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Magnitude of Pneumonia and Risk Factors among Children Aged from 2 to 59 Months in Fitche General Hospital, Ethiopia 2018: A Case Report

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Abstract

Background: Globally, every 35 seconds a child dies because of pneumonia. Around 905,059 under five children died due to pneumonia. The burden of child mortality due to pneumonia is higher in Sub-Sahara African countries. Therefore, this study aimed to assesses the magnitude of pneumonia and risk factors among children aged from 2 to 59 months.

Methodology: Institutional based case control study was employed at Fitche General Hospital in March, 2018. Data were collected using a pre-tested and standardized questionnaire. Anthropometric measurements were taken from 246 children with pneumonia and those came for immunization or with other illnesses except respiratory complaints. Systematic random sampling method was used to select study participants. Data was analyzed using Statistical Package for Social Science (SPSS) Version 20. Binary logistic regression analyses were carried out to check whether their was association or not between independent and dependent.

Results: Data collected from cases of 123 children diagnosed with pneumonia and controls of 123 children without pneumonia in Fitche General Hospital. Children with no malnutrition were less likely to develop pneumonia (AOR=0.299, 95% CI: 0.127-0.704; p<0.006) as compared to those who were malnourished. Breastfeeding was strongly associated with pneumonia, in children who were exclusively breast fed for 6 months with odds of (AOR=0.470, 95% CI: 0.226-0.977), p=0.043) compared to their counterpart.

Conclusion: This study presents the independent predisposing factors, which are not being exclusively breast fed and malnutrition, for a child aged between 2 to 59 months of age. Improving nutritional status and education on exclusive breast feeding might be help to prevent pneumonia.

Keywords: Prevalence; Pneumonia; Malnutrition; Breastfeeding

Abbreviations: URTI: Upper Respiratory Tract Infection; EBF: Exclusive Breast Feeding; NCLH: Number of people living in the same house as the child; OR: Odds Ratio

Introduction

Pneumonia is acute respiratory infection that affects the human lungs. The lungs are made up of small sacs called alveoli which fill with air when every person breathes. When an individual has pneumonia, the alveoli are filled with pus and fluid, which makes breathing painful and limits oxygen intake. Worldwide Pneumonia is one of the leading killers of children every 35 seconds. It was accountable for approximately 1.4 million deaths among under 5 years. It causes an estimated episode of 156 million morbidity and 14.9 million hospitalizations per year. In south Asia and Sub-Saharan Africa pneumonia killed an estimated 922,000 children in 2015 which 15% of all death is under five years old. Ethiopia ranked 27th in under five mortality with 119 deaths per 1,000 live births. Almost one in every ten babies born in Ethiopia does not survive to celebrate the first birthday [1].

Pneumonia, diarrhea, malaria, measles, AIDS and sepsis accounted for deaths of under five children 85% in Africa and 90% in Ethiopian. In Ethiopia, pneumonia is a leading single disease killing under five children. Annually around 3,370,000 children encounter pneumonia contributing 20% of deaths for under five children. In our previous five year retrospective study on mortality of pediatrics, pneumonia was the first rank from the top ten diseases of mortality. Pneumonia has many possible causes, but the most common causes are bacteria and viruses. These are Streptococcus pneumoniae, Haemophilus Influenzae type b (Hib), and Respiratory Syncytial Virus (RSV). Populations at risk for pneumonia are under-five years children, people aged greater than 65, and people with pre-existing health problems. Tobacco smoke exposure, malnutrition, immunological deficits (primary and/or secondary), environmental factors (indoor air pollution caused by cooking and heating with biomass fuels like wood or dung), and living with crowded conditions were increased a risk of

child's susceptibility to pneumonia. Deaths from pneumonia are highest in poor rural communities as a result of household air pollution which depend on solid fuels (wood, dung or charcoal) for cooking or heating, overcrowded homes, and less likely to be immunized against measles and whooping cough [2].

These deaths are easily preventable and treatable through simple and cost effective interventions. Immunization, exclusive breast feeding, appropriate complementary feeding and proper hygiene are among preventive method while administrations of amoxicillin and/or antibiotics treatment are the curative methods, which can save lives. However, use of inaccurate method of child health care may lead to irreversible health problem. Therefore, this study aimed to assesses the magnitude and risk factors that associated with pneumonia among children aged from 2 to 59 months at Fitche General Hospital.

Case Presentation

Study setting and design

An institutional based case control study design was used to assess the risk factors that associated with pneumonia in children of age between 2 to 59 months at Fitche General Hospital March 2018.

Study population

Children aged between 2 to 59 months and their mothers or caretakers at Fitche General Hospital with pneumonia (case) and those who come without pneumonia (other respiratory complaints and immunization) (control) [3].

Study subjects

The study enrolled mothers or caretakers of children aged between 2 to 59 months that are cases and controls. A case was defined as a child who received a diagnosis of pneumonia by the physician. Control subjects were defined as children who were brought to Fitche General Hospital with other than respiratory complaints, who came for immunization and who did not belong to the same household with case patient. Cases and Controls were recruited within the same facilities, time period and age group. The study recruited the participants in Fitche General Hospital for comparison [4].

Exclusion criteria

Mothers or caretakers who have hearing impairments or talking problem and children belonging to the same household either cases or controls were excluded from the study.

Sample size procedure

Sample size formula for comparing two proportions by using open Epi Info was applied to obtain the sample size. By considering 95% confidence level, 80% of power, 1:1 ratio of controls to cases, 23.8% of controls exposed, 2.25 odds ratio and 41.3% of cases with exposure. Through reviewed previous studies, the overcrowding is an exposure variable for pneumonia that gave the highest sample size 123 of cases and controls. We used one control for each case of age between 2 to 59 months (123 cases and 123 controls) [5,6].

Data collection

Data were collected by trained professional nurses using face-to-face interview with a pre-tested and standardized questionnaire, and anthropometric measurements. The questionnaire adopted by English language and translated to local language (Affan Oromo and Amharic), and back translation was done to see the consistence of the questionnaire. Anthropometric measurement of weight and height was done using standardized and calibrated measuring tools. Weight was recorded using analog weight scale and Mid-Upper Arm Circumference (MUAC) was also measured by using a MUAC tape record [7].

Data processing and analysis

The collected data were cleaned and checked for completeness; then it was entered, compiled and analyzed by using Epi info for data entry and SPSS software for analysis. Percentages, simple frequencies, mean, and ranges of the given data were calculated for each variable to describe findings. Additionally tables and different forms of graphs are used to assist data presentation [8]. To evaluate the potential risk factors for childhood pneumonia bivariate and multivariate analysis were performed to explain the study population and determine the independent risk factors associated with pneumonia. A p-value of less than 0.05 was considered statistically significant and adjusted odds ratios with 95% CI were calculated to determine association [9].

Ethical consideration

Ethical clearance was gained from Addis Ababa University. A formal letter of request for permission was submitted to Fitche General Hospital and permission was granted. Written and finger-print informed assent was obtained from each study participant (mothers or care takers of children) after they were introduced to the purpose of the study. All subjects to participate in this study were asked for their willingness to participate in the study. All the reasons why the subjected are chosen and why the research done was explained to the study subjects. Additionally confidentiality of all the data to be gained will be seriously maintained [10].

Results

The non response rate of all cases and controls were 0%. During data collection period 592 children visited the pediatric outpatient departments and from them 127 were children aged between 2 to 59 months diagnosed with pneumonia. Majority 154 (62.6%) of the study participants live in urban area with 71 (57.7%) were cases and 83 (67.5) were controls. One hundred seventy seven (71.95%) of the enrolled children were between 2 to 23 months and 69 (28.05%) were children aged 24 to 59 months old. More children enrolled in this study were males 132 (53.66%) with 68 cases, 64 controls and 14 (5.7%) were single parents, 8 cases and 6 controls. Greater than one-third (35.4%) of mothers or care givers were illiterate from these 42 cases [11,12].

Were cases and 35 were controls and 199 (80.89%) of the respondents were orthodox by religion which is 100 cases and 99 control caretakers. Ninety 1 (36.9%) control caretakers indicated that they had a monthly income of less than seven hundred fifty birr and 155 (63%) of the participants earned more than 750 birr a month. Thirty two percents and 85 (34.55%) of the respondents live in a single and two rooms respectively. Among the respondents 70

(47.94%) and 44 (48.48%) cases, and 76 (52.06%) and 51 (51.52%) controls owned radio and TV respectively (Table 1). Those study participant (42.7%) who live in houses occupied from 1 to 3 children and 68.4% cases and 31.6% control were live in houses occupied 5 to 8 children.

Table 1: Socio demographic characteristics of study subjects in Fitche General Hospital March 2018.

Characteristics	Cases	Control	Frequency	Percent
Residence				
Rural	52	40	92	37.4
Urban	71	83	154	62.6
Gender of child				
Male	68	64	172	53.7
Female	55	59	114	46.3
Age of the child				
24 to 59 months	40	29	69	28
2 to 23 months	83	94	177	72
Marital status				
Single	8	6	14	5.7
Married	115	106	221	89.8
Divorced	6	5	11	4.5
Religion				
Protestant	17	15	32	13
Orthodox	100	99	199	80.9
Muslim	6	9	15	6.1
Monthly income				
<750	47	44	91	36.9
>750	76	79	155	63.1
Radio in the house				
They don't own a radio	53	47	100	40.6
They own a radio	70	76	146	59.4
TV in the house				
They don't own a TV	75	72	147	59.7
They own a TV	48	51	99	40.3
Educational status of the mother or care giver				
Illiterate	42	35	77	31.3
1st cycle 1-4	17	13	30	12.2
2nd cycle 5-8	19	26	45	18.3
Secondary school 9-10	15	12	27	11
Preparatory 11-12	11	15	26	10.6

College and university	19	22	41	16.6
House size				
Four or more rooms	15	13	28	11.4
Three rooms	25	30	55	22.3
Two rooms	48	37	85	34.6
Single room	35	43	78	31.7

The overall malnutrition was found 38 (15.45%) of the children. More cases (76.3%) than controls (23.7%) were malnourished. One-fourth (25.6%) of study respondents indicated that their children were not exclusively breastfed with 45 (71.5%) and 18 (28.5%) caretakers of cases and controls, respectively. Greater than two-fifth cases and half control children were exclusively breasted more than 6 months. More than two-third (67.9%) of cases and 17 (32.07%) of controls were delivered at home and 18% of mothers or care takers did not expose their child to sun light properly which is 53.5% cases and 46.5% controls. 48% of cases and 52.48% of controls had a history of upper respiratory tract infection. Among the respondents 6 (42.85%), and 2 (66.7%) cases, and 8 (57.15%) and 2 (33.3%) controls had a history of measles and HIV/AIDS infection respectively (Table 2). The Expanded Program of Immunization (EPI) was cover 66.3% of children were fully vaccinated and 4.5% of the children were not vaccinated to at all [13].

Table 2: Frequency distribution of clinical presentation status of children at Fitche General Hospital, March, 2018.

Characteristics	Cases	Control	Frequency	Percent
Vaccination history				
Fully vaccinated	84	79	163	66.3
Not fully vaccinated	8	8	16	6.5
Is being vaccinated	24	32	56	22.7
Not vaccinated	7	4	11	4.5
Exclusive breast feeding				
Yes	78	105	183	74.4
No	45	18	63	25.6
Place of delivery				
Home	36	17	53	21.5
Health institution	87	106	193	78.5
Malnourished (weight for age)				
Malnourished (<90%)	29	9	38	15.4
Normal (>90%)	94	114	208	84.6
History of measles infection				
Yes	6	8	14	5.7
No	117	115	232	94.3
History of HIV				
Yes	4	2	6	2.4
No	119	121	240	97.6
History of URTI				
Yes	48	53	101	41.1
No	75	70	145	58.9

Table 3 shows that the potential indoor pollution related risk factors for pneumonia among the study subjects. Among the types of cooking fuels used, wood and electric stove were the most common type of fuel used by cases 78 (59.1%) and 12 (26.7%) and controls 54 (40.9%) and 33 (73.3%) for the two types of fuel sources respectively. Two-third of study participants lived in houses with their floor being soil and followed by cement 34.6%. The majority of study participants 70.3% used iron sheet in which 48.6% were cases and 51.5% were controls. 45 (18.3%) of all the households had a member smoking within the home with 60% cases and 40% were controls. 213 (86.6%) of the participants had kitchen inside the house where 48.4% cases and51.7% were controls. 23 (66.7%) of kitchen was detached from the main house among them were 48.2% cases and 51.8% controls. Twenty percent had kitchen that was not detached from the main house, among those 51.0% were cases and 49.0% were controls (Table 3). Solid fuels were the most common sources of fuel for cooking among the study participants which included wood (53.64%), charcoal (15.0%), electric stove (18.3%) and the less commonly used was cow dung (13.0%) [14].

Multivariate regression

We have selected the significant variables from binary regression as a candidate for those variables with p<0.2 for multivariate regression in order to calculate the adjusted odds ratio. Malnutrition was significantly associated in bivariate (OR=0.256, 95% CI: (0.12, 0.57) p=0.001) and it has also remained significant in multivariate logistic regression that children who were not malnourished were 0.30 fold less likely to develop pneumonia compared to the others who are malnourished (AOR=0.30, 95% CI (0.13, 0.70); p=0.006). When we see exclusive breast feeding, it was again found to be weakly associated that children who were exclusively breast fed were 0.45fold less likely to develop pneumonia when compared to those who were not exclusively breast fed (AOR=0.04, 95% CI; (0.23-0.98); p=0.043). Place of delivery was significantly associated in crudes odds ratio (AOR=2.58, 95% CI; (1.36, 4.91); p=0.004) but it was not associated in adjusted odds ratio. Having less than 3 children living in the same house was also significant in the crude odds ratio but it was adjusted in multi logistic regression (AOR=0.43, 95% CI; (0.14, 1.35); p=0.150) (Table 4).

Table 3: Frequency distribution of indoor pollution with cases and controls at Fitche General Hospital, March, 2018.

Characteristics	Cases	Control	Frequency	Percent
Type of floor				
Soil	87	74	161	65.4
Cement	36	49	85	34.6
Type of roof				
Grass	39	34	73	29.7
Iron sheet	84	89	173	70.3
Cigarette smoker				
Absent	96	105	201	81.7
Present	27	18	45	18.3
Presence of kitchen				
Absent	20	13	33	13.4
Kitchen detached from the main house				
Present	103	110	213	86.6
Not detached	34	28	62	25.2
Detached	89	95	184	74.8

Table 4: Adjusted odds ratio for selected significant variables in bivariate analysis Fitche General Hospital, March, 2018.

Characteristics	Participant type				COR (95% CI)	AOR (95% CI)	P value
	Cases (123)		Controls (123)				
	No	%	No	%			
Age of child							
24-59 months	40	58	29	42	0.64 (0.37-1.12)	1.62 (0.8-3.04)	0.131
2-23 months	83	46.9	94	53.1	1	1	
Residence							
Rural	52	56.5	40	43.5	0.66 (0.39-1.11)	0.97 (0.51-1.8)	0.924
Urban	71	46.1	83	53.9	1	1	
Malnourished							
Malnourished<90 %	29	76.3	9	23.7	0.26 (0.12-0.57)	0.30 (0.13-0.7)	0.006*
normal>90%	94	45.2	114	54.8	1	1	
EBF							
Yes	78	42.6	105	57.4	0.30 (0.20-0.55)	0.47 (0.2-0.98)	0.043*
No	45	71.4	18	28.6	1	1	
Place of delivery							
Home	36	68	17	32	2.58(1.36,4.91)	1.45 (0.6-3.14)	0.352
Health institution	87	45	106	55	1	1	
Number of people living in the same house as the child							
1-3	44	41.1	61	58.9	0.33 (0.12-0.94)	0.43 (0.14-1.3)	0.15
3-5	66	54.1	56	45.9	0.61 (0.36-1.04)	0.73 (0.24-2.2)	0.578
5-8	13	68.4	6	31.6	1	1	
Presence of kitchen							
Absent	20	60.6	13	39.4	1.03 (0.55-1.96)	1.74 (0.7-3.9)	0.185
Present	103	48.4	110	51.6	1	1	
Type of roof							
Soil	87	54	74	46	1.6 (0.94-2.72)	1.02 (0.5-1.9)	0.956
Cement	36	42.4	49	57.6	1	1	
Cigarette smoker							
Absent	96	46.8	105	53.2	0.61 (0.32-1.18)	0.59 (0.2-1.19)	0.138
Present	27	60	18	40	1	1	
Note: *p<0.05 was considered significant							

Discussion

Acute respiratory infection (particularly pneumonia) is a foremost cause of death in resource limited countries in children aged between 2 to 59 months. Identifying and addressing the risk factors for pneumonia are potentially open to appropriate intervention of public health importance [15,16]. In this study, risk factors have been tried to identify which may have implications for health intervention programs. We found that the magnitude of pneumonia in this study was 21.2% among children aged between 2 to 59 months attended in the Fitche General Hospital. The magnitude of pneumonia in this study was higher than study conducted in west Ethiopia. This different may be due to study method, the tools they used in their study and geographical area and attitude toward health care [17].

In our study, most of the respondent mothers or care givers were illiterate (35.4%). From these 54.55% were cases and 45.45% were controls and but it was no association found. This result was different from the study result in Brazil that mother's education was associated both in crude and adjusted analysis with Acute Lower Respiratory

Infection (ALRI). This might be because the difference of illiterates in both cases and controls was not that much different [18]. According to our study result we did not find a statistical significance with house hold income level and pneumonia. Conversely, previous studies done in Ethiopia and Brazil found an association between pneumonia and low family income. The reason for this may be the majority had an income more than 750 birr but it was not still enough to provide the quality of life that will be preventive of other illnesses [19].

Crowding favours propagation of microbial agents of respiratory tract infections has easily transmitted through the children. In fact, colonization of the respiratory tract of children by potential pathogens is almost universal in resource limited countries. In our study more than 5 occupants living in the same house of child were not found to be significant in adjusted odds ratio. However, a linear increase in the risk of pneumonia mortality with increasing people in a child's bedroom and increasing number of under-fives in a household was reported in adjusted analyses found in south Brazilian case-control study. The reason for this might be, in both cases and controls the number of house hold occupants did not show that much variation especially when it was adjusted for the odds ratio with other significant candidate variables [20].

A child whose parents used charcoal as main fuel was more likely to have pneumonia than those who did not use. Children who lived in a house where cattle were kept inside were also more likely to have pneumonia than a child who lived in a house where cattle were not kept inside. The reason for this might be in our study most of the cases and controls use similar type of fuel for cooking. And for the livestock's sharing the same house it might be because little number of both the cases and controls, and allowing the animals to live inside the household. Smoking was not found to be significantly associated to pneumonia in our study but more recently studies from China and USA showed a significant linear trend between parental smoking and occurrence of pneumonia both in crude and adjusted analysis. The reason might be in our study both the cases and control the number of smoker family members were not that much different to each other [21,22].

In our study malnutrition was significantly associated (OR=0.26, 95% CI: (0.12, 0.57); p=0.001) and it has also remained significant in adjusted (AOR=0.30, 95% CI: (0.13, 0.70); p=0.006). Children who were not malnourished were 0.30 fold less likely to develop pneumonia compared to those who are malnourished. This was in line with the studies found in Guatemala. So, we indicate that malnutrition might be identified as a risk factor for pneumonia. It has been reported that impaired cellular immunity in malnourished children makes them more prone to Respiratory Tract Infections (RTI). Inadequate nutrition in-utero and during infancy and early childhood is closely linked to lifelong immune deficiencies and acute respiratory infections. Nutritional deficits may result from any combination of insufficient caloric intake, lack of protein, and inadequate levels of micronutrients. Acute respiratory infections generally occur more frequently, last longer, and are more severe in malnourished children. Typically, the mucous membranes and other mechanical structures designed to keep the respiratory tract clear are impaired, and the immune system has not developed properly in children.

We found that exclusive breast feeding was significantly associated with pneumonia when compared to those who were not exclusively breast fed (AOR=0.47, 95% CI, (0.23, 0.98); p=0.043). This result was different from WHO comparative impact assessment of child pneumonia in 2009 which is a 15 times greater risk of death from pneumonia if not breastfed in first 6 months. Breastfeeding has great benefit for children to prevent health problems and built all systems. Maternal-milk used for transferring to infants maternal innate immune components (lactoferrin, lysozyme, secretary IgA), influences of breast milk on immune-system maturation, and enhancement of the antibody response to pathogens.

It offers a vital protection against pneumonia-related mortality. Study suggests that children who are not breastfed could be at greater risk than children who are either exclusively or even partially breasted. This shows that not exclusively breast feeding can be risk factor for developing child illness. In our study Vitamin D deficency is not statistacally significant but in a recent cross sectional survey has found that low blood level of vitamin D significantly increased the risk of pneumonia. Also an Indian hospital based case control study suggested that the deficiency of vitamin D considerably boosted the probability of child hood pneumonia.

Conclusion

This difference might be shortage of resources and time that we have only used history of sun light exposure and lack of laboratory investigation to assess for vitamin D deficiency. The magnitude of pneumonia was 21.2%. Malnutrition and exclusive breast feeding were found among the major risk for developing pneumonia that identified in this study among children from 2 to 59 months of age. Even though, pneumonia is an easily preventable disease. However, it still remains the leading cause of morbidity and mortality especially in the aged between 2 to 59 months of child.

Limitations

Participants were questioned mainly about the socio demographic characteristics, housing condition, child care practice, maternal awareness and events that have happened not more than two weeks ago related to the child illness to minimize recall bias but still there could be. Even though, the study design requires time to recruit cases and controls, due to the shortage of time we had for data collection, we took all cases and controls that came at that specific time of data collection period. In addition, matching controls were not selected before recruitment of a case to minimize variations in the findings due to shortage of time for the collection of data.

Declarations

Ethical clearance was gained from Addis Ababa University. A formal letter of request for permission was submitted to Fitche General Hospital and permission was granted. Written informed assent was obtained from each study participant (mothers or care takers of children) after they were introduced to the purpose of the study. All subjects to participate in this study were asked for their willingness to participate in the study. All the reasons why the subjected are chosen and why the research done was explained to the study subjects. Additionally confidentiality of all the data to be gained will be seriously maintained.

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