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Study to evaluate the socio-demographic and environmental factors affecting morbidity and mortality of community acquired pneumonia in children <5years

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Abstract---Aim: To evaluate the socio demographic and environmental factors affecting morbidity and mortality of community acquired pneumonia in children <5years. Materials and methods: The present Observational longitudinal study was carried in the Department of Paediatrics, Dr. D.Y. Patil Medical College, Pune, among 70 children less than 5 years of age admitted in the In-patient department , Neonatal Intensive Care Unit and Paediatric Intensive Care Unit diagnosed as community acquired pneumonia of either sex in the hospital. The study was carried out from may 2019-september 2021. The children who fulfilled the WHO criteria of Community Acquired Pneumonia were in addition to the Chest x-ray and investigations findings suggestive of CAP were enrolled. The details of the patient's personal and demographic profile, clinical presentation, underlying condition, laboratory investigations, therapy and course in the

hospital, and the final outcome were all recorded on a pre-designed proforma. Results: Mean age of children presenting with pneumonia (31.92 months) was approximately similar with those presenting with severe pneumonia (30.37 months). In a sample size of n=70, 45 (64%) were male children with CAP and 25 (36%) were female children with CAP. Significant association between past history of RTI, incomplete immunization, rural housing conditions, overcrowding in household, smoke exposure in household and higher antibiotic change with CAP cases of severe pneumonia with a p-value <0.05. The study reported 10 out of 19 children with severe CAP were under SAM and MAM nutrition status while 9 out of 19 belonged to adequate nutrition status. Conclusion: Effective preventive and early management strategies including health education and when to seek medical help. Awareness about the proper immunization, adequate nutrition and better household conditions may help in reducing the morbidity and mortality due to severe pneumonia in children.

Keywords---community acquired pneumonia, children, morbidity, mortality.

Introduction

In children under the age of five, pneumonia is one of the primary causes of morbidity and mortality. Pneumonia is expected to kill 410,000 children in India each year, with latest estimates indicating that pneumonia is responsible for 13% of deaths and 24% of the National Burden of Disease in children under the age of five.¹ The World Health Organization (WHO) began the Acute Respiratory Infection (ARI) control programme in 1983 to reduce mortality, which resulted in lower newborn and under-five mortality rates.²

According to recent World Health Organization estimates, pneumonia causes 20% of all fatalities in children under the age of five, resulting in 3 million deaths each year. Two-thirds of these deaths happen in childhood, and more than 90% of them happen in developing countries.³ According to hospital research, pneumonia accounts for 20–30% of admissions among children under the age of five. Hospitalized children's case fatality rates have been reported to range from 8.7% to 47%.⁴ More than 370,000 children die each year in India as a result of pneumonia, which accounts for more than 20% of all pneumonia deaths worldwide.⁵

Age, low birth weight, duration of illness, under nutrition, anaemia, lack of parental education, overcrowding, pollution at home, general housing conditions, previous episodes, lack of exclusive breast feeding, lack of measles immunisation, severe disease at presentation⁶ have all been identified as factors contributing to morbidity and mortality in children with pneumonia. A number of factors appear to influence the occurrence and severity of pneumonia.⁴ The World Health Organization (WHO) categories pneumonia risk factors as (definitely, likely, and prospective).⁵ Underweight, poor breastfeeding, lack of immunisation, and indoor and outdoor air pollution have all been linked to childhood pneumonia.⁶ With

socioeconomic progress and improvement in health awareness and referral services, an increasing proportion of pneumonia deaths will occur in hospitals.

Hence, the profile of pneumonia in tertiary care centres is likely to reflect the burden in the community. Only a few studies have performed such an evaluation in developing countries. Community Acquired Pneumonia is defined as symptoms of an acute lower respiratory tract illness (cough and at least one other lower respiratory tract symptom, e.g., dyspnoea or chest pain) with evidence of systemic illness (temperature >38 C and/or the symptom complex of sweating, fevers, shivers, and aches) and demonstrable consolidation or new radiographic shadowing on chest radiography for which no other explanation.⁷

CAP is defined as rapid breathing over an age-specific cutoff, according to WHO guidelines. The cutoff is 60 more breaths per minute (bpm) for infants under 2 months, 50 or more bpm for 2-11 months, and 40 or more bpm for 12-59 months. Furthermore, severe pneumonia is classified by WHO as CAP with certain risk indications such as inability to drink, recurrent vomiting, seizures, lethargy or coma, stridor in a quiet kid, or severe malnutrition. Children with rapid breathing and/or chest in-drawing are diagnosed with "pneumonia," while children with pneumonia and any danger signals are diagnosed with "severe pneumonia."⁸

CAP is accountable for 0.44 million deaths of children under the age of five in Southeast Asia.⁹ The Child Health Epidemiology Reference Group (CHERG)'s working group provided estimates of clinical pneumonia morbidity and death for 192 countries, including India.¹⁰ Only a few studies have evaluated the morbidity and mortality of children in developing countries who have pneumonia. More research is needed to determine the factors that predict morbidity and mortality in children in hospitals.

This data could help make the best use of limited resources for prevention and early management programmes. Hence, this study is planned to evaluate the socio demographic and environmental factors affecting morbidity and mortality of community acquired pneumonia in children <5 years.

Materials and Methods

The present Observational longitudinal study was carried in the Department of Paediatrics, Dr. D.Y. Patil Medical College, Pune, among 70 children less than 5 years of age admitted in the In-patient department , Neonatal Intensive Care Unit and Paediatric Intensive Care Unit diagnosed as community acquired pneumonia of either sex in the hospital. The study was carried out from may 2019-september 2021.

Sample size calculation

Considering Mean cases with change of antibiotic in CAP children as 56 per 100 and acceptable difference of 13 per 100 with confidence level 95% sample size of 57 by WINPEPI Software is taken

Inclusion criteria:

- Children less than 5 years of age admitted in the In-patient department, Neonatal Intensive Care Unit and Paediatric Intensive Care Unit diagnosed as community acquired pneumonia of either sex in the hospital.

Exclusion criteria:

- Known cases of Asthma
- Cases of Aspiration pneumonia, hospital acquired pneumonia
- Cases of Chemical pneumonitis
- Presence of immunosuppression or any primary immunodeficiency
- Primary disease of any organ
- Congenital lung malformations

Ethical approval and informed consent

Institute Ethics Committee Clearance was obtained before starting the study. Written informed consent was taken from the parents /care taker of the study population.

Methodology

Community acquired Pneumonia was defined as the presence of rapid breathing over an age-specific limit, according to WHO criteria. The cutoff is 60 more breaths per minute (bpm) for infants under 2 months, 50 or more bpm for 2–11 months, and 40 or more bpm for 12–59 months. Furthermore, severe pneumonia was classified by the WHO as CAP with the presence of certain risk indications such as inability to drink, recurrent vomiting, seizures, lethargy or unconsciousness, stridor in a quiet kid, or severe malnutrition. Children with rapid breathing and/or chest in-drawing are categorised as having "pneumonia," while children with pneumonia and any danger signals are classified as having "severe pneumonia."⁸

The children who fulfilled the WHO criteria of Community Acquired Pneumonia were in addition to the Chest x-ray and investigations findings suggestive of CAP were enrolled.

Data Collection

Children who met the study's inclusion requirements were enrolled. The details of the patient's personal and demographic profile, clinical presentation, underlying condition, laboratory investigations, therapy and course in the hospital, and the final outcome were all recorded on a pre-designed proforma. Laboratory parameters were included like anemia, thrombocytopenia, leucocytosis, neutrophilia and CRP (C reactive protein) levels. Radiological investigations taken was Chest X ray to confirm the diagnosis

Statistical Analysis

Data was entered into Microsoft Excel, and SPSS (Statistical Package for Social Sciences) Software version 20/Epi Info/Primer/Win-pepi was used to analyze it.

Results

Table 1
Age distribution in Pneumonia and Severe Pneumonia CAP

Variable	Type	n=70	Mean	Std. Deviation	Std. Error Mean	P value
Age (month)	Pneumonia	51.00	31.92	17.61	2.47	0.750
	Severe pneumonia	19.00	30.37	19.34	4.44	

Mean age of children presenting with pneumonia (31.92 months) was approximately similar with those presenting with severe pneumonia (30.37 months) and there was no significant difference between them ($p=0.750$) with total number of cases being 70.

Table 2
Association of various socio-demographic variables with CAP children

Variable		Type		Total	P value
		Pneumonia	Severe Pneumonia		
Family history	Absent	44	17	61	0.963
	Present	7	2	9	
Drug history	Absent	49	19	68	-
	Present	2	0	2	
Past history of RTI	Absent	44	11	55	0.010
	Present	7	8	15	
Immunization	Incomplete	8	8	16	0.0192
	Complete	43	11	54	
Housing condition	Rural	12	10	22	0.0197
	Urban	39	9	48	
Breastfeeding	Absent	7	5	12	0.214
	Present	44	14	58	
Overcrowding	Absent	44	11	55	0.0100
	Present	7	8	15	
Ventilation	poor	18	10	28	0.1879
	adequate	33	9	42	
Smoke exposure	Absent	43	7	50	0.0000
	Present	8	12	20	
Antibiotic change	Absent	48	9	57	0.000
	Present	3	10	13	

Significant association between past history of RTI with CAP cases of severe pneumonia with a p value of 0.10. Significant association between incomplete immunisation with CAP cases of severe pneumonia with a p value of 0.0192. Significant association between rural housing conditions with CAP cases of severe pneumonia with a p value of 0.0192. Significant association between overcrowding in household with CAP cases of severe pneumonia with a p value

of 0.100. Significant association between smoke exposure in household with CAP cases of severe pneumonia with a p value of 0.0000. Significant association between higher antibiotic change with CAP cases of severe pneumonia with a p value of 0.000.

Table 3
Nutrition status on CAP children

Variable		Type		Total n=70	P value
		Pneumonia	Severe Pneumonia		
Nutrition	Adequate	35	9	44	0.102
	SAM & MAM	16	10	26	

The study reported 10 out of 19 children with severe CAP were under SAM and MAM nutrition status while 9 out of 19 belonged to adequate nutrition status

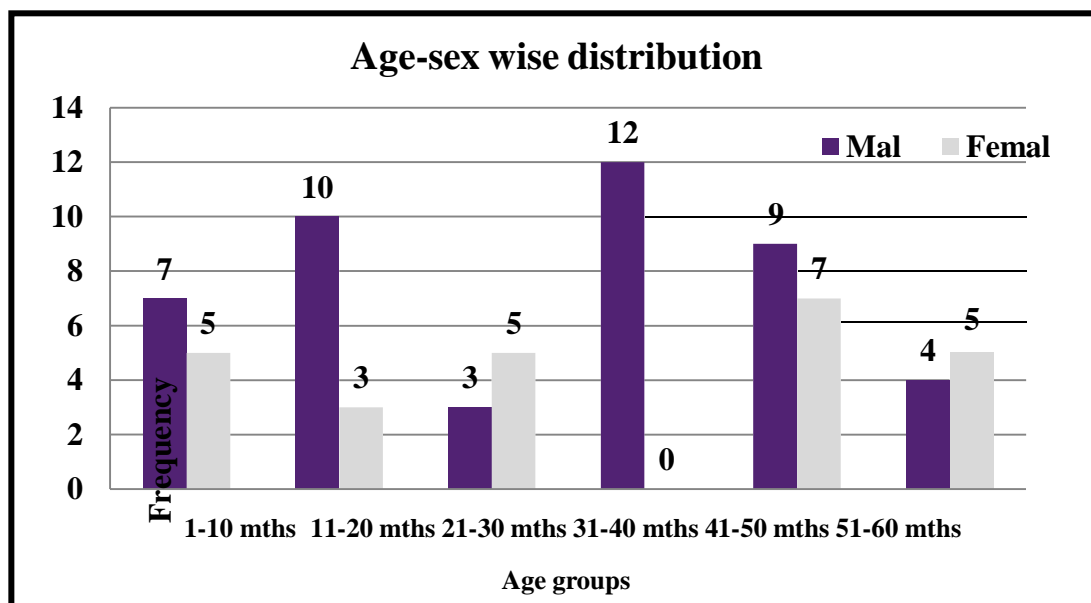


Figure 1: Age and sex wise distribution of children with CAP

Figure 1: In this study, there were 45 (64%) male and 25 (36%) female children while 16 (22.86%) samples were from 41-50 months age group followed by 13 (18.57%) subjects in 11-20 months age group.

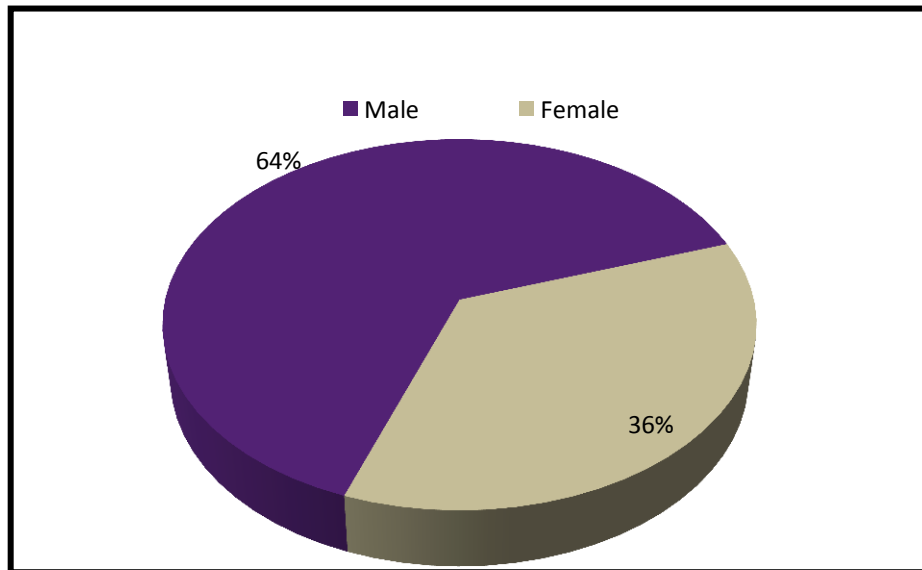


Figure 2: Sex distribution of children with CAP

Figure 2: depicts, in a sample size of $n=70$, 45 (64%) were male children with CAP and 25 (36%) were female children with CAP.

Discussion

In this study, with a sample size of 70, the mean age was 31.50 months with the highest being 5 years and lowest being 2 months. As per previous knowledge, the global prevalence of pneumonia is highest in the age group of 1-4 years.¹¹ In addition, when compared to older age groups, younger children have twice the risk of acquiring pneumonia. This finding was consistent with prior research^{12,13} which found that children aged 2 to 12 months were 2.5 times more likely to acquire pneumonia than children aged 12-59 months (OR=2.49, CI=1.37, 4.54).

The male gender was found to be a major predictor of community pneumonia in this investigation. In our community-acquired pneumonia study, 64 percent of the children were male and 36 percent were female. Girls have a stronger immune system than boys, which explains the gender differences. There's also evidence that males' peripheral airways are narrower in their early years of life, which could make them more susceptible to LRIs.¹⁴

In developing nations, a lack of breastfeeding is a significant risk factor for under-five morbidity and death.¹⁵ Inadequate breastfeeding is linked to pneumonia fatality and severe pneumonia in children under the age of five. Because the baby's immune system is still developing, breast milk contains a number of immuno-protective and nutritive chemicals that safeguard the newborn.¹⁶ In this study it was however noted there was no significant association between lack of breastfeeding and severe pneumonia with a p value of 0.214.

Another socio-demographic factor taken in the current study was overcrowding in line to a previous study¹⁷, this study showed significant association between overcrowding and severe pneumonia (p value= 0.0100). Crowding was defined as more than two people sharing a child's bedroom in previous studies¹⁸⁻²⁰ all of which were conducted in developing countries. Using multivariate analysis, these studies reported an odds ratio meta-estimate of 2.2. (95 percent CI 1.8 to 2.7).

It could be a reflection of the complicated intertwined relationship between socioeconomic variables and health. In terms of environmental factors, contrary to the findings of Zheng et al.²¹, our study found that poor home ventilation was not significantly (p value = 0.1879) linked with an increased risk of severe pneumonia.

Furthermore, it was discovered that exposing a child to home cigarette smoke raised the risk of pneumonia by 1.5 times; this association was confirmed in this study, with a significant link between exposure to any type of smoke in the house and severe pneumonia in the child (p value= 0.000). A prior study demonstrated that exposure to parental smoking increased the incidence of severe childhood pneumonia²², demonstrating a substantial relationship of pneumonia in children living with smokers (OR 1.79, 95 percent CI 1.18-2.72) and was an independent risk factor of poor outcome in another study.²³

Severe malnutrition has been identified as an independent risk factor for pneumonia in previous investigations.^{24,25} According to a comprehensive review²⁶, children with pneumonia and severe malnutrition have a higher mortality rate than children with moderate malnutrition. Despite this fact, only 10% of CAP patients had severe acute malnutrition in this research. Pneumonia was shown to be more common in partially immunized children than in fully immunized children in this investigation. (0.0192; p = 0.0192). Other studies²⁷⁻²⁹ have found that incomplete or no immunization is a major risk factor for pneumonia. This study also confirmed that partially vaccinated children have an increased risk of pneumonia.

Children living in kuccha huts had a higher incidence of severe pneumonia, which was one of the environmental risk factors. Kuccha dwellings are often constructed by the impoverished and have been linked to pneumonia in various Asian nations.^{30,31} Living spaces with insufficient ventilation have been recognized as risk factors for severe pneumonia. The main explanations for the increased risk of pneumonia in children were higher levels of outdoor pollution in urban areas^{32,33}, high levels of solid fuel consumption in rural regions generating inside pollution, and poorly constructed housing. Rural dwelling circumstances were found to be substantially related with severe pneumonia in our study, with a p=0.0197.

Furthermore, in this study, a similar past history was found to have a significant association with severe pneumonia in children, such as in a systematic review, children with a history of Acute Respiratory Tract Infections (ARTIs) were found to be at an increased risk of developing pneumonia, with the odds of pneumonia being higher among children with a history of ARTIs than among children without a history of ARTIs.³⁴

Conclusion

Predominant risk factors in the study were severe acute malnutrition, a significant past history of acute respiratory infection, incomplete immunization history, and rural housing conditions with presence of exposure to smoke and requirement of a higher antibiotic change during the course of treatment. Effective preventive and early management strategies including health education and when to seek medical help as well as awareness about the proper immunization, adequate nutrition and better household conditions may help in reducing the morbidity and mortality due to severe pneumonia in children.

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