ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCE
SCHOOL OF PUBLIC HEALTH

ASSESSMENT OF THE PREVALENCE AND ASSOCIATED FACTORS OF PNEUMONIA IN CHILDREN 2TO 59 MONTHS OLD, DEBREBERHAN DISTRICT,NORTH EAST ETHIOPIA

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Declaration

I, the undersigned, declare that this thesis is my original work, has not been presented for a degree in this or another university and that all sources of materials used for this thesis have been fully acknowledged.

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

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II. 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

D.E.C-Data Entry clerk

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

PBF-Partial Breast Feeding

PI-Principal Investigator

SPSS-Statistical Package for Social Science

UNICEF-United nations Children's Fund

UNHCR-United Nation High Commissioner for Refugees

WHO-World Health Organization

W.HO-Woreda Health Office

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III.Abstract

Background: Childhood Pneumonia is the commonest cause of suffering worldwide among under- five children where it accounts more than one out of seven under- five deaths globally. It is the single leading cause of death in Ethiopia, accounting 18% of all under five mortality burden.

Objective: The objective of the study was to assess the prevalence and associated factors of pneumonia in 2 -59 months old children in Debre-Brehan district.

Methods: Community based cross sectional study was conducted in Debre-Brehan district from February 15 to February 25, 2015, 2015. Stratified, multi-stage sampling technique was used to proportionally draw households from each of the selected 6 kebeles- two from rural and four from urban strata, based on the number of kebeles in the strata - by taking in to account the number of households in each of these selected kebeles. Pre-tested Interviewer administered structured questionnaire was employed to collect data from randomly selected 458 households. Three diploma nurses and a public health officer were participating in the survey as data collectors and supervisor, respectively. The data was entered in to EPIDATA version 3.1 and then exported to Statistical Package for Social Science (SPSS) version 21 for analysis.

Result: The prevalence of pneumonia in 2 to 59 months old children was estimated to be 5.5%. Past history of measles (AOR = 2.676;95%CI 1.049,6.830; p-value= 0.039) and diarrhea (AOR =5.293; 95%CI 2.107,13.298; p-value= 0.000), use of improved latrine (AOR= 0.157; 95% CI 0.057,0.431; p-value =0.000)) and breastfeeding for 2 or more years (AOR=0.152; 95%CI 0.042, 0.553; p-value= 0.004) were found to be significant predictors of pneumonia among 2 to 59 months old children in this study.

Conclusion and recommendation : The present study identified a relatively low prevalence of pneumonia in 2 to 59 months old children. It also pointed out such modifiable risk factors of pneumonia in this age group as past history of diarrhea & measles, use of not improved latrine and breast feeding the child for less than 2 years. The Worerda Health Office, in collaboration with the health institutions in the district, should design and communicate strategies to the community to help them acquire knowledge on the importance of breast feeding (for 2 or more years) and vaccinating (for Rota and Measles vaccine) their child to prevent Pneumonia among them.

Key wards: *2 -59 months old children, Pneumonia, cross sectional, Under five*

Background

1.1Introduction

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. 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 differ 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 come 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) [2] 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 [2,3] .

The presence of cough and fast breathing and or difficulty of breathing for specific age clenches the classification of suspected pneumonia in children older than 2 months and yet less than 60 months of age [2,3]. 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 [2,3]. 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 [2,3] .

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 UNICEF report in 2006, about 156 million new pneumonia cases are estimated to occure each year in the world while its incidence is believed to exceed 150 million new cases (0.29 episodes per year-child) in developing countries just in a year, making the developing nation to host more than 95% of all new pneumonia cases globally [1,4]. In 2011, there were 120 million new pneumonia infections worldwide, 14 million of which were sever enough to require hospitalization. More than 50% of all new pneumonia cases of the under- five childhood are concentrated in the poorest world's regions, Sub-Saharan Africa and South Asia [1,4,5].

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 [1,4,5]. Nearly 50% of pneumonia deaths take place in only five densely populated and poorest countries: India, Nigeria, Democratic republic of Congo, Pakistan and Ethiopia [6] . Currently, 15% of all deaths of children less than five years of age is shared by pneumonia.

Eighteen percent of all the under-five childhood death in Ethiopia is recognized to be due to pneumonia [6].The huge discrepancy between the current incongruously big and what should have been labeled as acceptable level of the toll of pneumonia reflects poorly designed prevention strategies in the poorest settings like Ethiopia [5]. Almost insignificant contribution of pneumonia to the under- five mortality in Germany,2%s, in comparison to the immense payment of the same problem in Ethiopia vividly shows this increasingly wide disagreement between what stage the problem is on currently and what it should have been [5]. Pneumonia is reportedly one of the largest cause of outpatient visit and hospital admission in the referral hospital in the Debre-Brehan district.

The vast majority of studies on pneumonia takes place in developed nation, with only negligible volume of surveys being conducted in developing countries, including Ethiopia. Some variables that are found to be predictor of pneumonia in one study may not necessarily be a risk factor of pneumonia in another study supporting the argument that possible determinants of under- five pneumonia vary across the geographical location. It may ,therefore, be difficult to generalize the result to the other regions outside of the study area.

Looking at the surveys in Ethiopia, virtually all are local specifically done with small sample size, from which the results could not be generalize to the other settings. The nationwide Ethiopian Demographic and Health Survey (EDHS) 2011may not accurately represent the prevalence of the problem since the problem was ascertained through recall based parental reporting. More importantly, there were no previous scientific studies to find out the prevalence of pneumonia among 2-59 months old children in this study area though the recent service report from the referral hospital found pneumonia to be one of the ten top diagnosis in children. Neither the nationwide EDHS report nor the locally specific surveys on the prevalence and associated factors of under-five pneumonia could represent the nature of the problem in Debre-Brehan District.

This study is, therefore, intended to bridge this information gap by determining the prevalence of pneumonia among 2 to 59 months old children and its associated factors in this district, and to update the previous knowledge on the same problem.

1.3 Rationale of the study

Under-five pneumonia is a universal problem of public health importance that disproportionately affects every region, including Ethiopia presently. Despite the sustained effort to stop the problem, pneumonia continue to kill millions of children worldwide which calls for innovative strategies that will come about only through systematic researches. The widespread nature of the problem in Ethiopia has already killed millions of children which calls for the need to look for lasting solution so as to end the problem.

The under-five pneumonia morbidity burden also costs the health services program as health services are passed on to cure high pneumonia morbidity cases. Pneumonia is not only the problems of individuals, but it is also equally the problem of policy makers, planners and communities at large. Controlling the continued threat of pneumonia is one of the major health priority of the government of Ethiopia for which this study will contribute its part. The result will be used to ensure the continuity of continuum of care so that healthy preschool children will be transformed to healthy adolescents. Above all, there were no previous studies in this area that could determine the prevalence of the problem.

1.4.Significance of the study

To start on effective strategy, the government in general and the District Health Bureau (DHB) in particular need to have scientific bases on the prevalence and possible risk factors of the diseases for which this study will supply valuable information so as to tackle the problem in the long run. Also, the result will be used as baseline information for further large scale studies on the same problem.

2.Literature Review

2.1Pneumonia Morbidity and Mortality burden among under- five children

2.1.1Morbidity: Incidence and Prevalence

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 [4].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 episode per child-year in 2010 [7], 2012 lancet report. 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 [4],respectively.Walker et al found, in 2011, that there were 120 million new pneumonia infections worldwide, 14 million of which were sever enough to require hospitalization [8].

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. 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% [9].A focused local community based cross sectional study done in Este town [10] in 2014 found that the prevalence was as high as16%.This study, however, suffered small sample size and ,again, the ascertainment is based on mothers or care takers' report like with the EDHS report [10].

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% [11] of the 9 million estimated deaths in children aged less than five years in- 2007 [12] was ascribed to pneumonia. Again, about 19% of all deaths in children aged less than five years in 2008 was attributable to pneumonia [4]. This figure has reportedly increased to 21% in the 2012 WHO world health statistics report [13]. However, the 2014 estimates of pneumonia mortality by the UNICEF[43] indicates that the disease was responsible for 15% of under five deaths in 2013.

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 [14]. 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 [15] . 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 [8] . According to 2012 lancet report, however, the global estimate of childhood pneumonia deaths was 18% [14],which can be translated to approximately 1.4 million childhood deaths, roughly a 100,000 deaths rise from the previous report of 2011.

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 [14]. 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 [8]. 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 [14].

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 [14].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 [14.] 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 [8].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% [6].

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 there were 389,000 under five deaths, of which 22% were due to pneumonia [15]. In 2010,pneumonia was responsible for 21% of all under five deaths in the country [5] ,only one percent reduction over the 4 years period. According to the recent 2014 countdown to 2015 report , however, the toll of under- five pneumonia deaths has supposedly plummeted to 18% [6],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 [16] .

2.2.Determinants of under- five pneumonia

2.2.1.Socio demographic characteristics

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 [8]. 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 [17].There is also evidences on the difference in incidence of pneumonia between boys and girls, with the higher episodes of pneumonia occurred among boys [8]. However, this result is in contrary to other finding where gender of the child did not affect the occurrence of child hood pneumonia [17]. Being the socio cultural factor, birth order is among the lists of factors that affects the risk of pneumonia in children [18].

Children born to younger mothers are likely to develop pneumonia than are children born to older mothers [10]. Educational status of parents [10] and that of the father [19] did not affect the probability of their child to acquire pneumonia infection. Similarly, a case control study in Pakistan [17] found that educational status of parents was not significantly associated with the development of pneumonia. Comparatively, children born from well to do family are less risky to develop pneumonia than are their counterparts from poor family [10]. Children whose parents are smoking have 60% probability of developing pneumonia [20]. Occupational status of parents appeared to have no effect on 02 -59 months oldpneumonia [10]. However, a report from case control study in Pakistan [17] revealed that maternal occupation was significantly associated with pneumonia in under fives. In a cross sectional study in India [21], the prevalence of pneumonia was not affected by the residence of children [21].

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 [5]. Indoor air pollution is known to accelerate the risk of pneumonia and pneumonia caused deaths [22]. 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% [22]. The result that came out of the randomized trial control among participants in rural Guatemala[23] , showed that wood made stove with chimney did not reduce the risk of pneumonia. 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 [10]. Half of the 2 million premature deaths in low income countries are due to pneumonia caused by indoor air pollution from solid fuel use [5]. Living in the crowded household environment enhances the transmission of pneumonia to the health child [8].

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 [18]. Diarrhea caused acute respiratory tract infection including pneumonia in a cohort study among children in Ghana and Brazil [24].Measles is an established risk factor for pneumonia. Pneumonia mortality caused by measles reached as high as 86% [25]. Measles actually accelerates the fatality rate of pneumonia[26] through immune suppression. 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 [17] .Lack of measles immunization is among the leading risk factors that predispose the 02 -59 months oldchildren to pneumonia [4].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 [18].Anemia in children is recently studied to be significantly associated with the development of pneumonia [27].

2.2.4.Nutritional factors

Children who have in appropriate 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 [19]. 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 [44]. Not exclusively feeding children younger than six months of age is another factor that put them at higher risk of pneumonia [5,8].Undernutrition ,zinc [8,28] and vitamin A [18] deficiencies have also been found to be an independent risk factors of pneumonia in children aged less than five years of age.

2.2.5. Other factors

Local health care system namely maternal and pediatric care, access to health care and low birth weight are found to predict pneumonia in under- fives. Altitude, annual rainfall, number and nature of the seasons and average monthly temperatures are the factors listed by CHERG as factors of under -five pneumonia [18]. Although the risk of vitamin D in the development of pneumonia remains undecided, a recent cross sectional survey has found that low blood level of vitamin D significantly increased the risk of pneumonia among adolescents [29]. An Indian hospital based case control study suggested that the deficiency state of vitamin D considerably boosted the probability of childhood pneumonia [30].These findings are, however, no longer supported by the other recent study in children conducted in Canada in 2009 where there found no association between this vitamin and risk of pneumonia [31]. Also, Randomized placebo controlled trial in 2010 was carried out among children 3 years or younger to see whether vitamin D supplementation can cure childhood pneumonia. The result, nonetheless, showed that there were no difference in improvement between the two groups of the disease except its effect on the risk of recurrence, where the treatment group were less likely to re-acquire pneumonia compared to the children in the placebo group [32]. Such factors as race, Asthma, Diabetes Mellitus, Congestive heart failure and Chronic Obstructive Pulmonary Disorder(COPD) are evidently found to largely put adolescents at risk of pneumonia [29].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 [1,34].

2.3.Methodological challenges

The findings from all relevant reviewed literatures are just presented without synthesizing the result in to general interpretation and conclusion. Good reasons account for this.

Firstly, the researchers employed different study design and sampling techniques .Some concepts are given different operational definition. The inclusion and exclusion criteria of all reviewed literature are not necessarily same. Secondly, the selection criteria of variables to be included in to the model vary widely. Some studies select variables based on their biological, social or behavioral significance in literatures they reviewed. Others select based on different p-value cut

off and used different analysis technique. Third, the study setting varies widely, all of which make the comparison on determinants of pneumonia across the studies almost impossible.

2.4.Analytical summary

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 .

3.Objectives of the study

3.1 General objective

To assess the prevalence and associated factors of 2 -59 months old children Pneumonia in Debre-Brehan district from February 15 to February 25, 2015.

3.2 Specific objectives

1.To determine the prevalence of 2 -59 months old pneumonia in Debre-Brehan district from February 15 to February 25, 2015.

2.To identify selected socio-demographic, comorbidity, environmental, and nutritional characteristics (factors) associated with 2 -59 months old children pneumonia in Debre-Brehan district from February 15 to February 25, 2015.

4.METHODS

4.1.Study area

The study was conducted in Debre-Brehan district, North -East, Ethiopia. Debre-Brehan was one of the earliest capital cities of Ethiopia and the Kingdom of Shewa. The town now is the capital city of North Shoa zone, Amhara National Regionsl State. Located 130km North East of Addis Ababa, the town has an elevation of 2,840 meters above sea level. Nine urban and five rural kebeles are under the jurisdiction of the district administration. According to the report that came out of 2007 population and housing censuses at present, about 65,214 population was estimated to reside in the district in16,767 households,31,658 of whom were males and 33,556 were females [33]. There are now 11,913 children under the age of five years in the district. Currently, there are one referral hospital, one private General hospital, one health center ,4 health posts and 18 different categories of private clinics in the district .

4.2.Study design and period

A community based cross sectional quantitative survey was employed to collect data on the 2 -59 months old children pneumonia in Debre-Brehan District from February 15 to February 25, 2015.

4.3.Source population

All 2 -59 months old children in the randomly selected six kebeles

4.4 Study population

The study population was children in the age group of 2 to 59 months in the selected six kebeles .

4.5 Sample size determination

The size of study participants recruited in to the research was calculated using the single and two population proportion formula separately. Considering the prevalence of under five pneumonia to be 16.1%% [10] , the recent community based cross sectional survey in Este town with similar ecological structure to the current study setting, level of confidence 95%,and margin of error 5%, the sample size was calculated as follows:

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

Where p- proportion of pneumonia cases

q-proportion of children who have no pneumonia

W-margin of error

Substituting the values for each of these variables in the above formula, the sample size was estimated to be 208. Adding the potential none response rate of 10% and multiplying the result by a design effect of 2 ,the final sample size of 458 households having children 2-59 months of age were required.

Alternatively, the two population proportion formula was used to calculate the required sample size of households having children 2-59 months old considering maternal educational status and history of measles 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
Maternal educational status	95%	39.7%	64%	2.71	1	146
History of measles	95%	57%	72.6%	2	1	318

Where,

P1-the percentage of under-five pneumonia in unexposed (among literate and who have no history of measles)

P2-the percentage of under-five pneumonia in exposed (among illiterate and who have history of measles). Since the sample size for each of these variables was calculated to be smaller than the size calculated for the single proportion formula, the 458 households remained the appropriate sample size for this study.

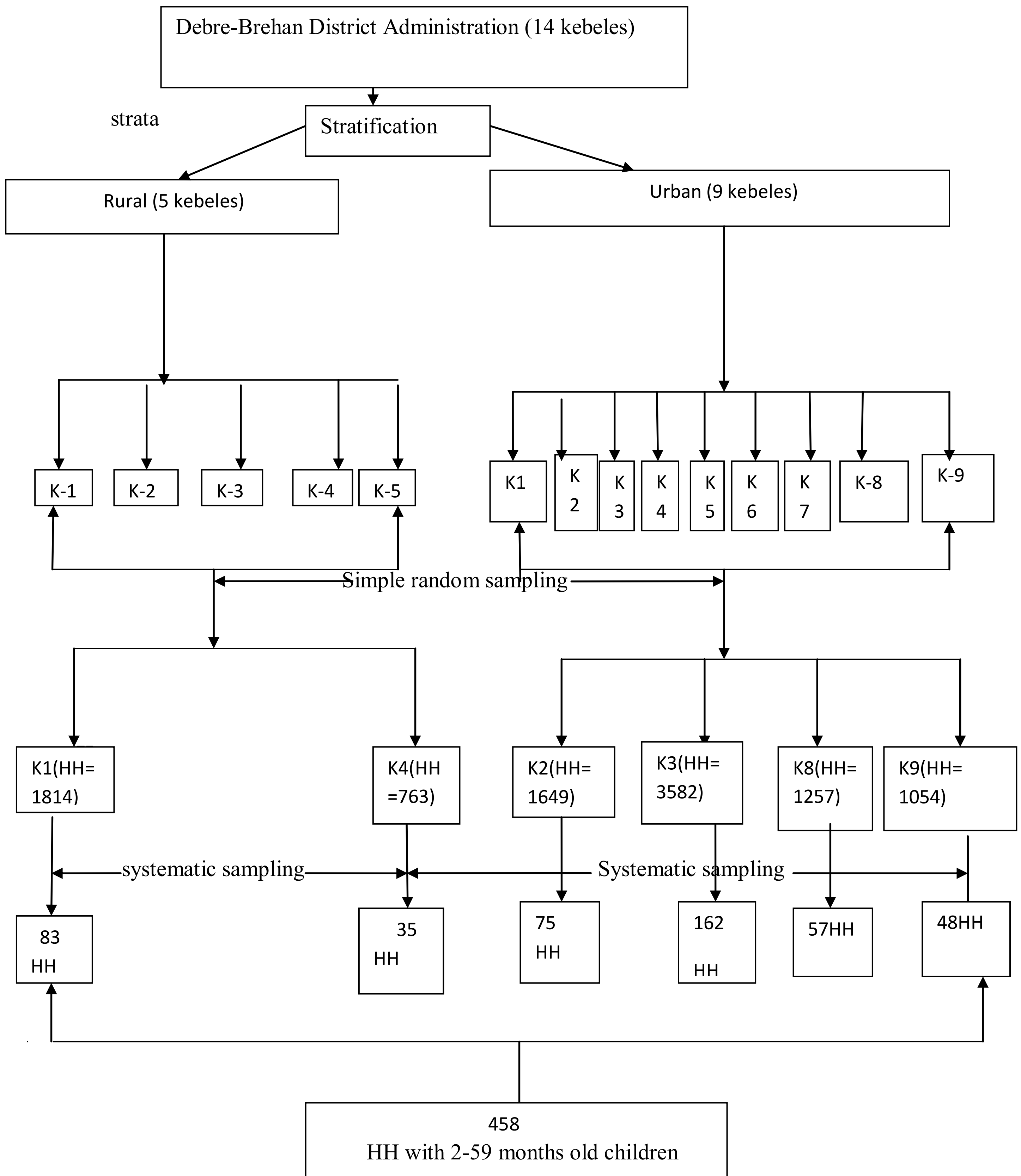
4.6.Sampling procedures

Stratified, multi-stage sampling technique was employed to include study participants in to the research. The study area was first stratified in to urban and rural kebeles since residency is known to affect the prevalence of under- five childhood pneumonia [21].

The total 14 kebeles of the study area were stratified in to two strata, urban and rural, each containing nine and five kebeles, respectively. Then in the first stage, two rural kebeles (kebeles 1 and 4) and four urban kebeles (kebeles 2,3,8,and 9) were selected proportionally-based on the number of kebeles in each stratum- through lottery method. In the second sampling stage, systematic sampling technique of every 22th interval was used to take households from each of the selected six kebeles-by taking into account the number of households in each of the sampled kebeles-until the calculated sample size in the respective kebeles was reached to achieve the sample size of 458 households in total.

The k interval, i.e., 22th interval was determined by dividing the total households within the sampled kebeles (10119 households) by the total sample size of 458 households having 02 -59 months old children. Altogether, there are1814 and 763 households in the first and fourth rural kebeles out of which 83 and 35 households drawn from each of them, respectively. And, there are1649, 3582, 1257 and 1054 households in each of the selected urban kebeles in the order they are listed above, and 75,162,57 and 48 households were proportionally taken from each, respectively.

The first household was selected randomly and the direction to move to the subsequent household was guided by the direction of the tip of the pen. Immediately the next household selected whenever children in the age group of 2-59 months were not found in the 22th household. Every time more than one children aged 2-59 months were found per household, the data collectors employed simple random sampling technique to take just a child for the study. The following diagram describes the detail procedures of household selection.



Notes: K-kebele, HH-Households

Fig.1: Schematic presentation of the sampling procedure in the selection of HH with under-five children

4.7.Inclusion and Exclusion criteria

4.7.1.Inclusion criteria

- Children 2-59 months of age and primary caretaker's pair

4.7.2.Exclusion criteria.

- Children and mothers or caretakers who were severely ill and or have hearing impairments or talking problem.

4.8.Variables of the study

4.8.1 Dependent variable

- Pneumonia of 2 -59 months old children

4.8.2 Independent variables

- Socio demographic characteristics
- Environmental characteristics
- Nutritional factors
- Past co morbidities

4.9. Operational and or standard[2,3,5,36] definitions

Suspected pneumonia case: The child with cough of two or less weeks of duration plus fast or difficult breathing due to a problem in the chest for specific age.

Suspected severe pneumonia case: The child with cough of two or less weeks of duration with one or more of the danger signs with or without fast breathing for specific age.

Fast breathing : 50 breaths per minute or more for children aged 2 to less 12 months

40 breaths per minute or more for children aged 12months -5 years

Danger signs: Any of the following in a child aged less than five years : convulsion, in ability to drink/eat, vomiting everything, unconsciousness, Lower chest in drawing, stridor, unusually sleepiness.

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

Solid fuels: These include such fuel as wood, crop waste, animal dung and charcoal

Improved sanitation/latrine: that are likely to ensure hygienic separation of human excreta from human contact, and includes the following.

- Flush or pour flush to:
  - piped sewer system
  - septic tank
  - pit latrine
- Ventilated improved pit(VIP) latrine
- Pit latrine with slab
- Compositing toilet

Unimproved sanitation/latrine: one that do not ensure hygienic separation of human excreta from human contact, and includes the following:

- pit latrines without a slab or platform
- hanging latrines and bucket latrines
- Pour flush to elsewhere

4.1.0. Data collection procedures

Interviewer administered structured questionnaire was used to collect data on 02 -59 months old pneumonia from the selected , i.e., primary caretaker's and the child's pair sampled households. The questionnaire was first developed in English and translated in to local Amharic language, and then translated back in to English by the third person to check the consistency. Three diploma nurses and one Bachelor of science (BSC) health officer were recruited as data collectors and supervisor, respectively, and trained for two days, and the sampling procedures were elucidated to them. Mothers who had 02 -59 months old children were interviewed on the presence or absence and duration of cough and past history of measles and diarrhea. The respiratory rate of each of the child who had been reported to have cough was measured then through counting the number of times the child's body moves up and down for one full minute. And also, the child with/without cough was assessed for any possibility of danger signs namely convulsion, inability to eat/drink, vomiting everything, chest in drawing, strider and unusually sleepiness. Mothers in the household with 2 -59 months old children who were absent during the first day of data collection were interviewed in the subsequent days (visited three times a day) until the final day of data collection.

4.1.1. Data quality control and assurance management

Both data collectors and a supervisor were trained for two days on such issues as the techniques of data collection and or face to face interview skills. The training also covered the importance of disclosing the possible benefits and purpose of the study to the study participants before the start

of data collection. Data collectors used certain unforgettable events such as the time of deaths and wedding of family members or other person, and the season of the year, 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 and or in month/s and year/s whenever the child had not yet celebrated his/her next birthday. Mechanisms of maintaining the confidentiality of the participants throughout the whole process of data collection and the study were discussed and ascertained during the two days long training. A supervisor was 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 visited data collectors twice a day to check whether they collect the data appropriately. The researcher evaluated the data during the data analysis stage to verify the completeness of the collected data. Both the data Collectors and a supervisor trained on the WHO's Integrated Management of Childhood and Neonatal Illness (IMNCI) classification of pneumonia [2,3] to enable them classify pneumonia cases appropriately.

Pre-test was carried out on the10% of the sample in a none study area and the questions was then revised based on the response obtained so that questions that induced ambiguity were rephrased.

4.1.2. Data Analysis procedures

The data was entered in to the Epi-Data version 3.1 up on creating the questionnaire template in the QES file of the software. The entered data subjected to cleaning using simple frequency and tabulation to ensure the validity of the data. Then, the analysis was made with IBM SPSS version 21 after exporting the prepared data. Descriptive statistics such as frequency distribution, cross tabulation and some measure of central tendency and variability (mean and standard deviation) were computed to describe the major variables of the study. Odds ratio and p-value were computed to see whether any relationship exists between the exposure and outcome variables. P-value less than 0.05 considered statistically significant. Binary logistic regression was done to see the effect of each of the independent variables on the outcome variable by simultaneously suppressing the effect of extraneous variables.

4.1.3. Ethical consideration

Ethical clearance for the start of the study was obtained from Research Ethical Committee of School of Public health**.** Also, permission for the study was obtained from the Woreda Health Office of the study area .Verbal informed consent was obtained from participants after a detailed

explanation on the purpose and benefit of the study right before the individual data collection. Data collectors and a supervisor were told to help participants involved in the study only willingly by clarifying them the objective and purpose of the study.

The participants were told 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 any time they want. And, also, participants get explained that the data collection procedure was entirely be accomplished anonymously together with observance of the necessary confidentiality pertaining already solicited information. The advantages of their honest decision and response to the successful completion of the study was briefed to the participants to help them involved in the research only willingly. Children who were classified as pneumonia cases were sent to health facility for appropriate treatment after collecting data . Also, up on encountering other none pneumonia cases, mothers were counseled to take the child to the nearest health facility.

4.1.4. **Dissemination of results**

The results of the study will get presented to the public defense and following which the final edition (revision) will be disseminated to Graduate School of Addis Ababa University through hard copies. Dissemination of the result will also be made to the health center and hospitals in the Woreda and Debre-Brehan Woreda Health Office through hard/ or softcopies found appropriate. Also, manuscript(s) will get submitted for publication in peer reviewed scientific journal.

5. Result

5.1.Socio demographic characteristics of the respondents

The study population consisted of children in the age group of 2 to 59 months from heterogeneous groups in terms of place of residence, education and occupation. Four hundred fifty eight (458) mothers /primary care takers and children's pair were included in the study with a response rate of 100%. Majority of study participants 340 (74.2%) were urban dwellers. About three fourth of mothers 349 (76.2%) and 365 (79.7%) of their husbands were educated. The largest proportion of mothers 157 (34.3%) and husbands 141 (30.8%) were primary school complete. One hundred and nine (23.8%) of husbands and 84 (18.3%) of mothers were either complete of or learning higher level program. About half of mothers 225 (49.1%) were housewife and only 4 (0.9%) of them were students. The largest proportion of husbands 145 (31.7%) were government employee with 7 (1.5%) of them being others which includes daily laborers, carpenters and drivers.

The highest proportion of children in the survey 269 (58.7%) were in the age group of 24-59 months and children in the age group of 2-11 months comprises the smallest percentages, 16.4%, with the mean age of the child determined to be 28.6±15.67 months. Two hundred fifty five (55.7%) 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 the respondents. Debrebirehan District , North Shoa Zone , Ethiopia, June 2015 (n=458 mothers and children's pair)

Variables	Number (n)	Percent (%)
Residence		
Urban	340	74.2
Rural	118	25.8
Educational status of the mother		
Primary school	157	34.3
Secondary school	91	19.9
Technic /vocational	16	3.5
Higher level	84	18.3
Educational status of the father		
Primary school	141	30.8
Secondary school	93	20.3
Technical/vocational	24	5.2
Higher institution	109	23.8
Mather 's occupation		
House wife	225	49.1
Maid servant	60	13.1
Student	4	0.9
Civil servant	77	16.8
Merchant	69	15.1
Others	23	5.0
Father's occupation		
Farmer	108	23.6
Student	87	19.0
Government employee	145	31.7
Merchant	111	24.2
Others	7	1.5
Age of the child		
2-11 months	75	16.4
12-23months	114	24.9
24-59months	269	58.7
Sex of the child		
Male	255	55.7
Female	203	44.3

5.2. Environmental characteristics of the respondents.

The vast majority of study participants 455 (99.3%) use pipe water for both hand washing and drinking purpose while only 3 (.7%) houses use protected well for the same purpose. The greater part of houses 196 (42.8%) use traditional pit latrine, followed by ventilated improved pit latrine where it accounts 38.9% of latrine use. Only 6 (1.3%) of mothers had the open field as their excreta disposal method. Charcoal and wood were the most common source of cooking fuel where about 45% of mothers reported they were using both of them. Insignificant number of mothers 3 (.7%) reported they used crop wastes. The highest proportion of respondents (59.8%) were cooking their food in the kitchen. The largest proportion of kitchen (66.6%) were found to have chimney. The largest percentages of living room (96.1%) had at least one window, and more than half (53.5%) of kitchens in the surveyed household had been observed to have no windows at all. Three hundred sixty eight (80.3%) of kitchen were separated from the living room. About 24% of children stayed near or on their mothers' back while she was cooking. Twenty nine (6.3%) of the respondents reported that there were smokers in the household. (Table 2)

Table 2. Environmental characteristics of the respondents. Debrebirehan District, North Shoa zone, Ethiopia, June 2015 (n=458 mothers and children's pair)

Variables	Number (n)	Percent (%)
Source of water for drinking and washing		
Pipe water	455	99.3
Protected well	3	0.7
Type of toilet		
Traditional pit	196	42.8
VIP pit latrine	178	38.9
Pour flush	78	17.0
Open field	6	1.3
Type of cooking fuel		
Charcoal	77	16.8
Wood	50	10.9
Electric power	31	6.8
Charcoal and wood	205	44.8
Charcoal and electric power	92	20.1
Crops	3	0.7
Place of food preparation		
Living room	76	16.6
Kitchen	274	59.8
Both	108	23.6
Number of windows in the Kitchen		
0	245	53.5
1	165	36.0
2	43	9.4
3 or more	5	1.1
Number of windows in the Living room		
0	18	3.9
1	195	42.6
2	169	36.9
3 or more	76	16.6

Table 2 (continued).

Chimney in the living room		
Yes	135	29.5
No	53	11.6
Chimney in the kitchen		
Yes	305	66.6
No	153	33.4
Place of child during cooking		
Near or on mother's back	108	23.6
Outside of cooking room	350	76.4
Smoker among household Residents		
Yes	29	6.3
No	429	93.7
Kitchen separated from the living room		
Yes	368	80.3
No	90	19.7

5.3.Feeding characteristics of the child and co-morbidities

The majority of children 278 (60.7%) whose mothers were interviewed were breastfed exclusively during the first six month of life. A reasonable number of children 90 (19.7%) were not given breast milk during this period of life. A significant number of children 308 (67.2%) were breast fed for less than 2 years. On average, the child had been on breast milk for one year and four months (16.39±9.88 months). The majority of children, 69.7 % and 61.6% respectively, had no any history of diarrhea and measles during or any time before the survey. (Table 3)

Table 3. Past co morbidities and nutritional characteristics of the study participant. Debrebirehan District, North Shoa zone, Ethiopia, June 2015 (n=458 mothers and children's pair)

Variables	Number (n)	Percent (%)
Breast feeding status of the child during the first 6 months		
EBF	278	60.7
PBF	90	19.7
No breast feeding	90	19.7
Duration of breast feeding		
<12 months	118	25.8
12-23 months	190	41.5
≥24 months	150	32.8
Diarrhea		
Yes	139	30.3
No	319	69.7
Measles		
Yes	176	38.4
No	282	61.6

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

Among 458 children interviewed, 53(11.6%) of them had cough during or any time before the survey, of whom 39 (8.5%) had history of cough during or within the last two weeks of the time of survey. Twenty five (5.5%) children had fast breathing at the time of the survey. The prevalence of pneumonia was common (6.14%) in 12-23 month aged children. The prevalence of pneumonia among urban dwellers was estimated to be 23 (6.8%) whereas its prevalence in rural children was 2 (1.7%). The overall prevalence of 2 -59 months old children pneumonia during the time of 10 days long survey was estimated to be 5.5%.

5.5. Factors associated with the presence of pneumonia in under-five(02 -59 months old children)

5.5.1.Socio-demographic characteristics (factors)

None of the socio-demographic variables of the study participants, including the residence, educational status and occupation of parents illustrated a statistically significant association with the occurrence of pneumonia in children at the bi variate analysis,. (Table 4)

Table 4. Socio-demographic characteristics of the respondents and their relation with under-five (02 -59 months old children) pneumonia. Debrebirehan District , North Shoa zone , Ethiopia, June 2015. (n=458 **mothers and children's pair)**

Variable	pneumonia **(%)**		**COR(95% CI**	**P- value**
	Yes	**No**		
Residence				0.054
Urban	6.5	93.5	4.208 (0.977,18.129)	
Rural	2.5	97.5	1	
Maternal education				0.981
Literate	5.4	94.6	0.988 (0.385, 2.541)	
Illiterate	5.5	94.5	1	
Husband's education				
Literate	5.2	94.8	0.796(0.309, 2.054)	0.637
Illiterate	6.5	93.5	1	
Occupation of the mother				0.101
House wife	4.3	95.7	1.833(0.379,8.861)	
Maid servant	12.5	87.5	0.583(0.113, 3.024)	
Civil servant	1.3	98.7	6.333(0.550,72.949)	
Merchant	7.2	92.8	1.067(0.194,5.872)	
Student /others	7.7	98.3	1	
Occupation of the father				0.287
Farmer	1.2	98.8	0.056(0.003, 1.010)	
Student	2.6	97.4	0.525(0.055, 4.999)	
Civil servant	7	93	0.397(0.043, 3.663)	
Merchant	4.1	95.9	0.404(0.043, 3.836)	
Others	9.6	90.4	1	
Age of the child (in months)				0.549
2-11	5.3	94.7	0.835(0.272, 2.561)	
12-23	3.5	96.5	0.539(0.177, 1.639)	
24-59	6.3	93.7	1	
Sex of the child				
Male	3.9	96.1	0.512(0.225,1.164)	0.110
Female	7.4	92.6	1	

5.5.2. Environmental characteristics

Type of latrine demonstrated significant association with the presence of pneumonia among 2 - 59 months old children at bivariate analysis. However, the other variables did not illustrate significant association with pneumonia in children . (Table 5).

Table 5. Bivariate analysis of 2 -59 months old pneumonia against environmental characteristics of study participants. Debrebirehan District, North Shoa zone , Ethiopia, June 2015.(n=458 mothers and children's pair)

Variable	Pneumonia Yes	Pneumonia No	COR (95% CI)	P-value
Type of latrine				
Improved	5.3	94.7	0.287(0.118,0.702)*	0.006
Not improved	5.6	94.4	1	
Chimney in the living room				
Yes	5.2	94.8	0.525(0.159,1.734)	0.290
No	9.4	90.6	1	
Chimney in the kitchen				
Yes	5.9	94.1	1.308 (0.534,3.203)	0.557
No	4.6	95.4	1	
Number of windows in the living room				
1 or more	5.7	94.3	0.318 (0.087,1.162)	0.083
0	2	98	1	
Smoker in the household				
Yes	6.9	93.1	1.308(0.293,5.840)	0.725
No	5.4	94.6	1	
Kitchen separated				
Yes	6	94	1.844(0.540,6.302)	0.329
No	3.3	96.7	1	
Cooking fuel				
Charcoal				
Yes	32.5	67.5	1.352(0.523,3.491)	0.534
No	29	61	1	
Wood				
Yes	2.6	96.4	1.419(0.317,6.362)	0.647
No	3.8	96.2	1	
Charcoal and wood				
Yes	8.3	91.7	1.894 (0.840, 4.270)	0.123
No	3.2	96.8	1	

* variable that showed association with pneumonia (p-value <0.05)

5.5.3. Past co morbidities and nutrition related factors

Among variables under this category, duration of breast feeding ,past history of measles and diarrhea were found to be significantly associated with 2 -59 months old children pneumonia at bivariate analysis. (Table 6)

Table 6. Bivariate analysis of 2 -59 months old pneumonia against co morbidities and nutritional characteristics of study participants. Debrebirehan District , North Shoa zone , Ethiopia, June 2015. (n=458 mothers and children's pair)

Variables	PNEUMONIA YES	NO	COR(95% CI)	P-value
Breast feeding during The first 6mons				0.185
EBF	4	96	0.422(0.164, 1.085)	
Partial breast feeding	6.7	93.3	0.732(0.243, 2.202)	
No breast feeding	8.9	91.1	1	
Duration of breast feeding				
<2 years	7.1	92.9	1	
2 years or more	2	98	0.265(0.078,0.901)*	0.033
Diarrhea				
Yes	10.8	89.2	3.738(1.635,8.545)*	0.002
No	3.1	96.9	1	
Measles				
Yes	9.1	90.9	3.033(1.310,7.024)*	0.010
No	3.2	96.8	1	

* Variables that showed association with pneumonia (p-value <0.05)

5.5.4. Over all factors of pneumonia in children

Variables that showed significant association in binary logistic regression model were duration of breast feeding, type of latrine, history of measles and diarrhea . These variables were taken to the multiple logistic model to control confounding, and they all remained significantly associated with pneumonia.

The survey showed that children were about 6 times (AOR=0.157; 95% CI 0.057,0.431; p-value <0.001) less likely to have pneumonia, if they were using improved latrine. Children who had been breast fed for 2 or more years has a reduced likelihood of pneumonia (AOR=0.152; 95%CI 0.042, 0.553; p-value= 0.004). Children who had past history of diarrhea were 5 times (AOR =5.293; 95%CI 2.107,13.298; p-value= <0.001) more likely to develop pneumonia. Similarly, pneumonia was about 3 times (AOR= 2.676;95%CI 1.049,6.830;p-value= 0.039) more common 2-59 months old children who had reported to have past history of measles . (Table 7)

Table 7 . Multivariate analysis of factors that determine the occurrence of 2 -59 months old children pneumonia. Debrebrehan District, North Shoa Zone, Ethiopia, June 2015. (n=458 mothers and children's pair)

Variables	AOR(95% CI)	P-value
Type of latrine		
Improved	0.157(0.057,0.431)	<0.001
Not improved	1	
Duration of breast feeding		
<2 years	1	
2 years or more	0.152(0.042, 0.553)	0.004
Diarrhea		
Yes	5.293(2.107,13.298)	<0.001
No	1	
Measles		
Yes	2.676(1.049,6.830)	0.039
No	1	

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 (5.5%) is slightly lower than the national prevalence of pneumonia (7%), according to EDHS 2011 [9] . This discrepancy might be due to the fact that the ascertainment of the diseases was based on mothers or care takers' report in EDHS, where mothers may classify none pneumonia cases as having pneumonia. Also, this finding is not in line with the findings from a cross sectional survey in Este town [10] which found the prevalence of under-five pneumonia to be significantly higher,16.1%.The possible reason for this difference could be that the ascertainment of pneumonia was based on mothers' report like with EDHS report. The other reason could be attributed to the difference in the skills of data collectors and Methodology. Similarly, this finding is not comparable to the findings from the retrospective study in UNHCR refugee camps [35] 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 such 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. Furthermore, the relatively low prevalence of pneumonia in the study area may reflect improved access to water and sanitation. On the other hand, this figure is close to the prevalence of under-five pneumonia (6.4%) in Amhara region [9].

The prevalence of pneumonia in children in this study setting is not consistent with the findings from a cross sectional survey in Uganda [37] 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 Kuhati, Bangladesh [38] showed the prevalence of under five pneumonia was estimated to be 53% .

In this study, the occurrence pneumonia was not affected by the residence. This is comparable to the findings from the cross sectional survey in Este town [10] where pneumonia prevalence was not different between urban and rural dwellers. The prevalence of pneumonia in under fives was

not affected by the educational status and occupation of parents**.** This finding is consistent with the findings from a case control study in Pakistan [17] 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 and skills of data collectors. Similarly, this finding is supported by the report from the cross sectional survey in Este town [10] where educational status and occupation of the parent did not illustrate significant association with pneumonia in children. Another case control study from India [19] reported that the literacy status of the father did not show any association with pneumonia in under fives. However, the same study found a statistically significant association between maternal educational status and under-five pneumonia. This discrepancy may be due to the difference in the methodology and skills of data collectors. Likewise, unlike to the present study, the scientific article published in Miami [39] found the maternal literacy status to be predictor of pneumonia in children.

Also, we did not find any significant difference in the occurrence of pneumonia with sex of the child. This finding is consistent with the findings from a case control study in Pakistan[17]. However, this is not supported by the report from lancet 2013 [8] 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. The parents' attitudinal change towards gender equality in the current study area may be the other reason for such difference . In this study, there was also no difference in the occurrence of pneumonia with the age of child. This finding is not in line with the report from lancet 2013 [8] which revealed higher occurrence of pneumonia in children younger than 2 years of age. Similarly, a case control study from Pakistan [17] showed that pneumonia tend to occur more frequently in younger children; the prevalence decreases as the child gets older. This difference may be due to the difference in the methodology .

Though this study showed that use of charcoal and wood for cooking was higher in the study area, there was no significant statistical association of prevalence of pneumonia in under fives with use of charcoal and wood for cooking. This is just the opposite findings to the cross sectional survey report in Este town [10] where there was a statistically significant difference in

prevalence of pneumonia between charcoal uses and none uses for cooking. The possible explanation for this difference, besides difference in study setting and skills of data collectors , could be that other variables such as level of ventilation and duration of exposure of the child to the charcoal smoke that determine the risk of indoor air pollution may not be assessed in the survey to affect the charcoal use and pneumonia association. Similarly, place of cooking and place of the child during cooking were not associated with pneumonia in this study. This is not consistent with the Este town cross sectional survey [10] findings ,where cooking in the living room and carrying the child during cooking were a significant risk factor for pneumonia. The same explanation as in the above may account for this difference. Besides, mothers who had reported that they had no kitchen might not necessarily cook inside the living room; until after the smoke from the charcoal disappears, it usually stayed out. There was also no significant association of pneumonia with the presence of chimney in the cooking area, which is in line with the findings from randomized control trial in rural Guatemala [23]. There is a possibility for the smoke to enter to the living room from the kitchen to increase the indoor air pollution in the living room. The smoke from the fire might carried away through vertical flue so slowly that it gets enough time to pollute the inside of the cooking area in much the same way it does in a none chimney cooking areas. Also, in the rural part of the study area where most households did not have formal chimney, the smoke carried away through a lot of small holes in the walls of the building as they were made with mud.

However, types of latrine was associated with pneumonia in 2 -59 months old children in this study. This is consistent with the WHO/UNICEF report [5] 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 [20], where children whose parents smoke were 60% more affected by pneumonia. Also, this finding is not supported by the scientific articles published in Miami [39] and Poland [40] and case control study in West Africa [41] where cigarette smoke was demonstrated to be the risk factor for pneumonia in children. There was no significant difference in the prevalence of pneumonia between children who had mother cook in the separated and not separated kitchens from the living room. The reason may be due to that separated kitchens could be too near to the living

room which enhances the entrance of the smoke to the main room as does in the none separated kitchens.

Children who had past history of measles and diarrhea were more affected by pneumonia in this study. This finding is supported by the cohort study done in Ghana [24] where diarrhea caused acute respiratory infection including pneumonia. Similarly, a Cross sectional survey in Kushtia [38] reported that children who had history of diarrhea were at increased risk of pneumonia . A case control study in Pakistan [17] showed that children with past history of measles were more susceptible to pneumonia than were children without history of measles. Breast feeding the child exclusively during the first 6 months of child's life was not found to factor pneumonia in children. This is not consistent with findings from a systematic review and meta analysis [45] done in USA,2013, 2011 UNICEF report [46] and the integrated action plan for prevention and control of pneumonia and diarrhea of 2013 of the WHO and UNICEF [47] where exclusive breast feeding was one of the factors that could determine the incidence and prevalence of 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. However, these same findings support the finding in this study that breast feeding children up to 2 or more years can reduce pneumonia morbidity.

Since there is lack of sufficient source of data on the prevalence of pneumonia among 2-59 months old children, all most all of the reviewed literatures includes studies on pneumonia among 0-59 months old children which impairs the comparison between the current and other studies. Therefore, the difference in the study population could be another big reason for the discrepancy that has occurred between the current study and other studies which were used in the discussion.

The effect of source of water for both drinking and hand washing on 2 -59 months old children pneumonia was not computed as the majority of households had similar sources.

7. Strengths and limitations of the study

Strengths

- Done in the community, this study may reflected 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.

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.
- Also, this study selectively addressed certain factors of under-five pneumonia while various factors are found to cause the diseases.
- And also, the WHO's IMNCI is not a confirmatory gold standard diagnostic tool to surely settle pneumonia diagnosis.
- The study may not measure indoor air pollution appropriately as it needs prospective measurement for its precise ascertainment.

8. Conclusion

The present study had identified a comparatively low prevalence of pneumonia in 2 -59 months old children. It also pointed out such modifiable risk factors of the pneumonia as diarrhea, measles, use of not improved latrine and breast feeding for less than 2 years .

9.Recommendation

Based on the findings in this study, the followings were recommended.

- The Woreda Health Office, in collaboration with the health facilities in the Woreda, should design strategies to help community strengthen their knowledge on the benefit of breast feeding their child to two or more years to reduce pneumonia.
- The Woreda Health Office, in collaboration with the health facilities in the Woreda, should create awareness among the community about the advantages of Rota and measles viruses immunization to help prevent measles and diarrheal diseases in children.
- The Woreda Health Office, in collaboration with environmental health professional, should communicate massages to the community to help them build and appropriately use improved latrine.

- Further large scale research should be carried out in this study area that could resolve the limitation of this study.

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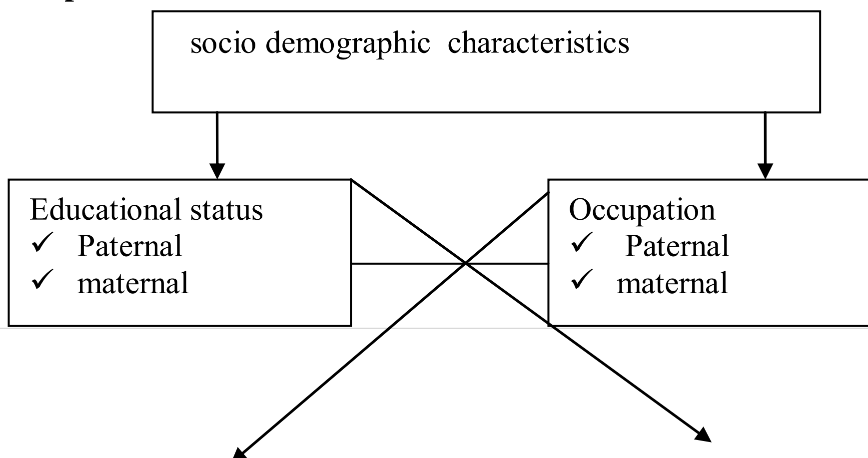
11.Annexes

11.1. Conceptual frame work



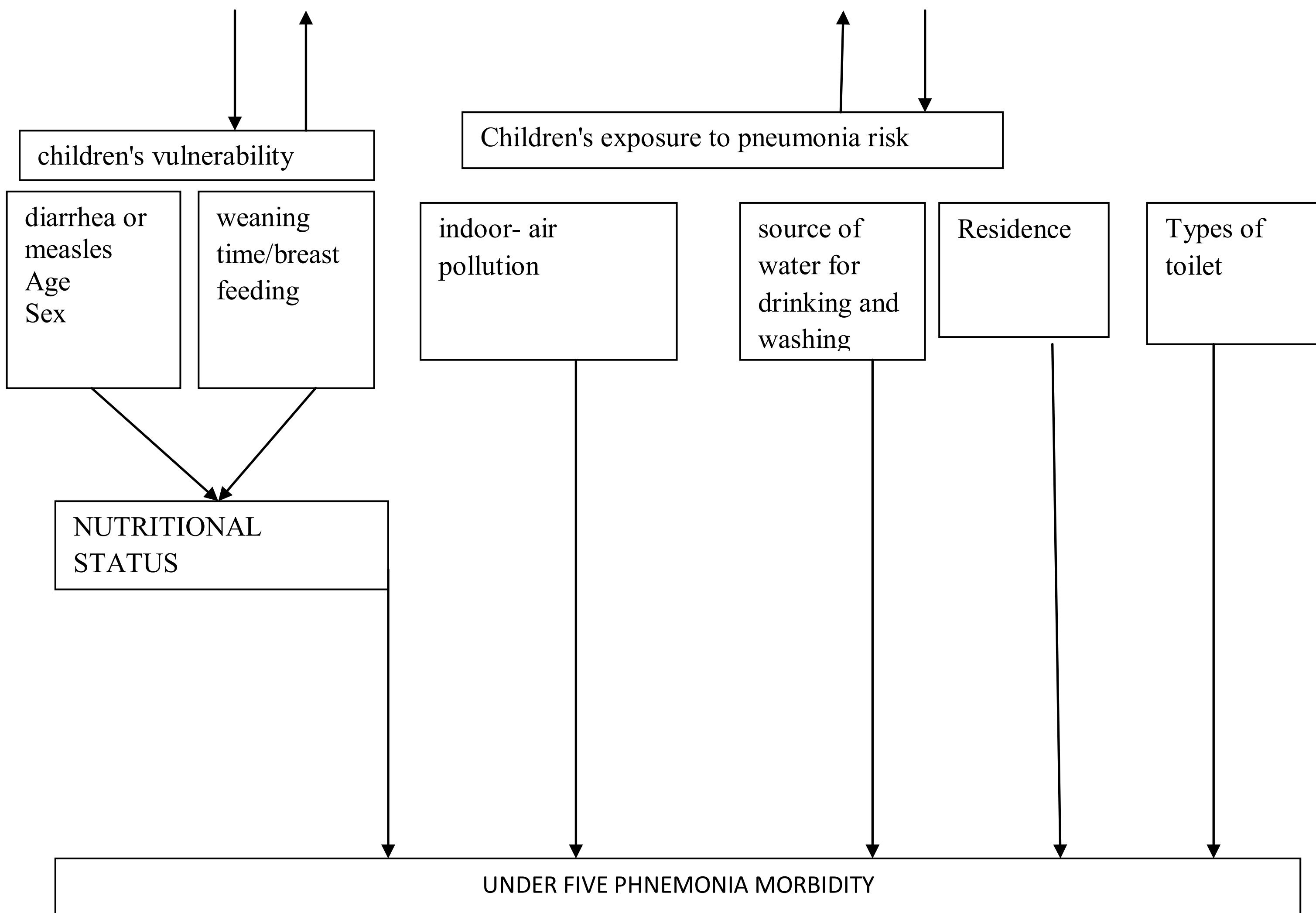


Fig. Conceptual frame work on causal relationship of 02 -59 months oldpneumonia development (adapted and modified : Rehfuess et al. Emerging Themes in Epidemiology 2013, 10:13 http://www.ete-online.com/content/10/1/13);Date of modified:8/19/2014 10:pm

11.2. Patient Information and Consent Form

11.2.1 Information sheet

Hello. My name is ________________and I am MPH student in Addis Ababa University, College of Health Science, School of Public Health. I am conducting survey on the prevalence and possible determinants 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

Tel:0931419767

Email:Gebretsh@gmail.com

Mulugeta.betre@aau.edu.et

11.2.2 Consent Form

I (the respondent), the undersigned, am told that the researcher is going to conduct study in this town to determine the prevalence and possible risk factors of 02 -59 months old childhood pneumonia, and s/he acquainted with me the first time s/he meets. I am also informed that the result of the study will be used by both the government and the Woreda health office to commence appropriate strategies to battle this problem. I am, too, told that the research will benefit the community in general including me, the respondent, and that the research will not

inflict any harm to me. I have been told that I have full right to have enough time to understand and then take part in the study on the basis of my interest and Besides, I am briefed that I will be interviewed for not more than 20 minutes. And , I am let know that my household and I was selected randomly by the investigator. Moreover, I am notified that my participation in the study is entirely voluntarily, and that I can quit from the study any time I want. Likewise, I am enlightened that I will not be subjected to any form of punishment following my failure to participate in the study. In the same way, I am explained that the information collected from me will not by any means be disclosed to any people other than those participating in the study unless obtained permission from me. Equally, I am told that I can ask them questions I found difficult or any type otherwise.

Name of the interviwee______________________________Date______________________

Signature_______________________.

Addresses

Tel:0931419767

Email:Gebretsh@gmail.com

Mulugeta.betre@aau.edu.et

11.3. Questionnaire form : English version

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

Date___________________________________

Questionnaire code:001

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	Have you ever attended school?	Yes---------------1 No---------------2	→ **104**
103	What is the highest level of schooling you attended?	primary --------------1 secondary------------2 technical/vocational ---------------------------3 Higher level------------4	
104	Has your husband ever attended school?	Yes------------------1 No--------------------2	→ **106**
105	What is the highest level of schooling your husband attended?	primary -------------1 secondary----------2 technical/vocational ------------------------3 Higher---------------4	
106	What is your current occupation?	Housewife-------------1 Maid servant----------2 Civil servant----------3 Merchant------------- 4 Student----------------5 Other specify--------99	
107	What is your husband's occupation?	Farmer -----------------1 Student----------------2 Civil servant----------3	

		Merchant--------------4 Other specify**-------99**	
108	Age of the child	2-11 months----------1 12 -23 months--------2 24-59 months---------3	
109	Sex of the child	Male--------------1 Female------------2	
110	Cough and or difficult of breathing (at the time of survey)	Yes-----------------1 No------------------2 →	**114**
111	Duration of cough	Less than two weeks---1 Two or more weeks----2	
112	Check the respiratory rate of the child		
113 **114**	Check chest wall in drawing Vomiting everything	Yes-----------------1 No------------------2 Yes-----------------1 No------------------**2**	
115	Check convulsion	Yes-----------------1 No------------------**2**	
116	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 Compositing toilet---4 Open field/bush--------5	
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** → **210**

206	Is the kitchen separated from the main house?	Yes No	
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	Number of windows in the kitchen	One----------------1 Two----------------2 Three--------------3 None--------------4	
210	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	
211	Is there any cigarette smoker in the member of the household?	Yes-------------1 No--------------2	

Part three. <u>Questions related to Breast feeding and past co morbidity</u>			
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 breast fed your child?	Less than 6 months-----1 6 to 12 months----------2 More than a year--------3	
303	Have your child ever had diarrhea?	Yes-------------------1 No--------------------2	
304	Have your child ever had Measles?	Yes--------------------1 No---------------------2	

The end

Thank you very much for your participation.

11.4 Amharic version of information sheet and Consent form

11.4.1 የመረጃ ገለጻና ማብራሪያ

ጤና ይስጥልኝ፡፡ እኔ-------------------------እባላለሁ፡፡ በአዲስ አበባ ዩንቨርስቲ በህክምና ፋኩልቲ በህብረተሰብ ጤና የትምህርት ክፍል በህብረተሰብ ጤና የሁለተኛ አመት የማስተርስ ድግሪ ተማሪ ስሆን በዚህ ከተማ ውስጥ የሚገኙ እድሜያቸው ከ5 አመት በታች የሆኑ ህፃናት የሚያጋጥማቸውን የሳንባ ምች በሽታና መንስዎቹን በተመለከተ ጥናት እያደረኩ እገኛለሁ፡፡ ከዚህ ጥናት የሚገኙት መረጃዎች ለመንግስት እና ለዚህ ከተማ የጤና ቢሮ በሽታውን ለመግታት አስፈላጊ የሆኑ እቅዶችንና ስልቶችን ለመንደፍ ጥቅም ላይ ይውላል፡፡ ስለሆነም በዚህ ጥናት ውስጥ የሚሳተፉና መላው ማህበረሰብ ከሳንባ ምች ጋር ተያይዞ በሚመጡ ችግሮች ልጆቻቸው እንዳይጠቁ ያደርጋል፡፡ጥናት ውስጥ በመሳተፍ ቀጥተኛ የሆነ ጥቅማ ጥቅም የሌለው ሲሆን ጥናት ውስጥ በመሳተፍ የሚመጣ ምንም አይነት ችግር ወይም ጉዳት ግን የለውም ፡፡ የጥናቱ መጠይቅ ቢበዛ 20 ደቂቃ ይወስዳል፡፡ እነዚህ ጥናት የሚደረግባቸው ቀበሌዎች በተመራማሪው አማካኝነት ከጠቅላላው ቀበሌዎች ውስጥ በዕጣ የተለዩ ናቸው ፡፡ ጥናቱ ውስጥ መሳተፍ የሚፈልጉ እናቶች በፈቃደኝነት ላይ ብቻ የተመሰረተ ተሳትፎ መሆኑን መገንዘብ አለባቸው ፡፡ ባለመሳተፍዎ ምክንያት የሚመጣ ምንም አይነት ቅጣት የለውም፤ ነገር ግን ከእርሶ የምናገኘውን መረጃ አስፈላጊ ስለሆነ ጥናት ውስጥ በፈቃደኝነት እንደሚሳተፉ ተስፋ አደርጋለሁ፡፡ ከእርስዎ የምናገኘው ማንኛውም አይነት መረጃ ከእኛ ጥናት ውስጥ ከምንሳተፈው ሰዎች ውጪ ለማንኛውም ሶስተኛ ወገን እንደማይደርስ እና ምስጢራዊነቱ የተጠበቀ እንደሚሆን ላረጋግጥላችሁ እወዳለሁ፡፡ መጠየቅ ለሚፈልጉት ማንኛውም አይነት ጥያቄ የሚከተለውን አድራሻ መጠቀም ይችላሉ፡፡ አሁን ቃለ መጠይቁን መጀመር እችላለሁኝ?

አዎ ካሉ ቃለ መጠይቁን ይቀጥሉ

አይሆንም ካሉ ደግሞ ያመስግኑና መጠይቁን ያቁሙ

ቃለ መጠይቁን የሚያደርገው ሰው

ስም---

ፊርማ ---

መጠይቁ የጠደረገበት ቀን-----------------------------------

የተቆጣጣሪው ስም -----------------------------------

ፊርማ---------------------------------------

ቀን---

አድራሻ ፡ ስልክ 09 31 41 97 67

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11.4.2 የፈቃደኝነት መጠየቂያ ፎርም

እኔ(ቃለመጠይቁ የሚደረግልኝ) በዚህ ከተማ ውስጥ የሚገኙና እድሜያቸው ከ 5 አመት በታች በሆኑ ህፃናት ላይ የሳንባምችን በሽታና መንስሄዎቹን በተመለከተ የሚካሄደውን ጥናት ዋና አላማ እና የሚያስከትለውን ጉዳት ፣ ከእኔ የሚወጣውን መረጃ ከተመራማሪዎቹ ለማንም እንደማይተላለፍ፣ ጥናት ውስጥ በመሳተፍ ቀጥተኛ የሆነ ጥቅማ ጥቅም የሌለው መሆኑን ፣ እኔ የምሰጠው መረጃ ለመንግስት እና ለከተማው ጤና ቢሮ አስፈላጊ መሆኑን ፣ የእኔ ቤትና እኔራሴ የተመረጥኩት በዕጣ አማካኝነት መሆኑን ፣ ጥናት ውስጥ መሳተፍ ያለብኝ በእኔ ፈቃደኝነት ላይ ብቻ የተመሰረተ እንደ ሆነ ፣ ጥነናት ውስጥ መግባት ባለመቻሌ ምንም አይነት ቅጣት እንደሌለው፣ ከጥናቱ በማንኛውም ሰአት ማቋረጥ እንደምችል፣ መጠይቁን ለማጠናቀቅ ቢበዛ 20ደቂቃ እንደሚወስድ እና ማንኛውን አይነት ጥያቄ መመጠየቅ እንደምችል በሚገባ ከተነገረኝ በኋላ በዚህ ጥናት ውስጥ በፈቃደኝነት መሳተፌን በፊርማዬ አረጋግጣለሁ፡፡

ቃለመጠይቁ የተደረገለት ሰው ስም ---

ፊርማ ---

ቀን ---

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11.5 Amharic version questionnaire

ቃለ-መጠይቅ

በአዲስ አበባ ዩንቨርስቲ ህክምና ፋኩልቲ በህብረተሰብ ጤና ትምህርት ክፍል እድሜአቸው ከ 5 አመት በታች በሆኑ ህፃናት ያለውን የሳንባ ምች በሽታና መንስኤዎቹን በተመለከተ የዘጋጀ ቃለመጠይቅ

ክፍል አንድ፤ የተጠያቂውን አጠቃላይ ማህበራዊና ግላዊ መረጃን በተመለከተ			
ተ.ቁ	ጥያቄ	አማረጭ መልስ	እለፍ
101	የዘወትር መኖሪያ አድራሻ	ከተማ----------------1 ገጠር-----------------2	
102	ተምረዋል ?	አዎ---------------------1 አይ--------------------2	→ 104
103	የትምህርት ደረጃ	አንደኛደረጃ-------------1 ሁለተኛደረጃ------------2 ቴክኒክናሙያ------------3 ከፍተኛ ተቋም-----------4	
104	ባለቤቶዎ ተምሯል	አዎ---------------------1 አይ--------------------2	→ 106
105	የትምህርት ደረጃ	አንደኛ ደረጃ……..1 ሁለተኛ ደረጃ…….2 ቴክኒክና ሙያ……..3 ከፍተኛ ተቋም…….4	
106	በአሁን ወቅት ስራው ምንድነው	የቤት እመቤት-----------1 የቤት ሰራተኛ-----------2 የመንግስት ሰራተኛ------3 ነጋዴ-------------------4 ተማሪ------------------5 ሌላ ካለ ይጥቀሱ---------99	
107	የባለቤቶዎ ስራ	አርሶ አደር--------------1 ተማሪ------------------2	

		የመንግስት ሰራተኛ------3 ነጋዴ--------------------4 ሌላ ካ ይጥቀሱ---------99	
108	የልጁ/የልጅቷ እድሜ	2-11 monthS----------1 12-23 months---------2 24-59 months--------3	
109	የልጁ /የልጅቷ ጾታ	ወንድ------------------1 ሴት-------------------2	
110	ሳል የመተንፈስ ችግር	አዎ-------------------1 የለም------------------2	→114
111	የሳሉ ቆይታ	ከሁለት ሳምንት በታች----1 ሁለት ሳምንት ና ከዛ በላዪ-2	
112	የአተነፋፈስ ስርዓት /ፍጥነት(በደቂቃ)		
113	የደረት ግድግዳ ወደውስጥ ወይም ወደ ውጪ የሚያደርገው ያልተለመደ እንቅስቃሴ	አለ--------------------1 የለም------------------2	
114	ትውከት(የበላውን/ችዉን /የጠጣውን /ቺዉን ሁሉ)	አለ--------------------1 የለም-------------------2	
115	የሰውነት መንቀጥቀጥ	አለ-------------------1 የለም------------------2	
116	መጠጣት/መብላት/ነመጥባት አለመቻል	አዎ-------------------1 አይ-------------------2	
	ክፍል፡ ሁለት፤ አከባቢያዊ ሁኔታን በተመለከተ		
201	የመጠጥ ውሃ የሚያገኙት ከየት ነው	ቧንቧዉሀ--------------------1 የተከለለጉድጓድ--------------2 ያልተከለለጉድጓድ------------3 የምንጭውሃ------------------4 የዝናብውሃ--------------------5 የወንዝ/የኩሬ /የግድብ ውሃ-----6	
202	እጅ መታጠቢያ የሚሆን ውሃ የሚያገኙት ከየት ነው	ቧንቧ------------------------1 የተከለለ ጉድጓድ--------------2	

		ያልተከለለ ጉድጓድ------------3 የምንጭ ውሃ------------------4 የዝናብ ውሃ--------------------5 የወንዝ/የኩሬ /የግድብ ውሃ------6	
203	የምትጠቀሙበት ሽንት ቤት ምን አይነት ነው	ክዳን የሌለው ጉድጓድ------1 ዝንቦችን መከላከል እንቿል ተደርጎ የተሰራ -----------2 በውሃ የሚታጠብ---------3 ኮምፖሲቲንግ-------------4 ሜዳ ላይ/ቁጥቋጦ ውስጥ---5	
204	ብዙን ጊዜ ለምግብ ማብሲያነት/ማዘጋጃነት የሚጠቀሙበት ነዳጅ ምንድነው	ከሰል--------------------1 እንጨት------------------2 ኮረንቲ-------------------3 ነጭ ጋዝ------------------4 የከብት እበት-------------5 ማገዶ---------------------6 ሌላ ካለ ይጥቀሱ----------99	
205	በብዛት ምግብ የምታበስሉት/የምታዘጋጁት የት ነው	ዋናው ቤት--------------1 ኩሽና--------------------2 ከቤት ውጪ--------------3 ሊላ ካለ ይጠቀሱ---------4	 →208 →208
206	ምግብ የምታዘጋጁት ቤት /ኩሽና ውስጥ ከሆነ ጭስ ማውጫ አለው	አዎ--------------------1 የለውም----------------2	
207	በቢቱ ወይንም በኩሚና ዉስጥ ስንት መስኮት አለዉ	አንድ-----------------1 ሁለት-----------------2 ሶስት------------------3 ምንም-----------------4	
208	ምግብ በሚዘጋጅበት ጊዜ ልጁ/ልጅቱ የትነው የሚሆነው/የሚቆየው	ምግብ የምታስለው እናት ጀርባ ላይ / አገብ ---------1 ምግብ ከሚበሰልበት ቤት ውጭ------	

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209	ቤታችሁ ውስጥ ሲጋራ የሚያጨስ የቤተሰብ አባል አለ	አዎ----------------------1 የለም--------------------2	
	ክፍል ሶስት : የእናት ጡትን ከማጥባትና ያለፉ/የቆዩ በሽታዎችን በተመለከተ		
301	በመጀመሪያዎቹ 6 ወራት የልጁ/የልጅቷ የእናት ጡትያመጋገብ ሁኔታ	ለ6 ወር የእናት ጡት ብቻ---1 ጡትና ሌላ ምግብ----------2 ምንም አልጠባም----------3	
302	በአጠቃላዩ ልጁ/ልጅቱ ለምን ያህል ጊዜ ጡት ጠባ/ጠባች	ከ 6 ወር በታች-----------1 ከ 6 -12 ወር--------------2 ከ አንድ አመት በታች-----3	
303	ተቅማጥ ይዞት/ይዟት ያውቃል	አዎ----------------------1 አያውቅም----------------2	
304	ኩፍኝ ይዞት /ይዟት ያውቃል	አዎ---------------------1 አያውቅም--------------2	

ስለትብብርዎ እናመሰግናለን

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