

# Sleeping in cooking room is associated with under-five pneumonia in North West Ethiopia: prospective cross-sectional study

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## Research article

**Keywords:** Proportion, Associated factors, Pneumonia, Under five children, North West Ethiopia

**Posted Date:** August 28th, 2019

**DOI:** <https://doi.org/10.21203/rs.2.13138/v1>

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# Abstract

Background Pneumonia is the one of the five-leading cause under-five morbidity and mortality in developing countries. It is the leading cause of under-five death in Ethiopia. However, data on its institutional burden and factors associated was not explored enough in the study area. Therefore, this study was aimed to asses institution-based proportion of under-five pneumonia and associated factors at Debre Tabor General Hospital.

Methods Institution based cross sectional survey was conducted from January 3 to February 10/2019 on a total of 342 participants. Data was collected using structured questionnaire. Additionally, medical charts were reviewed for objective diagnosis of pneumonia. After entered by EPI info version 7 data was exported to SPSS version 20 for further analysis. The result was summarized and presented using descriptive statistics. Logistic regression was computed to assess statistical association at 95% confidence level and p-value  $\leq 0.05$ .

Result Among all under-five children visiting under-five outpatient department 27.5% were diagnosed for pneumonia. Participants who were not sleeping in cooking room; 0.066 (0.035,0.123)), babies who had malnutrition (AOR (95% CI); 7.897 (2.480,25.145)), no breast feeding (AOR (95% CI); 5.805 (1.477,22.821)), and mixed breast feeding (AOR (95% CI); 4.111 (1.152,14.672)) were significantly associated with increased proportion of under-five pneumonia among children visiting Debre Tabor General Hospital under-five outpatient department.

Conclusion Institution-based proportion of under-five pneumonia was high in this study. Sleeping in cooking room, breast feeding and malnutrition were associated with under-five pneumonia. Therefore, health education on exclusive breastfeeding, separate cooking and sleeping room as well as improve nutrition status of children could reduce proportion of under-five pneumonia.

## Background

Pneumonia is inflammation of the lung parenchyma. Even though microorganism associated inflammation is common, noninfectious origins like; aspiration pneumonia, hypersensitivity reactions and drug/radiation induced inflammations might be the cause. Since direct culture of the lung tissue is invasive, indemnification of causes in individual patient is difficult. However, molecular diagnostic tests could diagnose 40-80% of bacterial or viral causes of community acquired pneumonia. *S. pneumoniae*, *H. influenza*, and *S. aureus* are the major causes of hospitalization and death from bacterial pneumonia among children in developing countries (1).

According to World Health Organization (WHO) accepted Integrated Management Newborn and Childhood Illness (IMNCI) guideline there are three severity classifications clinically for a child with cough or difficult of breathing irrespective of etiology i.e. severe pneumonia or very severe disease, pneumonia, and cough or cold (2).

Globally, pneumonia accounted for 920,000 deaths between 0-59-month age. Among 1-59-month age babies, about 720,000 children who were failed to celebrate their fifth year were due to pneumonia in 2015. In the same year, Ethiopia hosted the second highest (31,000) pneumonia associated deaths among the top five under five mortality burden countries in the world (3). Ethiopia met the 2015 Millennium Development Goal-4 (MDG-4) target (4). Under-five pneumonia is the second leading cause of morbidity, the leading cause of mortality and admission in the country (5). However, its institution-based proportion was not assessed in the study area.

Previous Ethiopian study reported, under five pneumonia was associated with maternal age less than 18 years, more than four family member in the house, parental smoking, non-exclusive breast feeding, no zinc supplementation and wasting (6). Nonetheless, data on associated factors was lacking in the study area. Therefore, this study was done to assess institution-based proportion and associated factors of under-five pneumonia among children visiting Debre Tabor general hospital under-five Outpatient Department (OPD); so as to be an input for planners, administrators and researchers.

## Methods

### Study area

The study was conducted at Debre Tabor General Hospital Under-five OPD which is found in Debre Tabor town 720 km far from the capital of Ethiopia in North West direction. The hospital gives referral service for nearly 3 million population who are living in South Gondar zone. Estimated number of under five children in this zone are about 196,529. According to the new health tier system of Ethiopia it is secondary health care unit with the capacity of 254 beds at different departments and 40 beds in pediatric ward. From total staffs of 402 at this hospital, 102 are administrative staffs, and 300 are clinical staffs.

### Study design and period

Institutional based cross-sectional study was conducted from January 3 to February 10 /2019 to determine the institution-based proportion of under-five pneumonia and associated factors at Debre Tabor General Hospital under five OPD.

### Population

#### Source of Population

All 2 -59 months old children visiting under-five OPD at Debre Tabor General Hospital.

#### Study population

The study populations were all selected 2-59 months old babies who visited under five OPD at Debre Tabor General Hospital during data collection period

## Inclusion and exclusion criteria

### Inclusion criteria

All under five Children 2-59 months of age with mother / care giver visiting under five OPD at Debre Tabor General Hospital during data collection period.

### Exclusion Criteria

Severely sick child need life treating intervention and/or mothers or caretakers who are severely ill and less than two months age infants.

## Sample size and sampling procedure

### Sample Size Determination

The sample size was determined using single population proportion formula. Prevalence of pneumonia among under-five (28.1%) in Jima Zone Public Hospitals was taken (7). By considering 95% confidence interval (CI) and 5% marginal error the, sample size was calculated as follows;

$$\text{Where } n = \frac{(Z_{\alpha/2})^2 \cdot p \cdot (1-p)}{d^2}$$

n = Sample size

p = Prevalence of pneumonia in Jima=28.1%

$\alpha$  = Probability to reject true null hypothesis

d = Margin of error

Z  $\alpha/2$  = Standard normal of value of normal distribution at  $\alpha/2$

$$n = \frac{(1.96)^2 \cdot (0.281) \cdot (0.719)}{(0.05)^2}$$

$$\mathbf{n=311}$$

For those participants who were not volunteer to participate 10% non-response rate was added on the calculated sample size. Then, the final total sample size was 342.

### Sampling procedure

Systematic random sampling technique was used to select the study participants. To determine sampling fraction (K) and skip interval (K<sup>th</sup>). A total of 3362 2-59-month-old children visiting Debre Tabor General Hospital under five OPD for the last six consecutive months was used. Thereafter, average monthly visit of 560 was divided by total sample size 342 gave K value of 2. Then the first participant was selected by lottery method to select 342 participants. To avoid the cyclic pattern new under five OPD visits were sampled.

## Variables

### Dependent Variable

### Pneumonia

### Independent variable

**Socio-economic factors:** - Age of the child, sex of the child, residence of the child, educational level parents, and occupation of parents

**Environmental factors:** - Indoor air pollution, Poor ventilation, over crowded, Tobacco smoke exposure

**Nutritional factors:** - Vaccination status, Breast feeding status

**Co-morbid conditions of child:** - Diarrhea, Measles, Asthma, HIV and Malaria

### Operational Definition

**Under five children:** Children age less than 59 months excluding under two months age.

**Under five pneumonia:** Objectively diagnosed cases of pneumonia by licensed clinician working at under five OPD

### Data collection tool and procedure

Interviewer administered structured questionnaire was used to collect data from sampled mother or care giver who visiting under five OPD. The questionnaire has socio-demographic characteristics, environmental factors, and Co-morbid conditions. The tool was adapted from related study and modified (7). The English version was translated into Amharic language by language professionals. Three diploma nurse data collectors and one BSc nurse supervisor were involved in the data collection. Finally, medical charts were reviewed by the data collectors to collect clinical marker of the children.

### Data Quality Control

Data was collected by well-trained data collectors using pretested questionnaire. Training was given for one day (including half day of pretest). Pretest was done on 10% percent of the total sample size at Addis Zemen Primary Hospital. Using pretest result sociodemographic variables were modified. One day

training was given on the objective the study, confidentiality of information, respondent's right, informed consent, techniques of interview and the elements of the questionnaires for data collectors and supervisor.

## Data Processing and Analysis

After visually checking for completeness and cleaning, data was entered into Epi info version 7 and exported into SPSS version 22 for coding and analysis. All variables were used in the bivariable logistic regression, then variables with p-value  $\leq 0.2$  were further considered for multivariable logistic regression to incorporate more candidate variables. The result was summarized and presented using descriptive statistics. Multivariable logistic regression was done to minimize confounders. Variables in the final model predict 57.4% of the outcome with Hosmer and Lemishow test result of 0.574. Finally, statistical association was declared using Adjusted Odds Ratio (AOR) at 95% confidence level and p-value  $\leq 0$ .

## Results

### Socio demographic characteristics of the respondents

Total of three hundred forty-two (342) mothers/care givers and children pair were included in the study with a response rate of 100%. The mean age of children was 20.44 +15.224 months old. The majority of 241 (70.5%) children were urban resident. Male accounts more than half 201 (58.8%) of the participated children. Children aged 24-59 months accounts largest proportion of surveyed children 128 (37.4%), but from the total pneumonia cases in this study children between 2-11 months accounted 37 (31.6%) (Table 1).

### Environmental and housing characteristics of the respondents

In this study more than half children live in cooking rooms. Besides, more than 2/3 of children who had pneumonia were sleeping in the same house used for cooking (Table 2).

### Nutritional, past co-morbidities and vaccination status of children

The majority of children 260 (76%) completed according to the EPI schedule of our country. More than 2/3 (77.3%) of children who had pneumonia were not feeding breast milk exclusively for six months (Table 3).

### Proportion of under-five pneumonia

The overall proportion of under-five pneumonia during the five weeks institution-based survey was estimated to be more than 1/4<sup>th</sup> of under-five children visiting Debre Tabor Hospital under-five outpatient department with 95% uncertainty range of 23.2%-31.8% (Fig 1).

### Factors associated with under-five pneumonia

In this study, multivariable analysis result revealed those participants who were not sleeping in cooking room (AOR (95% CI); 0.066 (0.035,0.123)), babies who had malnutrition (AOR (95% CI); 7.897 (2.480,25.145)), no breast feeding (AOR (95% CI); 5.805 (1.477,22.821)), and mixed breast feeding (AOR (95% CI); 4.111 (1.152,14.672)) were significantly associated with increased proportion of under-five pneumonia among children visiting Debre Tabor General Hospital under-five outpatient department (Table 4).

## Discussion

This study was done to estimate institution-based proportion of under-five pneumonia and associated factors at Debre Tabor General Hospital during 2019.

Keeping in mind the limitations of cross sectional and institution-based study, the proportion of under-five pneumonia among children visiting outpatient department at the hospital was 27.5%. This finding was above a community based done on slum residents of Nigerian study (8). Variation might be explained by difference in study setting, vaccine coverage, socio economic status, and health care accessibility.

This study found a proportion higher than a community-based study endorsed at Este districts in Amhara region, Ethiopia (9). In contrast, the result was lower than a proportion reported at Ilu Aba bora zone health centers in Ethiopia (10). The possible explanation for higher proportion in this study could be setting difference due to the fact that children visiting health institution are more likely to be diagnosed for pneumonia. While, the reason for lower proportion might be due to time variation, diagnostic sensitivity of currently applied IMNCI (Integrated Management of Newborn and Childhood Illness) protocol and wider implementation of PCV (Pneumococcal Conjugate Vaccine) in Ethiopia.

Sleeping in cooking room, malnutrition and breast-feeding status were associated with under-five pneumonia at our study setting. About 94% of children could be protected from pneumonia in this study. An Indian study support this finding (11). As sleeping in the same house increase indoor air pollution, indoor smoke exposure (8, 12-14), and lack of ventilation (11, 15). As a result, all these increase the development of pneumonia.

The likely hood of under-five pneumonia was as high as 8 times among malnourished babies in this study. Malnutrition ranging from under-weight to wasting were mentioned as factor for under-five pneumonia (6, 9, 11, 16-18). Under nutrition decreases immunity due to decrease in secretory IgA, IgM, IgG concentration in blood as well as cell mediated immunity with concomitant important micronutrient deficiency (19). Pneumonia might be consequently portrayed to those derangements.

Inappropriate breast-feeding expressed as either lack of exclusive breast feeding or mixed feeding before six months of age increase the odds of under-five pneumonia with six and four folds respectively in this study. Breast feeding was previously identified as a factor for worsening of severity as well as contributing factor for initiation of the pneumonia disease process (12, 18, 20, 21). This result was in line with previous studies done at different settings in Ethiopia (6, 10, 22). The possible reason behind for

increased proportion of under-five pneumonia among inappropriate breast feed children might be portrayed to the following reasons. Growth of viral or bacterial etiologies of under-five pneumonia might be enhanced when children failed to breast feed appropriately. Since the growth of important bacterium like *L. fermentum* CECT5716 and *L. salivarius* CECT5713 is low in inappropriately breast feed baby's activation of NK cells, CD4+ T cells, CD8+ T cells and regulatory T cells, innate and acquired immunity will not be produced enough/produced at all. Similarly, a wide range of pro- and anti-inflammatory cytokines and chemokines will not be produce adequately (23). Therefore, observed association of increased proportion in under-five pneumonia and mixed or not exclusively breast feed children in this study might be linked to those qualities of human milk.

## Conclusions

This study showed that the proportion of pneumonia was high in the study area. The study also identified that malnutrition, sleeping in cooking room, and inappropriate breast feeding were independently associated with increased proportion of under-five pneumonia. Therefore, sleep in separate room, educate mothers about exclusive breast feeding and improve nutrition would worth better to prevent under five pneumonia.

## Abbreviations

ARTI: Acute Respiratory Tract Infection; CSA: Central Statistical Agency; EBF: Exclusive Breast Feeding; EDHS: Ethiopian Demographic and Health Survey; IMNCI: Integrated Management of Neonatal and Childhood Illness; OPD: Out Patient Department; PCV: Pneumococcal Conjugate Vaccine; SDG: Sustainable Development Goal; SPSS: Statistical Package for Social Science

## Declarations

Ethics approval and consent to participate

Ethical clearance and approval were obtained from Debre Tabor University College of Health Sciences, Department of Nursing. Then the official written letter was given to Debre Tabor General Hospital Administrator. Verbal and written assent were 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 informed that their failure to participate in the study was not result in any form of penalty and assured that they can quit from the study any time they want.

Consent for publication

Not applicable



## Availability of data and material

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request

## Competing interests

The authors declare that they have no competing interest

## Funding

Not applicable

## Authors' contributions

AY: Conception of the research idea, study design, data collection, analysis and interpretation, and manuscript write-up. MB, WA, and AA: data collection, analysis and interpretation, and manuscript write-up. All authors read and approved the final manuscript.

## Acknowledgements

First, we would like to appreciate the support of Debre Tabor University in conducting this academic research. Debre tabor general hospital administration, under five OPD staffs and data collectors played their part in this research. Finally, the role of study participants was valuable without their cooperative response this research might not be evident.

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## Tables

Table 1. Socio-demographic characteristics of the respondents, Debre Tabor General Hospital South Gondar Zone Ethiopia, 2019 (n=342)

Variables	Category	Pneumonia		Total n (%)	X <sup>2</sup> p-value
		Yes n (%)	No n (%)		
<b>Sex of the child</b>	Male	55 (27.4)	146 (72.6)	201 (58.8)	0.952
	Female	39 (41.5%)	102 (41.2%)	141 (41.2)	
<b>Age of the child</b>	2-11 month	37 (31.6)	80 (68.4)	117 (34.2)	0.269
	12-23 month	28 (28.9)	69 (71.1)	97 (28.4)	
	24-59 month	29 (22.7)	99 (77.3)	128 (37.4)	
<b>Residence the child</b>	Urban	68 (28.2)	173 (71.8)	241 (70.5)	0.640
	Rural	26 (25.7)	75 (74.3)	101 (29.5)	
<b>Marital status of parent</b>	Married	79 (26.1)	224 (73.9)	303 (88.6)	0.465
	Single	1 (50)	1 (50)	2 (0.6)	
	Divorce	10 (37)	17 (63)	27 (7.9)	
	Widowed	4 (40)	6 (60)	10 (2.9)	
<b>Educational status of mother</b>	Unable to read and write	7 (20.6)	27 (79.4)	34 (9.9)	0.545
	Able to read	11 (24.4)	34 (75.6)	45 (13.2)	
	1-8 grade	11 (26.2)	31 (73.8)	42 (12.3)	
	9-12 grade	29 (29.9)	69 (70.1)	97 (28.4)	
	Diploma and above	35 (28.5)	88 (71.5)	123 (36)	
<b>Educational status of father</b>	Unable to read and write	5 (17.9)	23 (82.1)	28 (8.2)	0.060
	Able to read and write	1 (7.1)	13 (92.9)	14 (4.1)	
	1-8 grade	12 (32.4)	25 (67.6)	37 (10.8)	
	9-12 grade	35 (35.4)	64 (64.6)	99 (28.9)	
	Diploma & above	41 (25)	123 (75)	164 (48)	
<b>Mother current occupation</b>	Housewife	42 (28.8)	104 (71.2)	146 (42.7)	0.508
	Civil servant	19 (23.5)	62 (76.5)	81 (23.7)	
	Merchant	16 (23.9)	51 (76.1)	67 (19.6)	
	Student	12 (32.4)	25 (67.6)	37 (10.8)	
	Daily labourer	5 (45.5)	6 (54.5)	11 (3.2)	
<b>Occupation of the father</b>	Farmer	19 (26.8)	52 (73.2)	71 (20.8)	0.693
	Civil servant	10 (27.8)	26 (72.2)	36 (10.5)	
	Merchant	32 (24.1)	101 (75.9)	133 (38.9)	
	Student	16 (30.2)	37 (69.8)	53 (15.5)	
	Daily labourer	17 (34.7)	32 (65.3)	49 (14.3)	

Table 2. Environmental characteristic of the respondents at Debre Tabor General Hospital Northwest Ethiopia, 2019 (n=342)

Variable	Category	Pneumonia		Total n (%)	X <sup>2</sup> p-value
		Yes n (%)	No n (%)		
Source of drinking Water	Piped water	79 (28.7)	196 (71.3)	275 (80.4)	0.213
	Protected dug water	6 (42.9)	8 (57.1)	14 (4.1)	
	Unprotected dug water		3 (100%)	3 (0.9)	
	Spring water	7 (15.9)	37 (84.1)	44 (12.9)	
Kind of toilet facility	Pit latrine	44 (26.8)	120 (73.2)	164 (48)	0.049
	Open field	45 (32.1)	95 (67.9)	140 (40.9)	
	Ventilated latrine	5 (13.2)	33 (86.8)	38 (11.1)	
Type of fuel source	Charcoal	53 (31.2)	117 (68.8)	89 (26)	0.125
	Wood	25 (28.1)	64 (71.9)	83 (24.3)	
	Electric	16 (19.3)	67 (80.7)	170 (49.7)	
Cooking room	Living room	53 (27.7)	138 (72.3)	191 (55.8)	0.534
	Kitchen	38 (28.6)	95 (71.4)	133 (38.9)	
	Outdoor	3 (16.7)	15 (83.3)	18 (5.3)	
Children sleep in cooking house	Yes	72 (66.7)	36 (33.3)	108 (31.6)	0.000
	No	22 (9.4)	212 (90.6)	224 (68.4)	
Cigarette smoking exposure	Yes	1		1 (0.3)	0.614
	No	93 (27.3)	248 (72.7)	341 (99.7)	

Table 3. Nutritional status, past comorbidities and vaccination status of under five children at Debre Tabor General Hospital Northwest Ethiopia, 2019 (n=342)

Variables	Category	Pneumonia		Total n (%)	X <sup>2</sup> p-value
		Yes n (%)	No n (%)		
Child immunization status	Up-to-date	28 (34.6)	53 (65.4)	81 (23.7)	0.108
	Completed	66 (25.3)	195 (74.7)	261 (76.3)	
Breastfeeding status	No breast feeding	17 (77.3)	5 (22.7)	22 (6.4)	0.000
	Mixed feeding	16 (17.8)	74 (82.2)	90 (26.3)	
	Exclusive breast feeding	61 (26.5)	169 (73.5)	230 (67.3)	
Malnutrition WFH	Yes	21 (77.8)	6 (22.8)	27 (7.9)	0.000
	No	73 (23.2)	242 (76.8)	315 (92.1)	
Diarrhoea within two weeks	Yes	29 (33.7)	57 (66.3)	86 (25.1%)	0.140
	No	65 (25.4)	191 (74.6)	256 (74.9)	

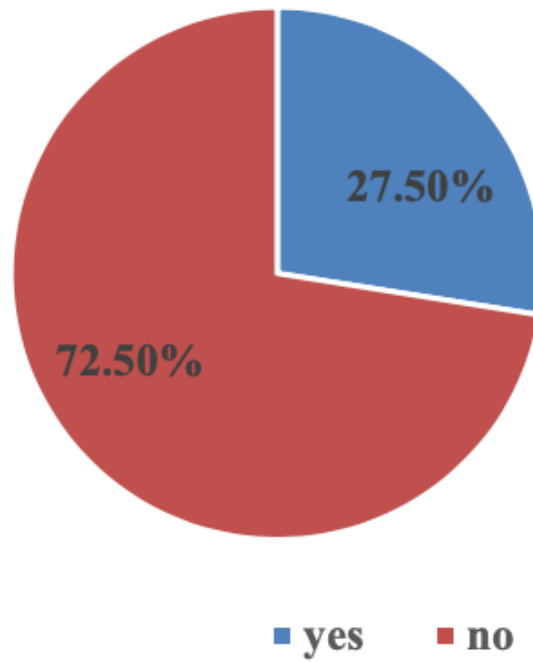
Table 4; Factors associated with under five pneumonia at Debre Tabor General Hospital North West Ethiopia, 2019 (n=342)

Variables	Pneumonia		COR (95% CI)	AOR (95% CI)	
	Yes	No			
<b>Educational status of the father</b>	Unable to read and write	5	23	0.652 (0.232,1.823)	
	Abele to read and write	1	13	0.230 (0.029,1.811)	
	1-8 grade	12	25	1.44 (0.664,3.120)	
	9-12 grade	35	64	1.64 (0.953,2.82)	
	Diploma& above	41	123	1	
<b>Sleeping in cooking room</b>	No	22	212	0.052 (0.029,0.072)	0.066 (0.035,0.123) **
	Yes	72	36	1	
<b>Fuel sources</b>	Charcoal	53	117	1.896 (1.005,3.575)	
	Wood	25	64	1.635 (0.800,3.340)	
	Electric	16	67	1	
<b>Toilet type</b>	Open field	45	95	3.126 (1.143,8.542)	
	Pit latrine	44	120	2.420 (0.888,6.586)	
	Ventilated latrine	5	33	1	
<b>Malnutrition</b>	Yes	21	6	11.602 (4.517,29.874)	7.897 (2.480,25.145) **
	No	73	242	1	1
<b>Exclusive breast feeding</b>	No	17	5	9.419 (3.330,26.602)	5.805 (1.477,22.821) *
	Mixed	16	74	0.599 (0.324,1.107)	4.111 (1.152,14.672) *
	EBF	61	169	1	1
<b>Immunization status</b>	Up-to-date	28	53	1.561 (0.913,2.667)	
	Completed	66	195	1	
<b>Diarrhoea in the last two weeks</b>	Yes	29	57	1.495 (0.881,2.534)	
	No	65	191	1	

Note: - \*  $\leq 0.05$ , \*\*  $\leq 0.001$ ; all variables with COR showed significance at  $p \leq 0.2$  in bivariable analysis; EBF: exclusive breast feeding

## Figures

### Proportion of under five pneumonia



**Figure 1**

Proportion of pneumonia among under five children visiting Debre Tabor General Hospital, North West Ethiopia, 2019