.

Malnutrition: - Is measured by Anthropometric, MUAC measurement.

4.7 Sample size determination and sampling techniques

4.7.1 Sample size determination

The sample size was calculated using the single and two population proportion formula separately.

4.7.1.1 Single population proportion

Considering the prevalence of pneumonia among under- five year children to be 12.7 %(48), level of confidence 95%, and margin of error 5%, the sample size is calculated as follows:

$$\text{Sample size} = \frac{Z\alpha^2 * p * q}{d^2}$$

Where:-

- **p**- proportion of pneumonia cases, P=12.7
- **q**- Proportion of children who have no pneumonia, q = 87.3
- $\mathbf{Z_\alpha}$ represents standard normal variable at (1-α) % confidence level with α level of significance, α taken to be 5% and Z_α is 1.96
- **W**-margin of error, 5%

Substituting the values for each of these variables in the above formula,

$$\text{Sample size} = \frac{(1.96)^2 * 0.127 * 0.873}{(0.05)^2} = 170$$

The sample size is estimated to be **170**. Adding the potential none response rate of 2% and multiplying the result by a design effect of 2 ,the final sample size will be**347**households having children 2-59 months of age are required.

4.7.1.2 Two population proportion

Alternatively, the two population proportion formula is used to calculate the required sample size of households having children 2-59 months old considering cooking place and history of breast feeding as the two major determinant factors of pneumonia in this age group. At 80% power, the sample size was calculated as follows:

Major variables	Confidence interval	P1	P2	OR	Ratio(unexposed: exposed)	Sample size
Cooking in the living house	95%	24.03%	68.4%	6.83	1	46
Duration of Breast feeding	95%	31.6%	56.2%	2.78	1	126

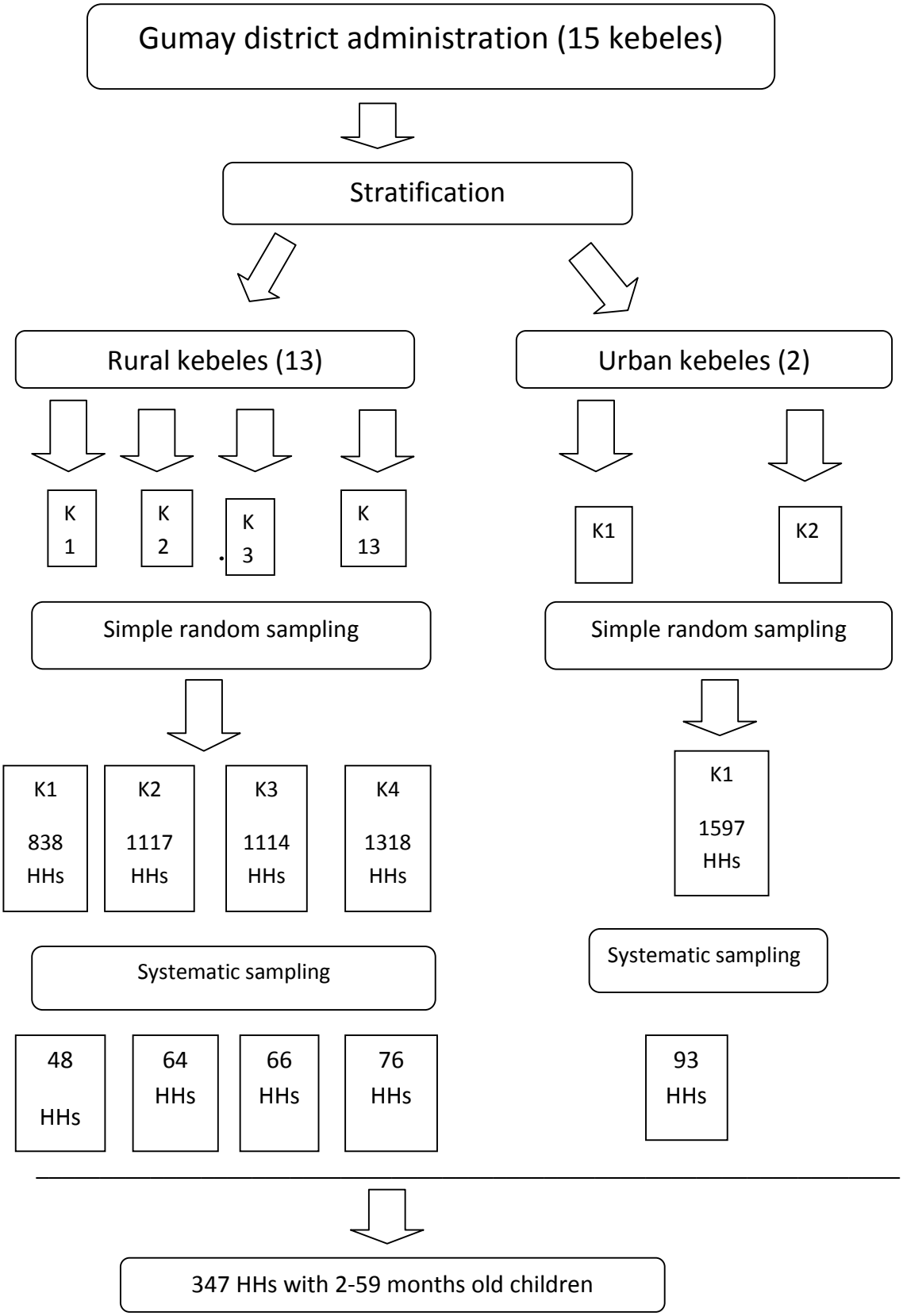
Where:-

- P1-the percentage of under five pneumonia in unexposed(among children living in households that have separately constructed kitchen and who have history of breast feeding for more than a year)
- P2-the percentage of pneumonia in exposed groups(among children living in households where cooking takes place in the main house and who have history of breast feeding for less than a year)

Since the sample size for each of these variables was calculated to be smaller than the size calculated for the single proportion formula, the 347 households remained the appropriate sample size for this study.

4.8. Sampling procedures

Multi-stage sampling technique was employed to include study participants in to the research. The study area first stratified in to urban and rural kebeles since residency is known to affect the prevalence of under- five childhood pneumonia(30) . The total 15 kebeles of the study area were stratified in to two strata, urban and rural, each containing two and 13 kebeles, respectively. Then in the first stage, out of the two urban kebeles one urban kebeles was selected randomly and out of the 13 rural kebeles four kebeles were selected through lottery method. In the third sampling stage, proportional systematic sampling technique of every K^{th} interval was used to take households from each of the selected six kebeles-by taking into account the number of households having under- five children in each of the sampled kebeles. The k interval, i.e.,K= 3was determined by dividing the total households having under- five children within the sampled kebeles(988 HHs) by the total sample size of347 households having 02 -59 months old children. When more than one child aged 2-59 months is found per household, a child was selected by lottery method. The following diagram describes the detail procedures of household selection.



Note: - K- Kebele, HH- Households

Figure 2.Schematic presentation of the sampling procedure in the selection of HH with under-five children

4.9. Operational definitions

Pneumonia:-Inflammation of the lung caused by infection from a bacterium or virus, in which the air sacs (alveoli) become filled with inflammatory cells and the lung becomes solid.

Pneumonia positive: - a child 2-59 months of age and had cough, fast breathing and chest in drawing.

Pneumonia negative:-a child 2-59 months of age and had no any sign and symptoms of pneumonia or having cough and /or fast breathing but no chest in drawing.

Respiratory rate=the number of respirations in one full minute (also called breathing rate)

Past morbidity=diseases of the child two weeks prior to the study; pneumonia and diarrhea in this case.

Convulsion- an involuntary contraction of the muscles producing contortion of the body and limbs

Stridor-the noise heard on breathing in when the trachea or larynx is obstructed. It needs to be louder and harsher than wheeze.

IMNCI syndrome classification: Strategy that uses signs and symptoms to classify common childhood illness

Improved sanitation/latrine: Households using latrine facility of the following type of latrine are considered to have improved sanitation.

- Flush or pour flush to: piped sewer system septic tank pit latrine
- Ventilated improved pit (VIP) latrine-Traditional pit latrine that have vent pipe with a slab.

Unimproved sanitation/latrine*:* Households that possess the following types of latrine facility:

- pit latrines without a slab or platform
- Open field/Bush

Pipe water-Tap water which is treated and distributed municipally or water from protected springs/hand pumps.

Protected spring-Spring water source that has a protecting wall constructed up-ward by brick and cement/other materials.

Nutritional status: the degree to which a child shows or does not show certain signs of malnutrition or anemia or low weight. In this course, a child's nutritional status may be classified as: severe malnutrition, moderate malnutrition and normal nutritional status.

Normal nutritional status: - A child 6-59 months of age whose MUAC measurement is >= 12.5cm

Severe malnutrition: - A child 6-59 months of age whose MUAC measurement is <= 11 cm.

Moderate malnutrition:- A child 6-59 months of age whose MUAC measurement >= 11.5cm to <12.5cm.

Immunization status: a comparison of a child's past immunizations with the recommended immunization schedule. Immunization status describes whether or not a child has received all of the immunizations recommended for his age, and, if not, what immunizations are needed now.

Health seeking behavior:-Mothers'/primary care taker's attitude and practice towards seeking treatment to sick children in a nearby health institute.

4.10. Data collection procedures

Interviewer administered structured questionnaire in Afan Oromo was used to collect data on 02 -59 months old children pneumonia from the selected households. Health professionals from the study area were recruited to data collection and professional supervisors also were recruited to supervision. Mothers or caretakers were interviewed on the presence or absence and duration of cough. A child having cough , fast breathing or lower chest in drawing or all of them at the time of the survey, was physically examined to assess his breathing rate and the presence of danger signs namely convulsion, inability to eat/drink, vomiting everything, strider and unusually sleepiness(2).In addition history of measles infection of the child and the presence of diarrhea during data collection or two weeks prior to the study were assessed. Anthropometric measurement of MUAC of the children was taken. Nutritional status of the children was determined using WHO growth standard to report principal anthropometric results, and the global acute malnutrition standard was used to categorize a child's condition as severe malnutrition, moderate malnutrition and normal nutritional status.

4.11. Data quality management

Both data collectors and supervisors were trained for two days on the techniques of data collection skills. The training covers the importance of disclosing the possible benefits and purpose of the study to the study participants before the start of data collection. The questionnaire was first developed in English and translated in to local Afan Oromo language, and then translated back in to English by the third person to check the consistency. Date of birth of the child was referred from immunization cards, if not, data collectors were

suggested to use events that can be easily remembered to help mothers relate and remember the exact age of their child. Besides, mothers requested to report the age of the child in month/s whenever the child has not yet celebrated his/her birthday. Mechanisms of maintaining the confidentiality of the participants throughout the whole process of the study was discussed and ascertained during the training. Supervisors were trained on how to check the completeness and consistencies of questionnaires filled by the data collectors to ensure the quality of the data, and also, the researcher have followed the progress of data collection in a daily basis. The researcher also evaluated the collected data during the data analysis stage to verify the completeness of the data. The training session incorporated WHO's Integrated Management of Childhood and Neonatal Illness (IMNCI) classification of pneumonia, to enable the data collectors identify pneumonia cases appropriately(2). Pre-test was carried out on 5% of the questionnaire out of the study area and the questions were revised based on the response obtained.

4.12. Data processing and Analysis plan

Data was first checked manually for completeness, inconsistencies and then entered into Epi-Data version 3. And then after data entry and cleaning, the data was transferred to SPSS version 20 for analysis. Descriptive analysis like percentages, proportions, mean and standard deviation were computed to describe study population in relation to demographic and socio-economic and other relevant variables.Bi-variate analysis was run using logistic regression to identify candidate variables for multivariable analysis. Variables with p-value ≤ 0.25 in bi-variate logistic regression were considered as candidates for multivariable logistic regression. Multivariable logistic regression was performed using stepwise method to identify factors independently associated with dependent variable.Multivariate analysis was used to adjust the effects of potential confounding variables. Strength of association was measured using odds ratio, and 95% confidence intervals. P-value ≤ 0.05 considered as statistically significant.

4.13. Ethical consideration

Ethical clearance was obtained from Jimma University College Health Science and Permission letter was also obtained from Jimma Zonal Health department and Gumay district Health office. Informed consent was obtained from each respondent after explanation of the study objective. The right to withdraw from the research process at any point in time was respected. Privacy and strict confidentiality was maintained throughout the study. When

there was a sick child in the household, Mothers/caretakers were advised to take the child to the nearest health institutions.

4.14. Dissemination of results

The results of the study will be presented and submitted to Jimma University Department of Epidemiology. After having approval from the Department, it will be communicated to concerned bodies through reports. The findings will also be disseminated to different organizations like Ministry of Health, Zonal Health Department, and stake holders or partners that will have a contribution to under five year children health program, especially in primary health care unit. The findings will be also presented in various workshops and conferences and an attempt will be made to publish the research article in scientific journals.

5. Result

5.1 Descriptive statistics

5.1.1 Socio demographic characteristics of the respondents

The study population consisted of children in the age group of 2 to 59 months and mother's/ primary care takers pair. A total of three hundred forty seven (347) households were included in the study with a response rate of 100%. Majority of mothers/care takers, 221 (75.2%) and 224 (76%) of the heads of the households were literate. The largest proportion of mothers 189 (54.5%) and husbands 184 (53%) were at primary school level in their educational status. The vast majority of the mothers of the study population were house wife in their occupation and the rest 27.8% of the study population was civil servants, merchants and daily labors in their occupation. More than 52% of the husbands were farmers and the remaining occupational percentage of the husbands is comprised of civil servants, merchants, drivers and daily labors. The highest proportion of children in the survey 140(40.3%) were in the age group of 12-23 months and children in the age group of 2-11 months comprises the smallest percentages, 24%with the mean age of the child 25.44 months ($SD \pm 9.12$).One hundred ninety five (56.2%) of the participant children were male. The large difference in the percentages of children by sex could have occurred merely by chance (Table 1).

Table 1 Socio-demographic characteristics of respondents, Gumay District, Jimma zone, south west of Ethiopia, March 2017(n=347 mothers and children's pair)

Variables	Number (n)	Percent (%)
Educational status of the mother		
Illiterates	**86**	**24.8**
Primary school	**189**	**54.5**
Secondary school	**38**	**11**
Technical/Vocational school	**11**	**3.2**
Higher level	**23**	**6.6**
Educational status of the father		
Illiterates	**83**	**24**
Primary school	**184**	**53**
Secondary school	**40**	**11.5**
Technical/Vocational school	**7**	**2**
Higher level	**33**	**9.5**
Occupation of the mother		
Housewife	**268**	**77.2**
Civil servant	**31**	**8.9**
Merchant	**26**	**8.4**
Other	**19**	**5.5**
Occupation of the father		
Farmer	**183**	**52.7**
Civil servant	**55**	**16**
Merchant	**60**	**17.3**
Other	**49**	**14**
Age of the child		
2 – 11 months	**83**	**24**
12 – 23 months	**140**	**40.3**
24 – 59 months	**124**	**35.7**
Sex of the child		
Male	**195**	**56.2**
Female	**152**	**43.8**

5.1.2. Environmental characteristics of the respondents.

Out of the total 347 households, 250 (72%) households were rural dwellers. The majority of the households of the study population have an average family size of 4-7 people per household. More than two third of the population use protected springs/hand pumps water sources for all purpose. More than 71% of the households use unimproved latrine facilities. Two hundred seventy nine households use kitchen as a regular cooking place, out of the total households that use kitchen for cooking the highest proportion of households (76%) have kitchen constructed separately from the main living house. More than 69% of the living rooms of the study population have two or more windows for ventilation. Regarding cleanliness of the houses only 37 % of the total households have clean and well ventilated living rooms but the rest 63 % of the houses were not good enough to provide good ventilation system to the dwellers. More than 24% of the children living in the studied households were exposed to indoor air pollution during cooking due to lack of separated cooking place.

5.1.3. Nutritional characteristics and previous infections

The majority of children 205 (59%) were breastfed exclusively during the first six month of their life. Out of the total children who had a history of breastfed in their first six months 60 % of them had weaning time more than a yearend the rest 36% had fed their mothers breast for less than a year. To determine the nutritional status of the children enrolled in the study, anthropometric measurements, MUAC, were taken and according to the finding of the assessment the majority 273(79%) of the children were normal however, 74(21%) children were affected by malnutrition and from this severe malnutrition constitutes 25% of the total malnutrition cases. Regarding previous infection disease history of the child the presence of diarrhea two weeks prior to the study and measles infection history of the children were assessed and according to the finding, 90(26%) children had diarrhea infection less than two weeks prior to the study and 37(10.7%) children had been affected by measles.

5.1.4. Health seeking behavior and immunization status

Among the total 347 mother who interviewed to assess their knowledge to the benefits of vaccines, the majority of the mothers 80% were aware to the benefit. More than 82% of the children have been vaccinated at least once in their life time and from the total 287 children who had been vaccinated, the majority, 236(68%) were fully immunized. The majority of the mother of the children used to take their sick children to a nearby health institute.

5.2. The prevalence of 2 -59 months old children pneumonia

Among 347 children enrolled in the study, 35(10.1%) of them had cough during or two weeks prior to the survey, of whom the majority had history of cough for less than two weeks. Thirty one children had cough and fast breathing and from this 27 of them had chest wall in drawing at the time of the survey. Out of the total children who showed different sign and symptoms that can be related to pneumonia, we determine the classification of the disease of a sick child as pneumonia positive based on the presence of cough, fast breathing and chest in drawing. Based on this, the number children who fulfilled these criteria were taken positive to pneumonia. As a result the number of children who were positive to pneumonia during the study period was 26.Therefore, the prevalence of pneumonia among children 02-59 months of age in Gumay district at the time of survey was 7.5 %.

5.3. Analytic statistics

5.3.1. Factors associated with the presence of pneumonia in children 02 -59 months of age

To determine the association of each variable with the occurrence of pneumonia among under-five children all variables were tested by using Bivariate analysis of logistic regression to identify candidate variables for multivariable analysis.

5.3.1.1 Socio-demographic characteristics

Out of the total 26 children with pneumonia, 8 mothers and 5 fathers of the children were illiterate and 15 mothers and 18 fathers have primary school educational status. The majority of the mothers, 21of the children were housewife and 18 fathers of the children with pneumonia were farmer in their occupation. The age group of 2-11 months comprises the majority of the children who were positive to pneumonia. Among the factors related to socio-demographic characteristics of the study population only the age of the child has shown statistical significant association with the occurrence of pneumonia among children 2 – 59 months of age living in the study area (Table 2).

Table 2. Socio-demographic characteristics of respondents, Gumay District, Jimma zone, south west of Ethiopia, March 2017(n=347 mothers and children's pair)

Variables	Pneumonia%		COR(95% CI)	P-Value
	Yes	No		
	N (%)	N (%)		
Mother educational status				
Literate	**17(6.5)**	**244(93.5)**	**1**	
Illiterate	**9 (10.5)**	**77 (89.5)**	**1.67 (0.72-3.92)**	**0.23**
Father educational status				
Literate	**21(8)**	**243(92)**	**1**	
Illiterate	**5 (6)**	**78 (94)**	**0.74 (0.27-2.03)**	**0.56**
Occupation of the mother				
House wife	**21 (7.8)**	**247 (92.2)**	**1**	
Other	**5 (6.3)**	**74 (93.7)**	**0.79 (0.29-2.2)**	**0.65**
Occupation of the father				
Farmer	**18 (10)**	**165 (90)**	**1**	
Other	**8 (5)**	**156 (95)**	**0.74 (0.2,1.13)**	**0.086**
Age of the child				
2-11 months	**16 (19)**	**67 (81)**	**4.8 (1.8, 12.8)**	**0.000***
12-23 months	**6 (4.3)**	**134 (95.7)**	**1.35 (0.2,2.6)**	**0.65**
24-59 months	**4 (3)**	**120 (97)**	**1**	
Sex of the child				
Male	**11 (5.6)**	**184 (94.4)**	**1**	
Female	**15 (10)**	**137 (90)**	**1.83 (0.82-4.23)**	**0.143**

5.3.1.2. Environmental characteristics

Most of the children who were positive to pneumonia, 24 were living in households that used unimproved latrine. Seventy three percent of the households of the children with pneumonia cook food in the main house. The majority of the children with pneumonia were found to live in houses constructed with less than two windows. Out of the total 94 children who were carried by their mothers back during cooking, more than 22% of the children were positive to pneumonia. The Bivariate logistic regression analysis revealed that, type of latrine facility used by the households (P=0.026), place of cooking in a regular basis (P=0.001), the presence of separately constructed kitchen (P=0.00), the number of windows in the house, cleanliness of the living rooms and place to keep the child while cooking (P=0.000) had significant association with community acquired pneumonia among children at P <0.25 significance level (Table 3).

Table 3.Bivariate analysis of Pneumonia among children 2 -59 months of age against environmental characteristics of study participants, Gumay District, Jimma zone, south west of Ethiopia, March 2017 .(n=347mothers and children's pair)

Variables	Pneumonia%		COR (95% CI)	P-Value
	Yes	No		
	N (%)	N (%)		
Residence				
Urban	**7 (7.2)**	**90 (92.8)**	**1**	
Rural	**19 (7.6)**	**231 (92.4)**	**1.05 (0.43,2.6)**	**0.903**
Family size				
No crowdedness	**7 (7.4)**	**87 (92.6)**	**1**	
Crowded	**19 (7.5)**	**234 (92.5)**	**1.01 (0.41,2.48)**	**0.98**
Water source				
Pipe water	**4(5)**	**78(95)**	**1**	
Protected spring/Hand pump	**18(7.4)**	**225(92.6)**	**0.64 (0.21,1.95)**	**0.43**
Unprotected water	**4(18)**	**18(82)**	**0.23 (0.05,1.01)**	**0.132**
Type of latrine facility				
Improved	**2(2)**	**98(98)**	**1**	
Unimproved	**24(9.7)**	**223(90.3)**	**5.27 (1.2,22.75)**	**0.026** **
Place of cooking				
Main house	**19(25.3)**	**56(74.7)**	**13(5.2,32)**	**0.001** **
Kitchen	**7(2.6)**	**265(97.4)**	**1**	
Kitchen is separated from house				
Yes	**11(4)**	**253(96)**	**1**	
No	**15(18)**	**68(82)**	**5.1(2.23,11.45)**	**0.000** **
Number of windows				
Less than two	**16(16)**	**86(84)**	**4.37(1.2,10.0)**	**0.000** **
Two and above	**10(4)**	**235(96)**	**1**	
Roofing of the living house				
CIS	**17(6)**	**69(93)**	**1**	
Thatched	**9(13)**	**62(87)**	**0.45 (0.19,1.06)**	**0.069**
Cleanliness of the house				
Good	**4(3)**	**124(97)**	**1**	

Not Good	**22(10)**	**197(90)**	**3.46(1.16,10.3)**	**0.025****
Location of the child during cooking				
On cooking mother's back	**21(22)**	**73(78)**	**14(5.2,39)**	**0.000****
Outside of the cooking house	**5(2)**	**248(98)**	**1**	
Exposure to cigarette smoke				
Yes	**9(11.5)**	**69(88.5)**	**1.93 (0.83,4.53)**	**0.195**
No	**17(6.3)**	**252(93.7)**	**1**	

5.3.1.3 Nutritional characteristics and previous infections

Sixty nine percent of the children with pneumonia had non excusive breast feeding during the first six months of their life and the majority of them had less than one year duration of breast feeding. Most of the children with pneumonia, had different degree of malnutrition based on the anthropometric measurement, MUAC. More than 14%, of the total children who had episodes of diarrhea two weeks prior to the study, were found positive to pneumonia and out of the total 26 children positive to pneumonia the number of children who had diarrhea comprises 65 % (Table 4).

Table 4.Bivariate analysis of Pneumonia among children 2-59 months of age against previous infections and nutritional characteristics, Gumay District, Jimma zone , south west of Ethiopia, March 2017(n=347 mothers and children's pair).

Variables	Pneumonia%		COR (95 % CI)	P - Value
	Yes	No		
	N (%)	N (%)		
Breast feeding status of the child				
Exclusive breast feeding	**8(4)**	**197(96)**	**1**	
Not exclusive feeding	**18(13)**	**124(87)**	**3.57(1.51,8.46)**	**0.004 ***
Weaning time				
Less than a year	**19(14)**	**120(86)**	**4.55 (1.8,11.13)**	**0.001 ***
One year and above	**7(3.4)**	**201(96.6)**	**1**	
Nutritional status of the child				
Normal	**16(23)**	**57 (77)**	**1**	
Malnutrition	**10 (3.6)**	**264 (96.4)**	**0.13(0.058,0.313)**	**0.000 ***
Diarrhea in the past two weeks				
Yes	**14(14.4)**	**80 (85.6)**	**3.17 (1.41,7.13)**	**0.005***
No	**13 (5)**	**240 (95)**	**1**	
History of measles				
Yes	**3 (8)**	**34 (92)**	**1.1 (0.31,3.86)**	**0.88**
No	**23 (7)**	**287 (93)**	**1**	

5.3.1.4 Immunization status and Health seeking behavior

Out of the total 347 household the majority of the mothers had awareness on the benefits of vaccines and more than 82% of the total 347 children were vaccinated at least once in their life time. However, the number of pneumonia positive children comprises 25% of the total unvaccinated children; i.e.57% of pneumonia positive children and 14% of children without pneumonia were unvaccinated. More than 84% of the children positive to pneumonia and 27% of the children without pneumonia were incompletely immunized .The majority of the mothers of the children with pneumonia do not take their sick children to a nearby health institute compared to the mothers of children without pneumonia. Mothers awareness on vaccine benefits (P=0.027), vaccination and Immunization status of the child and health seeking behavior of the mothers (P=0.00) were found to be statistically associated with the presence of pneumonia among 02-59 months of age during the Bivariate logistic regression analysis (Table 5)..

Table 5.Bivariate analysis of Pneumonia among children 2-59 months of age against previous immunization status and parents health seeking behavior, Gumay District, Jimma zone , south west of Ethiopia, March 2017(n=347 mothers and children's pair).

Variables	Pneumonia %		COR(95% CI)	P-Value
	Yes	No		
	N (%)	N (%)		
Awareness on benefits of vaccine				
Yes	**16(5.8)**	**262(94.2)**	**1**	
No	**10(14.5)**	**59(85.5)**	**2.77(1.2, 6.43)**	**0.017** **
Vaccination status of the child				
Vaccinated	**11 (4)**	**276 (96)**	**1**	
Unvaccinated	**15 (25)**	**45 (75)**	**8.36(3.61,19.4)**	**0.000**
Immunization status of the child				
Fully immunized	**4(2)**	**232(98)**	**1**	
Incomplete immunization	**22(19)**	**89(81)**	**14.3(4.81,42.71)**	**0.000** **
Health seeking behavior				
Yes	**11(3.8)**	**282(96.2)**	**1**	
No	**15(27.8)**	**39(72.4)**	**9.86(4.23, 23)**	**0.000** **

5.4. Factors independently associated with pneumonia in children

Variables that showed significant association in binary logistic regression model were Age of the child, type of latrine, cooking place and separately constructed kitchen, number of windows, cleanliness, location of the child during cooking, breast feeding status, weaning time, nutritional status, history of diarrhea, awareness of vaccine benefits, vaccination status, immunization status and health seeking behavior of the mothers. Age of the child, Regular cooking place, the number of windows, location of the child during cooking and vaccination history of the child remained significantly associated with pneumonia. The survey showed that children 2-11 months of age are about three times (AOR= 3.17; 95% CI 1.6, 6.3) more likely to develop pneumonia than children 24-59 months of age. The odds of pneumonia among children living in houses where food regularly cooked in main house was six times (AOR=5.7; 95% CI 1.83, 18) higher than their counter parts. Children living in houses with less than two windows were 3 times (AOR=3.18; 95% CI 1.07, 9.5) more likely to have pneumonia, than their counter part children living in houses with more than two windows. Children who were carried on their parents/care takers back were about five times (AOR=5.15; 95% CI; 1.6, 16.7) more likely susceptible to pneumonia than their counter part children who were not exposed to indoor air pollution resulting from use of biomass. Similarly, children who were not vaccinated were almost five times (AOR =4.76; 95%CI 1.69, 13.37) more likely to develop pneumonia than children who were vaccinated at least once in their life time (Table 6).

Table 6.Multivariate analysis of factors that determine the occurrence of pneumonia among children 2 -59 months of age, Gumay District, Jimma Zone, south west of Ethiopia, March 2017(n=347 mothers and children's pair).

Variables	AOR (95 % CI)	P-Value
Age of the child		
02 – 11 months	**3.17(1.6,6.3)**	**0.024**
24 – 59 months	**1**	
Cooking place		
Main house	**5.7(1.83,18)**	**0.004**
Kitchen	**1**	
Number of windows		
Two and less windows	**3.18(1.07,9.5)**	**0.034**
More than two windows	**1**	
Location of the child during cooking		
On cooking mother's back	**5.15(1.6,16.7)**	**0.008**
Outside cooking room	**1**	
Vaccination status of the child		
Vaccinated	**1**	
Unvaccinated	**4.76(1.69,13.37)**	**0.003**

6. Discussion

The present study has identified a relatively low prevalence of pneumonia among 2 -59 months old children and also pointed out certain modifiable risk factors. This figure of 2 -59 months old children pneumonia prevalence (7.5%) is almost equivalent to the national prevalence of pneumonia (7%), according to EDHS 2011(4) . This similarity might be due to following the same assessment method to ascertain the diseases based on mothers or care takers' report. On the other hand, this finding is not in line with the findings from a cross sectional survey in Este town (18)which found the prevalence of under-five pneumonia to be significantly higher, 16.1%.The possible reason for this difference could be due to the seasonal variation and topographic dissimilarity of the two study areas. Similarly, this finding is not comparable to the findings from the retrospective study in UNHCR refugee camps(49) where pneumonia accounted 17 % of child morbidity. Besides the difference in methodology, the study setting, i.e. the refugees camps are the area where there is overcrowding and hence higher chance of transmission of the disease, may have accounted for the difference in the prevalence of pneumonia in children. Also, efforts to improve access to maternal and child care services in this study area could have contributed to this low level of childhood pneumonia morbidity. The prevalence of pneumonia in children in this study setting is not consistent with the findings from a cross sectional survey in Uganda(50) where pneumonia prevalence was found to be significantly higher (53.7%). The discrepancy in the difference in the prevalence of pneumonia could be due to the difference in the setting in which these two studies were conducted, the latter being done in the National referral hospital of Uganda. The cross sectional survey in Kuwaiti, Bangladesh (28) showed the prevalence of under five pneumonia was estimated to be 53%.

In this study, the occurrence of pneumonia was not affected by the residence. This is comparable to the findings from the cross sectional survey in Este town (18) where pneumonia prevalence was not different between urban and rural dwellers. The presence of pneumonia among under five year children did not show statistical significant association with the educational status and occupation of parents**.** This finding is consistent with the findings from a case control study in Pakistan(27)where there was no a statistically significant difference in the prevalence of pneumonia between educated and none educated parents. This case control study, however, reported that maternal occupation had been found to be significantly associated with pneumonia, which is in contrary to the finding in this study. This difference could be explained by the difference in the methodology. Similarly,

this finding is supported by the report from the cross sectional survey in Este town (18)where educational status and occupation of the parent did not illustrate significant association with pneumonia in children. Another case control study from India(44) reported that the literacy status of the father did not show any association with pneumonia in under fives. Also, we did not find any significant difference in the occurrence of pneumonia with sex of the child. This finding is not consistent with the findings from the report of lancet 2013 (14)which showed higher occurrence of pneumonia in boys than in girls (median OR=1.3). The difference in the methodology could be the reason for this discrepancy.

In this study, there was a difference in the occurrence of pneumonia with the age of child. This finding is in line with the report from lancet 2013 (14) which revealed higher occurrence of pneumonia in children younger than 2 years of age. Similarly, the result is similar to studies conducted in Urban Areas of Oromiya Zone, Amhara Region (9) Where children at age rang 2-11months were 85% higher chance to have pneumonia as compared to older age. Though this study showed that use of charcoal and wood for cooking was higher in the study area, there was no significant statistical association with pneumonia in under fives. This is just the opposite findings to the cross sectional survey report in Este town (18)where there was a statistically significant association of the occurrence of pneumonia with charcoal use for cooking. On the other hand, place of cooking and place of the child during cooking were associated with pneumonia in this study. This is consistent with the Este town cross sectional survey (18)findings, where cooking in the living room and carrying the child during cooking were a significant risk factor for pneumonia.

In addition, types of latrines households use were not associated with pneumonia in 2 -59 months old children in this study. This is not consistent with the WHO/UNICEF report (26) which revealed that improved latrine can for most part prevent pneumonia in children. This study could not find a significant association between pneumonia in children and current smoking habits of any house hold resident. This is not in line with the reports from WHO training package on health sector (30), where children whose parents smoke were 60% more affected by pneumonia. Also, this finding is not supported by the scientific articles published in Miami(51) and Poland (52) and case control study in West Africa (53) where cigarette smoke was demonstrated to be the risk factor for pneumonia in children.

The finding of this study revealed that the number of windows of the living house has a significant association with the prevalence of pneumonia in the study area; this finding is

similar to the study conducted in Este town, where the finding of the study showed that indoor air pollution resulting from the use of biomass fuel for cooking has statistical association with pneumonia. Air pollutants associated with biomass fuel use may adversely affect specific and non-specific host defenses of the respiratory tract against pathogens.

Exclusive breast feeding status of the child during the first 6 months of child's life was not found to factor pneumonia in children in the study area. This is not consistent with findings from a systematic review and meta analysis (54)done in USA, 2013, 2011 UNICEF report (55) and the integrated action plan for prevention and control of pneumonia and diarrhea report 2013 of the WHO and UNICEF(56) where exclusive breast feeding was one of the factors that could determine the incidence and prevalence of pneumonia and mortality from pneumonia in children. This difference could be explained by the fact that mothers who might know that breast feeding children exclusively to the first 6 months of children's life is socially acceptable may falsely reported that their children had been breastfed exclusively during their first 6 months of age.

The presence of malnutrition among children2-59 months of age was not statically associated with the prevalence of pneumonia in the study area, this finding is not in line to studies conducted in Costa Rica and Philippines(57) which revealed a significantly higher proportion of sever pneumonic infant with first, second and third degree of malnutrition compared with normal nutritional status. A similar study conducted in Ethiopia demonstrates the fact that children with malnutrition tend to have low immunity and are vulnerable to a number of infections, including Pneumonia(58). Finally, the finding of our study revealed that vaccination status of the child has a significant association with the prevalence of pneumonia. It was least in children who were fully immunized (12.5%) as compared to unimmunized children. Similarly an Indian study reported that non immunized infants were more prone to develop sever pneumonia (59)

6.1. Strengths and limitations of the study

6.1.1 Strengths

Done in the community, this study may reflect the actual prevalence of 2 -59 months old children pneumonia in the study area.

Ascertainment of pneumonia was based on objective assessments by trained data collectors.

6.1.2 Limitations

The cross-sectional survey could not help establish temporal relationship between the possible determinants 2 -59 months old children pneumonia and the outcome of interest, pneumonia among 2 -59 months old children.

The study selectively addressed certain factors of under-five pneumonia while various factors are found to cause the diseases.

The WHO's IMNCI is not a confirmatory gold standard diagnostic tool to surely settle pneumonia diagnosis.

It was difficult to measure indoor air pollution.

7. Conclusion and Recommendation

7.1 Conclusion

The study identified a comparatively similar result with the national prevalence of pneumonia among children 2-59 months of age. It also came up with some modifiable risk factors of pneumonia in the study area. Risk factors associated with community acquired pneumonia in Gumay woreda were Age of the child, cooking foods regularly in the main house, number of windows the house is constructed with, carrying the child on the back during cooking and lack of chance to be vaccinated at least once in the child's life time.

7.2 Recommendations

Based on the findings in this study, the following recommendation were forwarded

The district Health Office should:-

- Raise awareness of the community about the adverse health effect of indoor air pollution, resulting from cooking in living house without adequate ventilation.
- The district health office in collaboration with different sectors needs to encourage contracting kitchens separately from the living house.
- District health office should establish a strong awareness raising strategies in the community to improve proper child cares and to promote the acceptability of vaccines.
- Mothers/caregivers should keep children away from smoke during cooking.
- Households should ventilate living rooms by opening doors and windows.

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9. Annex

9.1. Consent Form

Hello. My name is _____and I am MPH student in Jimma University, institute of Health, department of Epidemiology. I am conducting survey on the prevalence and associated factors of under- five childhood pneumonia within this district (rural and urban) administration. The result that will come out of this study will be used by the government and the district health office to base their rational decision to develop appropriate strategies to combat this problem. The research is intended to benefit the community including the people that will be participating in this research and will introduce no risk to the participant. The questionnaire requires the maximum of 20 minutes to complete. These households are selected randomly through lottery method from all kebeles of the town by the researcher. Your participation is entirely voluntarily, and you can quit from the study any time you want. You will have no penalty if you fail to show desire to participate. I, however, do hope that you will participate in the study since the data that will come from you will be important for us. Your name and other personal identity will not be used ,and hence the information we will collect from you will completely be kept confidential and will not be disclosed to any third person other than the people participating in this study. For any question you want to ask us, you can use the contact address here under.

May I now begin the interview?

If yes, continue interviewing

If No, thank and stop interviewing

Name of the interviewer_____

Sign. _____ Date _____

Name of the supervisor _____.

Sign. _____ Date_____

Addresses

Name: Anteneh Tesfaye: Mobile: +251917385373 E-mail. antuyejimma@gmail.com

8.2. Questionnaire form

English version

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

Questionnaire code: _____

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

Part I. Socio demographic characteristics

No	Questions	Coding category	Skip
101	Usual Residence	Urban----------1 Rural----------2	
102	Family size		
103	Have you ever attended school?	Yes----------1 No----------2	104
104	What is the highest level of schooling you attended?	primary ----------1 secondary----------2 technical/vocational ----------3 Higher level----------4	
105	Has your husband ever attended school?	Yes----------1 No----------2	106
106	What is the highest level of schooling your husband attended?	primary ----------1 secondary----------2 technical/vocational ----------3 Higher----------4	
107	What is your current occupation?	Housewife----------1 Maid servant----------2 Civil servant----------3 Merchant---------- 4 Student----------5 Other specify--------99	
108	What is your husband's occupation?	Farmer ----------1 Student----------2 Civil servant----------3 Merchant----------4 Other specify**-------99**	
109	Age of the child	2-11 months----------1 12 -23 months--------2 24-59 months---------3	

110	Sex of the child	Male----------1 Female----------2	
Health Status of the child			
111	Cough and or difficult of breathing (at the time of survey)	Yes----------1 No----------2	114
112	Duration of cough	Less than two weeks---1 Two or more weeks----2	
113	Check the respiratory rate of the child		
114	Check chest wall in drawing	Yes----------1 No----------2	
115	Vomiting everything	Yes----------1 No----------**2**	
116	Check convulsion	Yes----------1 No----------**2**	
117	Unable to drink/breast feed/eat	Yes----------1 No----------2	

Part two: questions on environmental factors

No	Questions	Coding category	Skip
201	What is the main source of drinking water for members of your household?	Piped water----------1 Protected dug well----2 None protected dug well----------3 Spring water----------4 Rain water----------5 River/pond/ /dam----6	
202	What is the main source of water used by your household for Hand washing?	Piped water----------1 Protected dug well----2 None protected dug well----------3 Spring water----------4 Rain water----------5 River/pond/ /dam----6	
203	What kind of toilet facility do members of your household usually use?	Open pit latrine------1 Ventilated improved pit latrine-------2 Pour flush latrine-----3 Open field/bush--------4	

204	What fuel is used most for cooking in your home	Charcoal----------1 Wood----------2 Electricity----------3 Kerosene----------4 animal dung----------5 Crop wastes----------6 Other specify---------99	
205	Where is the cooking usually done ?	Main House----------1 Kitchen----------2 Outdoors----------3 Other----------4	210
206	Is the kitchen separated from the main house?	Yes------1 No ------2	
207	Is there a hood or Chimney in the house or kitchen?	Yes----------1 No----------2	
208	Number of windows in the household	One----------1 Two----------2 Three----------3 None----------4	
209	The roofing material of the main house?	CIS----------1 Thatched----------2 Plastic----------3	
210	The floor of the main house?	Cemented----------1 Brick----------2 Earthen----------3 Dung plastered-----4	
211	Cleanliness of the rooms of the main house?	Good----------1 Fair----------2 Bad----------3	
212	Where is the usual location of the child during cooking?	On cooking mothers back or besides the mother----------1 Outside of the cooking house----2	
213	Is there any cigarette smoker in the member of the household?	Yes----------1 No----------2	
No	**Questions**	**Coding category**	**Skip**
301	Breast feeding status of the child during the first 6 months of life.	Exclusive breast feeding----------1 Partial Breast feeding----------2 Not Breast feeding----------3	
302	For how long have you breasted fed your child?	Less than 6 months-----1 6 to 12 months----------2 More than a year--------3	

303	Nutritional status of the child (MUAC)	Normal----------1 Severe malnutrition-----2 Mild malnutrition--------3 Moderate malnutrition--4	
304	Have your child ever had diarrhea?	Yes----------1 No----------2	
305	Have your child ever had Measles?	Yes----------1 No----------2	

Part four: Questions related to Health seeking behavior

No	Questions	Coding category	Skip
401	Do you know the benefit of vaccine?	Yes------1 No------2	
402	Have you vaccinated your children?	Yes------1 No------2	
403	Immunization status of the child?	Fully immunized---------1 Partially immunized-----2 Unimmunized----------3	
404	Do you follow the day to day behavior of the child?	Yes------1 No------2	
405	Do you understand immediately if your child reflects unusual behavior?	Yes------1 No------2	
406	Do you know the signs and symptoms of a sick child?	Yes------1 No------2	
407	If your child is sick, do you take him immediately to a nearby health institute?	Yes------1 No------2	
408	If no, why you refused to take the child to the nearby health institute?	Health institute is far from the house----1 Long waiting time----------2 Lack of awareness on the presence of treatment for a sick child----------3 Lack of money----------4 Other----------99	

8.3 Ibsaaqo'annaa

Akkamjirtu?Maqaankoo _____ dha. Aanaa kana keessattiwantootnidhibeeNimooniyaa fiNimooniyaawajjinwalqabatanmaalakkata'anaddaanbaasuufqo'annoogeggeessaajirra.Qo'an noonkunmaaltuakkahaalaatalaalliiijoolleewajjinwalqabatuqorachuu fi yoomucaankeessankanhintalaalchifamneta'e/taateimmoomaalifakkamucaankeessanhintalaalf aminaddaanbaasuufadeemsisaajirra.

Aniwarraragaafunaankeessatokkoodha.Gaaffileetokkotokkowaa'eekeessanii fi waa'eetalaalliimucaakeessaniiisingaafachuufandhufe.Hirmaachuukeessaniifjechamiidhanisin irraaga'utokkolleehinjiru.Deebiiisinkennitaniifjechafaayyidaanisinirraahir'atushinjiru.Garuuh irmaannankeessanrakkootalaalliiijoollee fi hawaasakeessaniifooyyessuufwaangargaruuf, deebiinkeessanbaay'eemurteesaadha.Deebiinisinkennitanfedhiikeessaninalaeeynumattuudaba rfameehinhimamu, akkasumas,

maqaakeessanhimuunisinhinbarbaachisu.Ittidabaleesqo'annaa kana irrattihirmaachuundirqamamiti, gaaffiibarbaaddandeebisuudhiisuunidandeessu. Kanaaf, irrattihirmaachuuffedhiiqabduu?

Eeyyee_____ Lakkii _____

Unkawaliigaltee

Waa'eenqo'annaakanaasirriittinagaleeraa, kaayyooisaashubadheeraa.

Kanaafirrattihirmaadheedeebiikennukoomallattokootiinanmirkaneessera.

Mallattoo _____ Guyyaa _____

Gaaffiiyooqabaattanteessookanaanwalqunnamuunnidanda'ama.

AnteeneeTasfaayee:LakkBilbila +251917385373, E-meeyilii. antuyejimma@gmail.com

8.4. Questionnaire form

Baraaffii (Afan Oromo version)

Bargaaffii amma dhukkuba michii sombaa fi sababoota issa daa' imman umrii waggaa Shanii gadii

Koodii gaaffii : _____

Ajaja: Gaaffiiwwan armaan gaditti heeraman deebii sirrii namni gaafatame/hirmaataan qorannoo kanaa/ deebiseen guuti. **Kutaa I:Amaloota hawaas-dinagdee hirmaattotaa**			
Lakk	Gaaffii	Koodii filannoo	Itti darbi
101	Iddoji reenyaa	Magalaa----------1 Badiyaa----------2	
102	Baay'inni maatii keessanii meeqa?		
103	Barumsa Barattani jirtuu?	Eeyyee------1 Lakkii-----2	
104	Yoo barattantaate hanga kutaa/sadarkaa meeqaati?	1. Kutaa 1-8 2. Kutaa 9-12 3. Teeknikaa fi ogummaa 4. Koollejjii/ Yuuniversitii	
105	Abban mana keetii Barumsa hordofeera?	Eeyyee------1 Lakkii-----2	
106	Yoo hordofetaate hanga sadarkaa meeqaffaati?	1. Kutaa 1-8 2. Kutaa 9-12 5. Teeknikaa fi ogummaa 3. Koollejjii/ Yuuniversitii	
107	Hoojiin idilee haadha mucaa maalii?	1. Haadhamanaa 2. Hojjattuumoottummaa 3. Daldaltuu 4. Hoojiiguyyaa 5. QonnaanBultuu 6. Hojjettuumit-mootummaa 7. Kanbiroo, ibsi, _____	
108	Hoojiin idilee Abbaa mucaa maalii?	1. Kanhinqacaramne 2. Hojjetaamoottummaa 3. Daldalaa 4. Hojjetaaguyyaa 5. QonnaanBulaa 6. Hojjetaamit-mootummaa 7. Kanbiroo, ibsi, _____	

109	Umurii mucaa (ji'aan)	Jiha 2-11 ----------1 Jiha 12 -23--------2 Jiha 24-59 --------3	
110	1. Saala mucaa	Dhiira-------1 Dhalaa------2	
Haala fayyaa daa'ima			
111	Qufaa/utalloo fi dhiibbaa hargansuu	Eeyyee------1 Lakkii-----2	114
112	Yeroo quufaasisu	Torban 2 gadi---1 Torbaan 2 fi isaa oli----2	
113	Haala hargansuu daa'imamirkaneessu		
114	Qara laphee yeroo hafuur abaafatu akkaqodhu mirkaneessu ?	Eeyyee------1 Lakkii-----2	
115	Wantoota keessatti fudhatuhundani deebisisa/Haqisaa ?	Eeyyee------1 Lakkii-----2	
116	Nigaggabsisaa ?	Eeyyee------1 Lakkii-----2	
117	Dhugaati/nyaatanyaachuuni dhorgiisaa?	Eeyyee------1 Lakkii-----2	

Kutaa II: Gaaffii waa'ee naannoo jireenyaan wal qabatan

Lakk	Gaaffii	Koodii filannoo	Itti darbi
201	Maddi ykn bakki dhugaatii bishaan dhugaati maatiin keessan fayyaddamu essarrayi?	Bishaan boombaa----------1 Bishaan boollaa eegumsa qabu----2 Bishaan boollaa eegumsa hin qabne…3 Bishaan burqaa----------4 Bishaan bokkaa----------5 Laga/haroo ciisaa----6	
202	Maddibishaanmaatiikeessandhiqanahar kaatiffayadamuessarrayi?	Bishaan boombaa----------1 Bishaan boollaa eegumsa qabu----2 Bishaan boollaa eegumsa hin qabne…3 Bishaan burqaa----------4 Bishaan bokkaa----------5 Laga/haroo ciisaa----6	

203	Mannifincaani/qulqullumman mana fincani maatiin keessaa fayyadamani akkam?	Mana fincaanii ijaarsa hin qaabne-1 Mana finaaanii ujummoo qilleensa baasuun qabu---2 Mana fincaanii bishaaniin qulqulleeffamu -----3 Dirree/bosonatti--------4	
204	Wanti ibidda ffayyadamani wantoota akkamiti keessattii nyaata hojjachuuf	Kasala----------1 Qoraan----------2 Elektirikii----------3 Kerosinii----------4 Faltii loonii----------5 Galabaa midhaanii----------6 Kan biroo(ibsi) ---------99	
205	NyaatniEessatti hojjatama yeroo bay'ee?	Mana jireenyaa----------1 Mana nyaataa----------2 Bakkeetti ----------3 Kan biroo----------4	210
206	Manni hojii fi manni jireenya adda adda jiraa?	Eeyyee------1 Lakkii-----2	
207	Iddoo naarriitti qaraa laattibahuqaraqubba mana nyaatni ittidalaqamunt olfameeraa?	Eeyyee------1 Lakkii-----2	
208	Baay'ina foodda mana jireenya keessatti?	Tokko----------1 Lama----------2 Sadii----------3 Homaa hin qabu----------4	
209	Baatiin mana jireenyaa maaliin ijaarame?	Qorqoorroo ----------1 Citaa ----------2 Pilaastikaan ----------3	
210	Lafti mana jireenyaa maaliin ijaarame?	Simintoo ----------1 Xuubii ----------2 Biyyoo ----------3 Faltii looniin dhoobame ….4	
211	Qulqullinni mana jireenyaa maal fakkaata?	Gaariidha ----------1 Giddu galeessa ----------2 Badaadha ----------3	
212	Daa'imman eessa turu yeroo nyaatni hojjatamatti?	Dugda haadharra ykn cinaa nyaatni itti qophaawu----------1 Mana nyaatni itti qophaahuun ala2	

213	Maatiikeessannamnisigaraaqarsunijiraa ?	Eeyyee------1 Lakkii-----2	

Kutaa III: gaaffiiwwan harma hoosisuu fi seenaa dhukkuba darbe faana wal qabatu

Lakk	Gaaffii	Koodii filannoo	Itti darbi
301	Jioottanjahadurattidaa'immanharmahaad hahanalaittihosisan?	Harma haadhaa qofan hoosisa--1 Harmaa fi nyaataa wal keessa---2 Harma hin hoosisu----------3	
302	Hangamiifdaa'imakeessankanharmahoosiftan?	Jiha 6 gadiif-----1 Jiha 6 hanga 12----------2 Waggaa 1 oliif--------3	
303	Akkaatandaa'imninyaataittiinfudhatuhaalakamiin? (MUAC)	Normaalii/fayyaadha---------1 Hanqina nyaataa cimaa-----2 Hanqina nyaataa salphaa--------3 Hanqina nyaataa giddu galeessaa --4	
304	Daa'imnikeessanalbaatiiyeroobay'eeniqa baayknammadurahoo?	Eeyyee------1 Lakkii-----2	
305	Daa'imnikeessanGifraanqabameturtee?	Eeyyee------1 Lakkii-----2	

Kutaa IV: Gaaffiiwwan amala yaala fayyaa barbaaduu

Lakk	Gaaffii	Koodii filannoo	Itti darbi
401	Faayidaa talaallii daa'immanii ni beektaa?	Eeyyee------1 Lakkii-----2	
402	Mucaankee kun talaalliiidileefudhateeraa/fudhatteettii??	Eeyyee------1 Lakkii-----2	
403	HaalaTalaalliiMucaa?	Gutummaantalaalfameera/ Fully immunized/---------1 Hangatokkotalaalfameera /Partially immunized/-----2 Hintalaalfamne /Unimmunized/----3	
404	Akkaata/amalootadaa'imakeessaniguyya guyyaannihordoftuu?	Eeyyee------1 Lakkii-----2	
405	Yoohalli/amallidaa'imankeessanijijjiram eisiinnihubatuu?	Eeyyee------1 Lakkii-----2	
406	Mallattoleedaa'imakeessankandhukkubsa tenibeektuu?	Eeyyee------1	

		Lakkii-----2	
407	Daa'imnikeessanyoodhukkubsate, GaraWal'aansafayyanaannokeessaninigeessituu?	Eeyyee------1 Lakkii-----2	
408	Yoomitita'e, sababa nigarawal'aansa fayya geesuudh abdaniif maalii?	Wal'aansifayyaaiddojireenyakeenyarrawaanfagaatuuf----1 Yeroodheeraafeeguuosootajaajilawal'aansahinargatin----------2 Hanqinatajaajilawal'aansagahaa/quubsadaa'imadhukkubsateefkeennu--------3 Hanqinamaallaqaa----------4 Kan biroo----------99	