Prevalence and Associated Factors of Community Acquired Pneumonia among Children 2 To 59 Months in Arsi Zone Towns, Oromia Regional State, Ethiopia

Merga Bayou[1*], Muhammedawel Kaso[2], Deenalakshmi Ammu[1] and Hulamanaye Tureneh[3]

[1]Department of Clinical Nursing, College of Health Science, Arsi University, Asella, Ethiopia.

[2]Department of Public Health, College of Health Science, Arsi University, Arsi Asella, Ethiopia,

[3]Department of Midwifery, College of Health Science, Arsi University, Arsi Asella, Ethiopia,

*Corresponding author: Merga Bayou .Email: mergabbig@gmail.com.

Abstract

Background: According to 2011 Ethiopian Demography and Health Survey (EDHS) prevalence of acute respiratory infection in Ethiopia is 7% with the significant variation across regions. Identifying its prevalence in under-five children with its associated factors is crucial to achieve and to reduce morbidity and mortality in developing countries to address the sustainable development.

Objective: To assess prevalence and factors associated with community acquired pneumonia among children of age 2-59 months, in Arsi Zone towns, Oromia Regional State, South Eastern Ethiopia, 2017 G.C.

Methods: A community based cross sectional study design was conducted from November 1, 2017 G.C. to December 1, 2017 G.C. among children of age 2- 59 months in Arsi Zone towns. Multi-stage random sampling technique was used to select 454 household and trained BSc nurses collected

the data through face to face interview from mother/care givers of the children. Collected data was entered into Epi-info and exported to SPSS for step by step analysis. The descriptive statistics were used to analysis the collected data. Bivariate and then multivariate binary logistic regression and AOR with its 95% CI and P<0.05 was used to identify the factors associated with community acquired pneumonia.

Result: The two weeks' prevalence of community Acquired pneumonia in children of age 2-59 months was 12.9% in Arsi zone. Children of mother who had learnt secondary school were less likely to develop community Acquired pneumonia (AOR: 0.284, 95% CI, (0.106, 0.755). The orthodox religion followers (COR: 0.412, CI 95%, (0.176, 0.964)) and Muslim religion followers (COR: 0.309, CI 95%, (0.123, 0.775) children of mother were less likely affected by CAP.

Conclusion: The prevalence of CAP in 2-59 months' children is high. Educational status was inversely related to community Acquired pneumonia and religion are the factors associated with community acquired pneumonia. It is better if the further research is done on specific cause of community Acquired pneumonia and to investigate more associated factors of community Acquired pneumonia.

Key words: Community Acquired pneumonia, Arsi Zone towns, Oromia region

Introduction

Pneumonia is inflammation of lung tissue due to an infectious agent which manifested as cough or difficulties in breathing and tachypnea (Singh V, 2011; Vinogradova Y 2009; Andrade AL et al, 2012). 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 childhoods are in the poorest world's regions, Sub-Saharan Africa, and South Asia (Kothe H et al, 2008). Study conducted in New Delhi; India and Bangladesh revealed that overall prevalence of Acute Respiratory Infection (ARI) among under five was 4.5% for one-month period (Black RE et al, 2010) and 21.3 for two weeks period respectively (De Wals P et al, 2008).

According to 2011 Ethiopian Demography and Health Survey (EDHS) prevalence of ARI in Ethiopia is 7% with the significant variation across regions (Dambrava PG et al, 2008). Other local study conducted in Northwest; Ethiopia showed overall two weeks prevalence of pneumonia among under-five children was 16.1% (Nascimento LF et al, 2004). According the study conducted in southern part of the Ethiopia, the overall prevalence under five children pneumonia during the time of three weeks survey was 33.3% (Abuka T, 2017).

Evidence showed that several factors were associated with occurrence of under-five pneumonia. These include socio-economic, demographic, nutritional and behavioral, and environmental factors as the risk factors. Boys are more likely to suffer than girls, and infants are more vulnerable to suffer from ARI compared to toddler and child who may have the chance to

build up some natural immunity (Nascimento LF et al, 2004). Lack of exclusive breast feeding, Malnourished children are at significantly higher risk of suffering from ARI compared with healthy children (Wonodi CB, 2012; Jackson S, 2013; Williams BG, 2002; Ribeiro GS, 2007; Ladhani S, 2010; Domingues CM, 2014; Afonso ET, 2013; Brooks WA, 2010). Vitamin A helps to decrease the severity of many infections, such as diarrhea and measles (Fonseca Lima E, 2015; Goya A, 2005).

To end this problem, the World Health Organization (WHO) and United Nation's Children Fund tried IMNCI, ARI case management, etc. However, pneumonia is still community problem (Kothe H, 2008).

The main problem of CAP is the case is not reportable and this causes difficult to determine the true figure of community acquired pneumonia in the country and in Arsi zone. The other challenges in community acquired pneumonia are different risk factors and many causes of pneumonia. This study was, therefore, intended to bridge this information gap by determining the prevalence and its associated factors among 2 to 59 months old children of Arsi Zone towns.

Methods

Study area

Arsi zone is one of the zones found in Oromia regional states and is located south eastern in Ethiopia at 175 km from Addis Ababa with area of 21,120.29Sq. Km. Based on the 2007 census conducted by the CSA, this zone has total population of 2,637,657 of whom 1,323,424 are men and 1, 341, 233 are woman in total households of 541, 959. The Arsi Zone holds 25 Woredas which in turn holds 499 rural villages and 59 towns (Arsi Zone profile of 2008).

Study design and period

A community based cross-sectional study design was conducted from November 1, 2017 to December 1, 2017 to determine the prevalence and factors associated with community acquired pneumonia in Arsi Zone towns.

Source and study population

All household with children two to 59 months old, paired with their mothers/ care givers considered for the study. All children 2-59 months old living in selected district/Kebele was included in the study. Mothers who were not resident for the last 6 months during the commencement of the study in the study area, family who couldn't answer the prepared questions due to social problems like death, mothers or caretakers who were severely ill and or had hearing impairments or speaking problems were excluded from the study.

Sample size determination

The required sample size was calculated using the formula of estimating a single population proportion **n= $[(Z\alpha/_2)^2$ p (1-p)/$d^2]$. At 95% CI = 1.96, P= 17% (20), d= 0.05** as: n = $[(Z\alpha_2)^2$ p (1-p)] /d^2 = $((1.96)^2$ X0.17

X0.83)/0.05^2=217 Multiplying the result by a design effect of 2, (multi stage sampling technique was used), the final sample size of **434** households having children 2-59 months of age was be required.

Sampling technique

Multi-stage sampling technique was employed to include study participants for the research. *Sherka (Gobesa), Tena (Ticho), Digalu* and *Tijo (Sagure)* and *Hetosa (Iteya)* districts which were selected randomly from the Arsi zone divided into *Kebeles* and proportional allocation of households with child mother pair to size of the selected *Kebeles* was employed to share the sample size. The final households with mothers of child 2-59 months were selected by systematic random sampling technique. The lists of households with eligible mother-child pair was taken from the log book of Health Extension Workers. When two or more eligible mothers were present in one household, only one woman was considered by lottery method and when two or more eligible children were present in one house the younger child was selected.

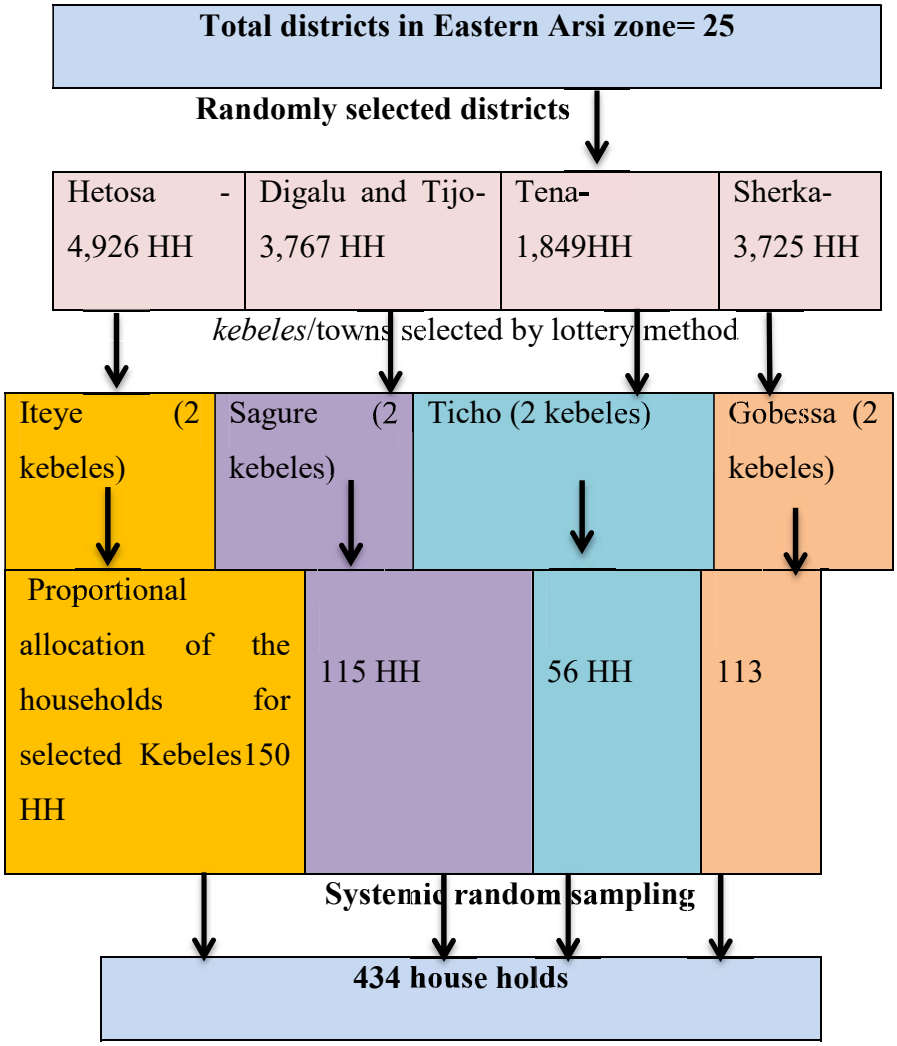

Figure 1: Showing the sampling procedure in Arsi zone to assess the prevalence and associated factors of CAP, 2016/7

Data Collection tools and Procedures

The data was collected at the house-to-house level from all mothers of having children of age 2-59 months using a structured questionnaire on the study community to ask questions related to socio-demographic data of

mothers and child, and questions to assess the prevalence and associated factors of CAP. The questionnaire which was adopted from EDHS of 2011 and different literature review was first prepared in English and then was translated into Afaan Oromo by expert who is fluent in both language and then was retranslated back to English by another person to compare accuracy and consistency with original questionnaire. To check the validity of the study, to improve the sensitive or ethically unacceptable words and to check the questionnaire was in line of the objective the study, pretest was done on 5% of sample population of the Bokoji town.

The enumerators/ interviewers were given intensive training on how to administer the questionnaires and information was collected under close supervision by trained supervisors and principal investigator in order to achieve reliable and valid data. At the end of each day the completed questionnaire was checked to ascertain that all questions were answered correctly and consistently. Children who had cough and other sign and symptom like fever, difficulty of breathing and chest indrawing before two weeks of the data collection was recorded as children with community acquired pneumonia. Additionally, these sign and symptom was recorded during data collection period.

Age of the child was recorded in birth dates by asking the mother of the child or observing the immunization card and if the exact date is not known the mother was asked the known local events calendar by the year and that will be converted to months.

Data Processing and Analysis

The completeness of questionnaire was checked every day during data collection. The data was processed by using Epi.info version 7 and SPSS version 21 for analysis. Cross-checking was done for inconsistencies by running frequencies of each variable. Similarly, frequency distribution, percentage, tables and charts were used to present results of univariate analysis. Cross tabulation, and odds ratio (OR) using 95% confidence interval (95% CI) was done. Multivariate binary logistic regression model was done to control for possible confounders. Variable showed statistical significance at $p<0.05$ was declared as significant contributing factors of community acquired pneumonia.

Ethical considerations

Ethical clearance was obtained from the institutions Ethics review board (IRB). An official permission was communicated through formal letters from Arsi University Research and Community Service Directorate Offices for woreda health beuruo and chairman of the Kebeles. Both oral consent and assent was secured from each participant. Participants were told that the information provided was confidential and that their identities were not revealed in association with the information they were provided

Result

Socio-demographic characteristic children and mothers/ care givers

All study participants, 434 households having children of age 2-59 months, were interviewed which provided the response rate of 100%. The mean age of the children was 24.32 (±14.92) months and 216 (49.8%) of the total children in the age of 12-35 months. Fifty percent (50%) of the total children were males.

The mean age of the mothers was 27.46 and about 278 (64.1%) were between age of 20-29 years. From the total respondents of 434 the 98 (23.6%) of them had more than one child of age less than 5 years.

Majority of the respondents 240 (55.3%) were Orthodox Christian religion followers. The majority of study participants 347 (80%) belong to the Oromo. Concerning educational status, 44 (10.1%) of mothers were illiterate and only 72 (16.6%) learnt up to college and university. Among the interviewed mothers, the majority 230 (53%) were housewives (Table 1).

Table 1: Socio-demographic characteristic of children and mothers/ care givers in Arsi zone, 2017 (n=434)

Variable		Frequency	Percent (%)
Age of mother in years	15-19	20	4.6
	20-24	114	26.3
	25-29	164	37.8
	30-34	67	15.4
	35-39	57	13.1
	40-44	9	2.1
	45-49	3	0.7
Marital status	Single	8	1.8
	Married	381	87.7
	Divorced	33	7.6
	Died	12	2. 2.8
Educational status	Illiterate	44	10.1
	Read and write	7	1.6
	Primary school	184	42.2
	Secondary school	127	29.3
	Higher education	72	16.6
Religion	Orthodox	240	55.3
	Muslim	160	36.9
	Protestant	34	7.8
E Ethnicity	Oromo	347	80.0
	Amhara	64	14.7
	Gurage	23	5.7

Housing and Environmental condition

From the total of 434 respondents 403 (92.9%) had no proper pit to dispose waste. Almost all of the respondents 431 (99.3%) use the charcoal or wood as a main source of fuel in their houses. The respondents who use stove or electric as source of fuel were 135 (31.1%). From the total respondent of 434, twenty-two (5.1) had no kitchen for cooking and 412 (94.9%) had kitchen for cooking. From total house hold, 412, having kitchen 391 (94.9%) of kitchen separated from the main house and 21 (5.1%) was not separated from the main house. Additionally, only 109(25.1%) has chimney, 32(7.4%) had other form of ventilation and 271 (65.8) had no chimney. From the total respondents 29 (6.7%) main house had no window and 195 (44.9%), 139 (32%) and 71 (16.4%) had 1, 2 and 3 windows respectively. From the total of 434 respondents, 403(92.9%) put their children outside of the cooking place and 31 (7.1%) hold their child on their back when cooking. From the total households of 434, in the 11 (2.5%) there were smokers.

Table 2: Housing and environmental condition of children and mothers/ care givers in Arsi zone, 2017 G.C.

Variable			Frequency	Percent (%)
Source of drinking water		River	2	0.5
		Wells	3	0.7
		Tap	429	98.8
Toilet		Open field	7	1.6
		Latrine	427	98.4
Waste disposal		Open field	403	92.9
		In pit	31	7.1
What is used for cooking food in home?	**Charcoal**	No	3	0.7
		Yes	431	99.3
	Wood	No	13	3.0
		Yes	421	97.0
	Electric	No	299	68.9
		Yes	135	31.1
	Kerosene	No	432	99.5
		Yes	2	0.5
	Animal Dung	No	428	98.6
		Yes	6	1.4
	Crop waste	No	428	98.6
		Yes	6	1.4
Kitchen present in house		No	22	5.1
		Yes	412	94.9

Kitchen relative to main house (N= 412)	Separate	391	90.1
	With	21	4.8
Kitchen has chimney (N= 412)	No	271	62.4
	Yes	141	32.5
Number of windows in kitchen (N= 412)	No	279	64.3
	One	120	27.6
	Two	11	2.5
	Three	2	0.5
Number of windows in main house (N= 434)	1. No	29	6.7
	2. One	195	44.9
	3. Two	139	32.0
	4. Three	71	16.4
Location of child when cooking	On back	31	7.1
	Outside	403	92.9
Smoker in house	No	423	97.5
	Yes	11	2.5

Sign and symptom of community acquired pneumonia during data collection

From the total of 434 children, 50 (11.5%) had a cough during data collection. From the total fifty children having cough, during data collection 49 of them had cough for less than one week and only 1 child had cough for greater than one week. Additionally, from those who had a cough, 4 (8%) of them had a chest in drawing. From total of 434 children 22 (5.1%) had a

fever, 8 (1.8%) had vomiting, 8 (1.8%) had diarrhea, 3 (0.7%) had tonsillitis, 3 (0.7%) unable to eat/drink during data collection time.

Prevalence of community acquired pneumonia

In the past two weeks of data collection from the total of 434 children, 56 (12.9%) had pneumonia of which 2 (0.5%) had a severe pneumonia. Most of the children who had a cough, 47 (84%) treated in a health institution and the rest, 9 (16%), treated at home. Ahead two weeks of data collection from the total children of 434 who had a fever, diarrhea, and tonsillitis were 47 (10.8%), 15 (3.5%) and 15 (3.5%) respectively.

Breastfeeding and Immunization status of children in the study area

Exclusive Breast feeding: From the total of 434 respondents 349 (80.4%) provide exclusively breast for their child during the first six months of age and 85 (19.6%) did not give exclusive breast feeding. Among those who did not give exclusive breast feeding, 41 (48.2%) did not provide for their children due to work overload and 21 (24.7%) were due to disease. The rest were reported the reason of not providing EBF due that lack of knowledge 13 (15.3%) and children separation from mother 10 (11.8%).

Weaning of breast feeding: From the total, 434, interviewed mother's/care givers, 78 (18%), 275 (63.4%), and 81 (18.6%) stop breast feeding before 24 months, at 24 months and after 24 months respectively.

Immunization status: From the total of 434 children, 329 (75.8%) fully immunized and from these 234 (71.1) presented card for the validity of their completeness and 95(28.9) had no card for their completeness of all scheduled immunization (Figure 2).

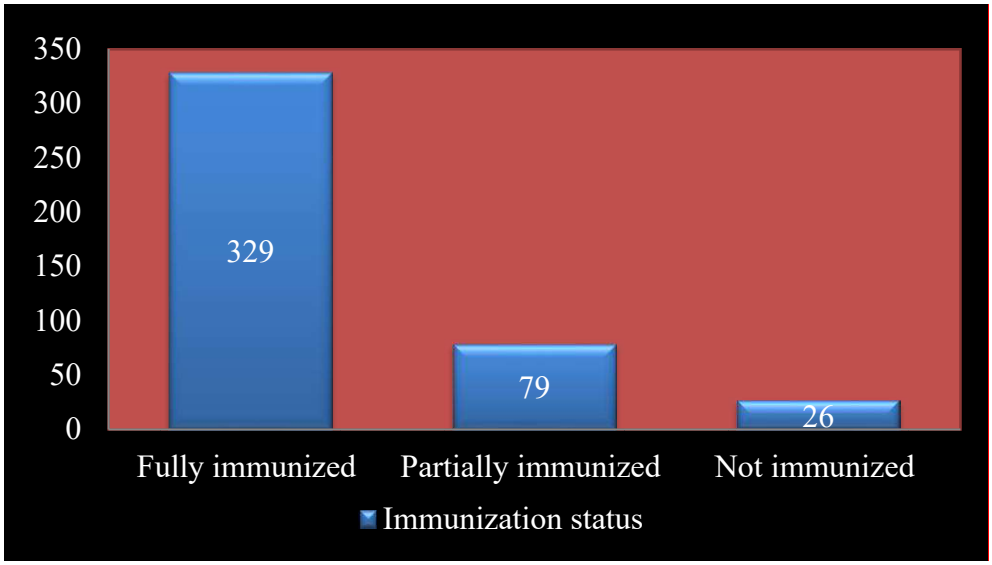

Figure 2: Showing the immunization status of the children of age 2-59 months in Arsi zone, 2017

Factors associated with pneumonia among children

Bivariate analysis

Socio-Demographic Characteristics

From the socio-demographic characteristics the only factors affecting community acquired pneumonia of children by bivariate analysis was the educational status and religion of the mother.

By keeping higher educational status constant mothers who had learnt secondary school their children were less likely affected by pneumonia (COR: 0.265, 95% CI: (0.100- 0.699)) at P-value of 0.007. This showed the odds of having pneumonia among children of mothers who educated secondary school level was 73% less compared to mother who had learnt College and university. By keeping the protestant religion constant, the

orthodox religion followers (COR: 0.412, CI 95%, (0.176, 0.964)) and Muslim religion followers (COR: 0.309, CI 95%, (0.123, 0.775) mother of children was less likely affected by community acquired pneumonia. In this study there is no statically significant association among environmental factor and CAP.

Health indicators

The health other indicators of children like immunization status, exclusive breast feeding and duration of breastfeeding had no statistically significant association with CAP in this study.

Multivariate analysis

The relationship among children having pneumonia and socio-demographic characteristic was assessed at P- level of 0.05 and CI of 95%. The result showed the educational status and religion of the mother was associated with CAP. The children of mothers who had learnt secondary school was 72% less affected by children of mother who learnt higher education (AOR: 0.282, CI 95%, (0.106, 0.775)). On the other hand, mothers of orthodox religion followers (AOR: 0.396, CI 95%, (0.164, .952)) and Muslim religion followers (AOR: 0.296, CI 95%, (0.114, 0.769) children were less likely affected by community acquired pneumonia than other religion followers.

Table 3: Socio-demographic characteristics of mothers/ care givers, environmental, housing condition, breastfeeding and immunization effect on CAP among 2-59 months children and in Arsi zone, 2017/18 (n=434)

Variable		CAP		COR (95%CI)	P-value	AOR (95%CI)
		No	Yes			
Educational status	Illiterate	37	7	0.859 (0.314, 2.349)	0.767	0.948 (0.342, 2.632)
	Read and write	6	1	0.756 (0.084, 6.830)	0.804	0.651 (0.068, 6.223
	Primary school	156	28	0.815 (0.395, 1.678)	0.578	0.930 (0.443, 1.952)
	Secondary school	120	7	**0.265 (0.100, 0.699) ***	**0.007**	**0.284 (0.106, 0.755) * p=0.012**
	Higher Education	59	13	1		
Religion	Orthodox	209	31	**0.412 (0.176, 0.964) ***	**0.041**	**0.396 (0.164, .952) *p=0.039**
	Muslim	144	16	**0.309 (0.123, 0.775) ***	**0.012**	**0.296 (0.114, 0.769) * p=0.012**
	Protestant	25	9	1		
Ethnicity	Oromo	308	39	0.844 (0.240, 2.971)	0.792	
	Amhara	50	14	1.867 (0.484, 7.204)	0.365	
	Gurage	20	3	1		
Occupational status	House wife	199	31	0.640 (0.282, 1.455)	0.287	
	Farmer	15	1	0.274 (0.032, 2.356)	0.238	
	Merchant	94	9	0.394 (0.145, 1.069)	0.067	

	Private	33	6	0.747 (0.240, 2.325)	0.615
	Gov. employee	37	9	1	
Waste disposal	Open	349	54	2.244 (0 .520, 9.673)	0.278
	In pi	29	2	1	
Number of windows in the main house (n= 434)	No	22	7	2.909 (0.917, 9.226)	0.070
	One	176	19	0.987 (0.396, 2.458)	0.978
	Two	116	23	1.813 (0.737, 4.456)	195
	Three	4			
Duration of Breastfeeding	23.70 ± 7.239	378	56	1.010 (0.971, 1.050)	0.624
Immunization status	Incomplete	89	16	0.770 (0.411, 1.441)	0.413
	Complete	289	40	1	
Breastfeeding	Not exclusive	70	15	0.621 (0.326, 1.185)	0.149
	Exclusive	308	41		

Discussion

In this study the prevalence of CAP in the past two weeks of study time was 12.9%. A community-based study in Bangladesh on total of 1162 showed 21.3% of children less than five years of age suffered from ARI during the two weeks preceding the survey (Persson L, 2009). According the study conducted in southern part of the Ethiopia, the overall prevalence under five children pneumonia during the time of three weeks survey was estimated to be 33.3% (Abuka T, 2017). Similar research done in Este town, Ethiopia and revealed the prevalence of two weeks' pneumonia as 16.1% (Abaje G, 2014) which shows slightly higher. This difference might be seasonal variation of the study time and case definition skill of CAP, wider time of survey for studying prevalence which was the prevalence of two weeks in this study, larger sample size.

In this study the prevalence of CAP in the past two weeks of study time was 12.9%. According to Study conducted in New Delhi, India revealed that overall prevalence of Acute Respiratory Infection (ARI) among under five was 4.5% for one-month period (De Wals P et al, 2008). According to 2011 Ethiopian Demography and Health Survey (EDHS) prevalence of ARI in Ethiopia is 7% with the significant variation across regions (Dambrava PG et al, 2008). This difference could be due to wider time of assessing back the prevalence of the CAP which was one month and two weeks for this study, recall bias and seasonal variation.

In this study the educational status of the mother was inversely proportional with the prevalence of the CAP; for the mothers who had learnt secondary school their children were less likely affected by pneumonia as compared to children who's their mother had learnt higher education (AOR:0.282, CI 95%, (0.106, 0.775)). According the research done in Kenya pneumonia was

inversely associated with number of years in education and with current employment. This similarity could be due to socio cultural approximate of Ethiopia and Kenya. In this study, the orthodox religion followers (AOR: 0.396, CI 95% (0.164, .952)) and Muslim religion followers (AOR: 0.296, CI 95%, (0.114, 0.769)) mothers of children was less likely affected by community acquired pneumonia than those of protestant religion followers. This difference could be due to smaller number of protestant religion followers in this study.

On the other hand, in this study environmental and house condition, breastfeeding (exclusive and non-exclusive) and immunization status (complete and incomplete) had not significantly associated with CAP of children of age between 2-59 months.

Conclusion and recommendation

Conclusion

The prevalence of CAP in 2-59 months' children is high. Educational status was inversely related to CAP and child with their mothers Orthodox and Muslim religion followers were less likely affected by CAP.

Recommendations

We would to recommend health extension workers and woreda health office to provide health education for the community about the sign and symptom of community acquired pneumonia to increase their awareness because this higher prevalence could due to lack of knowledge about sign and symptom, prevention measure of CAP.

We would like to recommend other researcher to consider further research on specific cause of community acquired pneumonia that is supported by laboratorial evidence and to investigate additional associated factors.

Acknowledgment

This work would not have been possible without the financial support. So, our in-depth thanks go to Arsi University for the financial support and encouraging us by selecting the thematic area to initiate this research from the proposal preparation up to writing the finding. We especially, indebted to Demographic service, research and community service coordinator of college of health science for timely informing and supporting us by writing letter to Zonal health office of Arsi Zone.

References

Abaje G (2014). Prevalence of pneumonia among under- five children in Este town and the surrounding rural Kebeles, Northwest Ethiopia: Science of journal public health, 2(3): 150-155.

Abuka T et al (2017). Prevalence of pneumonia and factors associated among children 2-59 months old in Wondo Genet district, Sidama zone, SNNPR, Ethiopia: Curr Pediatr Res, 21 (1): 22-23.

Afonso ET, Minamisava R, Bierrenbach AL, Escalante JJ, Alencar AP, Domingues CM, et al (2013). Effect of 10-valent pneumococcal vaccine on pneumonia among children, Brazil, Emerg Infect Dis, 19 (4): 589–97.

Andrade AL, Oliveira R, Vieira MA, Minamisava R, Pessoa VJ, Brandi Leone MC, et al (2012). Population-based surveillance for invasive

pneumococcal disease and pneumonia in infants and young children in Goiania, Brazil: Vaccine, 30 (1): 1901–9.

Black RE, Cousens S, Johnson HL, Lawn JE, Rudan I, Bassani DG, et al (2010). Global, regional, and national causes of child mortality, a systematic analysis: Lancet J, 37 (5): 969–87.

Brooks WA, Goswami D, Rahman M, Nahar K, Fry AM, Balish A, et al (2010). Influenza is a major contributor to childhood pneumonia in a tropical developing country: Pediatr Infect Dis J, 29 (3): 216–21.

Dambrava PG, Torres A, Valles X, et al (2008). Adherence to guidelines' empirical antibiotic recommendations and community-acquired pneumonia outcome: Eur Respir J, 32(4): 892–901.

De Wals P, Robin E, Fortin E, Thibeault R, Ouakki M, Douville Fradet M (2008). Pneumonia after implementation of the pneumococcal conjugate vaccine program in the province of Quebec, Canada: Pediatr Infect Dis J, 27 (3): 963–8.

Domingues CM, Verani JR, Montenegro Renoiner EI, de CuntoBrandileone MC, Flannery B, de Oliveira LH, et al (2014). Effectiveness of ten-valent pneumococcal conjugate vaccine against invasive pneumonoccal disease in Brazil, a matched case-control study: Lancet Respir Med, 2 (6): 464–71.

Fonseca Lima E et al (2015). Clinical and epidemiological characteristics of severe community-acquired pneumonia in children after introduction of the 10-valent pneumococcal vaccine: Dov.press, 6 (3): 131—138.

Goya A, Ferrari GF (2005). Risk factors for morbidity and mortality due to pneumonia in children: Rev Paul Pediatr, 23 (2): 99–105.

Jackson S, Mathews KH, Pulanić D, Falconer R, Rudan I, Campbell H, et al (2013). Risk factors for severe acute lower respiratory infections in children: a systematic review and meta-analysis. Croat Med J, 54 (2): 110–21.

Kazi M. Abul K. et.al (2009). Risk Factors for Acute Respiratory Infections (ARI) Among Children Under-five Years in Bangladesh: J. Sci. Res, 1(1): 72-81.

Kothe H., Bauer T., Marre R. Suttorp, N., Welte1 T, Dalhoff K (2008). Outcome of community-acquired pneumonia influence of age, residence status and antimicrobial treatment: Eur Respir J, 32 (1): 139–146.

Ladhani S, Heath PT, Slack MP, McIntyre PB, Diez-Domingo J, Campos J, et al (2010). Hemophilus influenzae serotype b conjugate vaccine failure in twelve countries with established national childhood immunization programmes: Clin Microbiol Infect, 16 (17): 948–954.

Nascimento LF, Marcitelli R, Agostinho FS, Gimenes CS (2004). Hierarchical approach to determining risk factors for pneumonia in children: J Bras Pneumol, 30 (5): 445–51.

Persson L (2009). The unfinished child survival revolution, the role of nutrition Scandinavian: Journal of Nutrition, 49 (4): 146 - 150.

Ribeiro GS, Lima JB, Reis JN, Gouveia EL, Cordeiro SM, Lobo TS, et al (2007). Hemophilus Influenzae Meningitis 5 Years After Introduction

of the Hemophilus Influenzae Type B Conjugate Vaccine in Brazil: Vaccine, 25 (22): 4420–8.

Singh V, Aneja, S (2011). Pneumonia management in the developing World Pediatric respiratory Reviews: CME, 12(1): 52-59.

Vinogradova Y et.al (2009). Identification of new risk factors for pneumonia: British Journal of General practice, 3 (2): 329-338.

Williams BG, Gouws E, Boschi-Pinto C, Bryce J, Dye C (2002). Estimates of world-wide distribution of child deaths from acute respiratory infections: Lancet Infect Dis, 2 (1): 25–32.

Wonodi CB, Deloria-Knoll M, Feikin DR, DeLuca AN, Driscoll AJ, Moïsi JC, et al (2012). Evaluation of risk factors for severe pneumonia in children; the Pneumonia Etiology Research for Child Health study: CID, 54 (1): 93-103.