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Original Article

Factors Contributing to Pneumonia in Children Under five Years of age in Nepal

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Abstract

Introduction: Pneumonia is the biggest infectious killer of children under five years of age, especially in poor countries. In addition to the immune system of the children, various factors play a vital role in developing pneumonia in these children. We aimed to analyze the factors in Nepal Demography and Health Survey 2016 that could contribute to developing pneumonia in children under 5.

Methods: We used the 2016 Nepal Demographic and Health Survey (NDHS) dataset in this analysis. According to World Health Organization (WHO), pneumonia is diagnosed in under five population as having cough and / or difficult breathing, with / without fever. We considered pneumonia if at least two of these symptoms were present. We created three separate variables: having cough (Yes = 1, No = 0), difficulty breathing (Yes = 1, No = 0) and with fever (Yes = 1, No = 0). We assessed the association between pneumonia and other categorical variables using chi-square test and compared means using independent samples t-test.

Results: In bivariate analysis, wealth index, use of drug for intestinal parasite and history of diarrhea in past two weeks had statistically significant association in occurrence of pneumonia in children under five years of age. However, in multivariate analysis, occurrence of pneumonia was 1.78 times higher in children with history of recent diarrhea after controlling for wealth index and drug for intestinal parasite.

Conclusion: Measures that could prevent the occurrence of diarrhea could also prevent the development of pneumonia in children under five years of age.

Introduction

Pneumonia is the biggest infectious killer of children worldwide.[1] Each year more than 700,000 children under five years die due to pneumonia. It is an acute respiratory infection of lungs and could be due to either bacteria, viruses or fungi in the air. The largest number of child pneumonia deaths occur in sub-Saharan Africa and Asia and is concentrated in world's poorest countries.[2] Most healthy children's immune system can protect them from the infections but children with weak immune system are more prone to develop pneumonia.[3]

In Nepal too, pneumonia has emerged as a leading cause of death among children under five years.[4] Factors like underweight, current smoking mothers, rural area, non-disadvantageous families contributed significantly to developing pneumonia in

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children.[5]

This study was carried out to analyze the factors in the Nepal DHS 2016 data that could contribute to developing pneumonia in children under five years.

Methods

We used the 2016 NDHS dataset in this analysis. NDHS is a two-stage cluster survey that is representative at rural and urban areas of the seven provinces. NDHS 2006 and 2011 has considered symptoms of ARI which are cough accompanied by short, rapid breathing / difficult breathing as proxy for pneumonia. Since fever is also common in pneumonia, we have included fever also in the criteria of pneumonia. In addition, according to WHO, pneumonia is diagnosed in under five population as having cough and / or difficult breathing, with / without fever. We considered pneumonia if at least two of these symptoms were present in the NDHS dataset.

We created three separate variables: having cough (Yes = 1, No = 0), difficulty breathing (Yes = 1, No = 0) and with fever (Yes = 1, No = 0). These three binary variables were added to create a pneumonia scale and a new variable called "pneumonia status" was created as follows: children with score of 2 and above were classified as suffering from pneumonia (Pneumonia = 1) and not suffering from pneumonia (Pneumonia = 0) in the past two weeks. We assessed the association between pneumonia status variable and other categorical variables using chi-square test and compared means using independent samples t-test. All the statistically significant (P-value < 0.05) and clinically significant (P-value < 0.25) independent variables were taken to the multivariate logistic regression model. The multicollinearity (confounding) among these independent variables were assessed using variance inflation factor (VIF) and variables with VIF < 2 was retained in the final multivariate logistic regression model.

Results

Table 1: Frequency distribution of symptoms of pneumonia.

Pneumonia symptoms	N	%
No symptoms	2642	67.85
Only 1 symptom	586	15.06
With 2 symptoms	482	12.39
With 3 symptoms	183	4.71
Total	3893	100

The total number of children under five years of age were 3893 in 2016 as per NHDS report. Out of these, 3228 children did not have pneumonia. However, 665 children had the disease.

Table 2: Bivariate analysis of factors contributing to in children under five years.

Background variable	With pneumonia	Without pneumonia	Chi - Squared / t-test*	p -value
Duration of breastfeeding				
Never breastfed	6	26	0.56	> 0.05 (0.76)
Ever breastfed	146	785		
Still breastfeeding	489	2,458		
Parity				
1	255	1207	2.05	> 0.05 (0.36)
2	180	986		
3+	206	1076		
Highest education level				
No education	189	1007	0.66	> 0.05 (0.88)
Primary	126	621		
Secondary	229	1133		
Higher	97	508		
Wealth index				
Poorest	139	863		
Poorer	143	689		
Middle	140	664	6.72	> 0.05 (0.15)
Richer	133	614		
Richest	86	439		

Table 2 Continue...

Had diarrhea in last two weeks				
Yes	125	178	147.49	< 0.05 (0.00)
No	516	3083		
Pneumococcal conjugate vaccine				
Yes	960	797	0.0001	> 0.05 (0.993)
No	1668	1385		
Drugs for intestinal parasite				
Yes	368	1998	2.59	> 0.05 (0.108)
No	269	1268		
Birth weight of child				
No. of children	391	1882	0.314*	> 0.05 (0.753)
Mean birth weight	2867.74 ± 542.81	2876 ± 506.81		

According to the bivariate analysis, breastfeeding, birth weight of the child, level of education of caretaker, pneumococcal vaccine or parity did not make statistically significant difference in the occurrence of pneumonia. However, the wealth index, use of drug for intestinal parasite and history of diarrhea in past two weeks did have statistically significant association in occurrence of pneumonia in children under five years of age. The wealth index, use of drug for intestinal parasite and history of diarrhea in past two had p value less than 0.25. As these variables could have clinical significance they were used in multivariate analysis as shown in table 3.

in multivariate analysis, only the history of diarrhea in past two weeks had statistically significant relationship with pneumonia status of the children. The occurrence of pneumonia was 1.78 times higher in children with history of recent diarrhea after controlling for wealth index and drug for intestinal parasite.

Discussion

This study finds that the occurrence of pneumonia in children under five years of age is predominantly affected by the of history recent diarrhea. The wealth index and the use of drugs for intestinal parasite also seemed to have clinical significance in the univariate analysis as the p-value was less than 0.25.

Table 3: Multivariate analysis of factors contributing to pneumonia.

Background variable	With pneumonia	Without pneumonia	Odd ratio	95% CI of odds ratio	p -value	VIF
Wealth index						
Poorest	139	863	Ref			
Poorer	143	689	1.20	0.88 - 1.64	0.243	1.44
Middle	140	664	1.18	0.87 - 1.61	0.278	1.43
Richer	133	614	1.16	0.85 - 1.59	0.341	1.41
Richest	86	439	0.88	0.61 - 1.26	0.494	1.32
Had diarrhea in last two weeks						
Yes	125	178	1.78	1.55-2.03	< 0.001	1
No	516	3083	Ref			
Drugs for intestinal parasite						
Yes	368	1998	0.92	0.77-1.10	0.351	1
No	269	1268	Ref			

All the variables included in the final model had VIF < 2, so we used these in the final model. Out of these three variables

However, in multivariate analysis, controlling the two variables only diarrhea had significant effect in causing pneumonia.

Breastfeeding did not provide any protection from pneumonia which was similar to findings from Bangladesh[6] and Kenya.[7] This could be due to the fact that median duration of exclusive breastfeeding in Nepal was 4.2 months only[4] and to gain the protective effect of breastfeeding against pneumonia, the duration of exclusive breastfeeding should be six months or more.[8]

Parity did not influence the occurrence of pneumonia in children under five years of age which was in contrary to other study where parity greater than five had significant influence on increasing child mortality.[9,10] This could be due to the reason that on average women bore four children in Nepal while greater than five parity showed significant effect in other studies.

The level of education of caregiver did not reduce the chances of having pneumonia which was similar to a study done in a teaching hospital in Nepal.[11] In a study in Kenya, the children of caregivers with incomplete education were more likely to suffer infections than children of caregivers with no education.[7] They argue that it could be due to the reason that caregivers with no education bear child early and have older family member to take care of the children. The older family member possesses more experience in taking care of the children and in preventing and managing childhood diseases. On the other hand, caregivers with incomplete education are comparatively more mature and look after their families independently. Other study however found that caregivers with higher level of education had greater knowledge about pneumonia.[12]

The wealth index of the family was related to the occurrence of pneumonia in children under five in the bivariate analysis. However, in multivariate analysis it did not have any effect on pneumonia. In other study parents in higher wealth quintile were more likely to seek appropriate care for the infection and was independent of education.[13] They argue that cost of medical care plays an important role in health care seeking behavior. Another study also mentioned that lower wealth quintile was associated with hospitalization with pneumonia under five years.[14]

Pneumococcal conjugate vaccine was introduced in Nepal in 2015 in phases and have to be given in the first year of life.[4] We found that 55% of the PCV vaccinated children suffered from pneumonia while 45% did not. However, the result was not statistically significant. However, studies have shown significant decrease in pneumonia cases with vaccination of children.[15]

Drugs for intestinal parasite seemed to make a difference in occurrence of pneumonia in children but in multivariate analysis it was not so. In a study, children who received drug for intestinal parasite six months prior to survey suffered more from respiratory infection than children who did not.[16]

In this study, the birth weight of children in both the groups were remarkably similar and was more than 2800 grams in average. Children with low birth weight was seen to be affected by pneumonia[10,17] as the children were not of low birth weight in our study, we did not find any relation between birthweight and pneumonia.

In this study, the only variable that had influence on pneumonia was history of diarrhea in last two weeks. Pneumonia was around 1.78 times higher among children with diarrhea controlling for wealth quintile and intestinal drug and was similar to another study.[18] Repeated episodes of diarrhea have shown to cause reduced dietary intake, loss of nutrient due to intestinal malabsorption and the malabsorption in turn reduce the barrier protection afforded by mucosal membrane and ultimately reducing the immune function.[19] The reduced immunity in children make them more prone to further infection like respiratory infections. Study from Ghana showed that the risk of lower respiratory tract infection increased significantly if the child has history of recent diarrhea.[20] Occurrence of respiratory tract infection in children with diarrhea was found in another study too.[21] On the contrary, in a teaching hospital in Nepal, children with diarrhea in past three months were less likely to suffer from pneumonia.[11] The author considers this as unlikely and explains that it could be due to the treatment provided for diarrhea, which are antibiotics and zinc that could provide protection against pneumonia.

This is a novel study looking into the validity of NDHS data for the diagnosis of pneumonia. However, we have to acknowledge few limitations. This is a single centric study with relatively small sample size. Hence, the findings from this study should be validated with further multi centric larger studies.

Conclusion

In this study, we found that out of the various variables that could contribute to developing pneumonia, the most significant one was past history of diarrhea. Factors like hygiene and sanitation which in necessary for prevention of diarrheal disease would also decrease the risk of developing respiratory illnesses like pneumonia. Therefore, appropriate and timely intervention of diarrheal outbreak could help prevent another infectious disease.

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Conflict of Interest None

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