



## CLINICAL DETERMINANTS OF LOWER RESPIRATORY TRACT INFECTIONS IN HOSPITALIZED PEDIATRIC PATIENTS

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### ABSTRACT

**Background:** Lower respiratory tract infection (LRTI) is the main cause of pediatric mortality and morbidity in low- and middle-income countries. **Aim:** This study was carried out to determine the clinical characteristics of children with LRTI. **Method:** A retrospective study was conducted on all pediatric patients who were hospitalized due to LRTI in Hospital during one year. Incomplete medical records and children who were treated on an outpatient basis, as well as infants younger than 1 month of age, were excluded. The patients were evaluated in terms of clinical, and paraclinical characteristics. **Results:** A total of 100 hospitalized children and infants were identified. Their mean age was  $29:09 \pm 38:96$  months (range 1 month-15 years), and 59.4% of them were males. The highest frequency of patients was at the age below one year (50.8%, n= 154). Pneumonia and bronchitis were the most common LRTIs. Respiratory (54.6%) and neurological (21.6%) diseases were the most prevalent underlying medical conditions. Admission was more common in winter (n= 120, 39.6%) and spring (n=79, 26.1%). The mean length of stay (LOS) in the hospital was  $8:2 \pm 5:5$  days, and the overall mortality rate was 11.6%. **Conclusion:** Additional studies are required to determine factors contributing to disease severity among children with LRTI to develop appropriate preventive and therapeutic strategies.

**KEYWORDS :** LRTI , Clinical , Acute Respiratory Infection, pneumonia

### INTRODUCTION:

Acute respiratory tract infection (ARI) is the major cause of death and morbidity in low- and middle-income countries (LMICs) <sup>1,2</sup> in all age groups and genders<sup>3</sup>. ARIs are generally caused by viruses or bacteria, which are categorized into lower respiratory tract infections (LRTIs) and upper respiratory tract infections (URTIs)<sup>4</sup>. LRTIs refer to any infection involving the respiratory tract below the level of the larynx, which include bronchiolitis, bronchitis, tracheitis, and bronchopneumonia<sup>5</sup>. They are determined by the occurrence of symptoms and signs of acute respiratory infection (cough, oropharyngeal hyperemia, and nasal discharge) and lower respiratory signs (retraction, extended expiratory time, tachypnea, and wheezing or crackles on auscultation)<sup>6</sup>. The majority (97%) of acute lower respiratory infection (ALRI) cases are found in LMICs<sup>7</sup>, where 6.9 million children died in 2011 and nearly one in five of these deaths were due to ALRI<sup>8</sup>. In 2016, LRTIs caused 652,572 deaths in children under the age of five, worldwide<sup>9</sup>. Particularly in developing countries, they are critical public health problems in the early years of life with almost one-fifth of all deaths among children younger than five years old<sup>10-12</sup>. Bronchiolitis among acute LRTIs is the major common cause for hospitalization of infants<sup>13</sup>; however, pneumonia is the most common cause of death in adults (mainly above 65 years old) and children, comprising 3.46 million (6.1%) deaths globally and over 1.05 million (11.3%) in lower-income countries<sup>14,15</sup>. ARIs in children constitute a large burden of diseases which require health care; therefore, it is necessary to determine the exact epidemiological and clinical data of ARIs for health policymakers to produce and implement rational strategies for the management of these diseases according to local evidence-based guidelines and improve patient quality of care. Several studies have been conducted in India on selected populations of children with ARI in different regions of the country with diverse results. At present, inadequate data are available related to pediatric LRTIs in India as a middle-income country. To advance the public health insights into the interrelated burdens of childhood LRTI in India, we have critically checked the available clinical data of pediatric patients with LRTI who admitted to a hospital in southwest India.

### MATERIAL AND METHODS:

This retrospective epidemiological study was carried out among all pediatric patients who were admitted due to LRTI during one year (July 2019-July 2020). The patients were in the age range from one month to 15 years. The medical records of 202 children and infants were evaluated. The documents of 102 patients were excluded from the study. Finally, a total of 100 children were included in this study. The diagnostic criteria at the time of admission were clinical symptoms (fever, cough, and changes in breath sounds) and radiography of the lungs (infiltration, consolidation). The study

involved children diagnosed with LRTI symptoms (initial symptoms or final diagnosis), including pneumonia, bronchiolitis, and pertussis-like syndrome (PLI). The exclusion criteria were children who were treated on an outpatient basis (outpatient diagnosis and treatment), those with incomplete medical records, and infants younger than one month of age. After preparation of the checklist, all pediatric patients' medical records over the 1-year duration were reviewed to extract the required data. Patients' data, including gender, age, body temperature, clinical symptoms, admission time, preclinical findings, hospitalization period (days), vital signs, height, weight, nutritional status (using standard Z-scores), mortality rate, underlying disease, and final diagnosis, were summarized for this study. In addition, vaccination coverage was assessed with the immunization card. Complete immunization was taken as age appropriate immunization according to the expanded program of immunization (EPI) schedule in India. Partial immunization was defined as incompleteness of the EPI schedule. A non-immunized child was defined as not receiving any vaccination.

### RESULTS:

In the current study, a total number of 100 medical records of hospitalized children and infants with LRTI between 2019 and 2020 were reviewed. The majority of patients were males (59.4%), and 40.6% were females, while there was no significant association between gender and LRTI. The mean age was  $29:09 \pm 38:96$  months (ranging from one month to 15 years), and there were no statistically significant differences in the mean age between the two genders. The highest rates of hospitalization for severe LRTI and mortality during LRTI hospitalization were in children under age one (50.8%) and decreased with age. Of the 100 patients, (21.5%) and (10.9%) patients were severely ( $<-3Z$ -score) and moderately underweight. In addition, (17.8%) and (12.2%) patients were severely ( $<-3Z$ -score) and moderately stunted. There were no significant differences in weight and height (cm) between the two genders. The patients had presented to the hospital averagely  $7:50 \pm 12:39$  days after the onset of symptoms (range 1 day-90 days). Admission was more common in winter (39.6%) and spring (26.1%) compared with fall (19.8%) and summer (14.5%). The mean body temperature of children at the time of admission was  $37.55^\circ\text{C}$  (range  $35.6-40^\circ\text{C}$ ). In addition, 11.2% of patients were born preterm. The most common symptoms were cough (77.2%), tachypnea (56.4%), fever (50.8%), and tachycardia (37.9%) at the time of admission. Furthermore, all children were fully immunized, and age-appropriate vaccinations were completed according to the expanded program of immunization (EPI) schedule in India. Abnormal CRP levels were significantly associated with longer length of stay (LOS) in hospital ( $p < 0.05$ ). Pneumonia (74.6%) and bronchitis (17.2%) were the most common LRTIs among patients, and there was no significant association between gender and type of LRTI

disease. There was a significant trend, based on the logistic regression test, towards a month increase in their age and lower risk of pneumonia and bronchiolitis in the patients ( $p < 0.001$ ). The mean length of hospital stay was  $8.2 \pm 5.5$  days (range 1-57), and the overall mortality rate was 11.6%. The mortality rates caused by pneumonia and bronchitis were 10.23% and 0.66%, while there was a significant association between mortality and disease diagnosis ( $\chi^2 = 22.37, < 0.05$ ). In addition, there was no significant association between the LOS and mortality rate. Approximately more than half of the children (61.05%) hospitalized with LRTI had at least one underlying medical condition. In addition, there was a significant association between ventilator support and mortality rate ( $\chi^2 = 2211.330, p < 0.001$ ). The most common underlying diseases were respiratory (e.g., asthma, hyper-reactive airway disease (HRAD), and cystic fibrosis with pulmonary manifestations) and neurological diseases (e.g., spinal muscular atrophy (SMA), polymyalgiarheumatica (PMR), and cerebral palsy (CP)). The highest mortality rate was among those with neurological underlying diseases, and there was a significant association between the type of underlying disease and the mortality rate of the patients ( $p < 0.001$ ). In addition, there was a significant association between having an underlying disease and having consanguineous parents ( $p < 0.01$ ). According to linear regression, in patients who did not have a history of the underlying disease, the length of hospital stay was reduced ( $\beta = -1.5$ ), which indicated a significant association between the underlying disease and length of hospital stay ( $p < 0.05$ ). Around 32% of patients had LRTI hospitalization history while 29% of them were hospitalized with LRTI more than one time. In addition, there was no significant association between the frequency of hospitalization and mortality rate.

## DISCUSSION

In the current study, more than half of the pediatric patients with LRTI were male. The average age of them was around 29 months. The highest LRTI hospitalization rate was among children less than 1 year of age and decreased with age. There was a significant trend towards each month of increase in their age and lower risk of pneumonia and bronchiolitis. However, in a similar study which was conducted in India among 182 children, the mean age of patients was 4.7 years and the most common age of the disease was older than 5 years. It has been reported by a similar study in the USA that the rate of hospitalization for severe LRTI declined with increasing age. In another study, among 436 children with ARIs in Nigeria, the most affected age group was 10 to 19 months. This age range is appropriate for the introduction of complementary feeding and reduction of breastfeeding while there are associated risks and weaning of passive maternal antibodies.

The present study is one of a few single center studies related to LRTI in India. Its findings may improve our insight into the clinical and epidemiological characteristics of children with LRTI in a middle income and Middle Eastern country. The main limitation of the study was the retrospective nature of the study. The epidemiology of respiratory viral infections was reported to be varied by geographical region. The prevalence of these viruses in temperate climates is well recognized as a cause of annual winter epidemics of acute LRTIs. The identification of the specific causes of infection prepares a good starting point for the finding of disease attributable to respiratory infection and may provide related data to the development of prevention strategies. These data may reveal important information for program managers and policymakers at regional and national levels to help priority settings, program planning, and resource allocation, as well as to determine the most cost effective treatment and preventive interventions to decrease the problem of childhood LRTI. Simple approaches should also be considered such as attaining adequate nutritional status in these pediatric patients and educating their parents. However, additional studies are required among children with LRTI to develop appropriate preventive and therapeutic strategies.

## CONCLUSION

In summary, the highest frequency of patients was at the age younger than one year. Pneumonia and bronchitis were the most common LRTIs, and admission was more common in winter and spring. The mean LOS in the hospital was around 8 days. In addition, the majority of patients were malnourished, and the overall mortality rate was 11.6%. Further more, there was a significant association between having an underlying disease and consanguineous parents, as well as the frequency of hospitalization. The findings from this study may reveal important missing data on LRTIs in India as a middle-income country. Precise insights into the identification of risk factors for

LRTIs, epidemiology, seasonality, and etiology are essential for successful therapy or prevention programs. These risk factors can be modified with simple strategies such as immunization, parental education, adequate nutrition, environmental sanitation, avoidance of pollution, and appropriate counselling of caregivers to the parents. Proper legislation should be used, and health care services should focus on the specific reference to its necessary components such as environmental management, immunization, and nutrition.

## Ethical clearance:

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Conflict of Interest: Nil

## REFERENCES:

- [1] C. L. Walker, I. Rudan, L. Liu et al., "Global burden of childhood pneumonia and diarrhoea," *The Lancet*, vol. 381, no. 9875, pp. 1405–1416, 2013.
- [2] M. R. Boloursaz, F. Lotfian, F. Aghahosseini et al., "Epidemiology of lower respiratory tract infections in children," *Journal of Comprehensive Pediatrics*, vol. 4, no. 2, pp. 93–98, 2013.
- [3] The Global Burden of Disease Child and Adolescent Health Collaboration, N. Kassebaum, H. H. Kyu et al., "Child and adolescent health from 1990 to 2015: findings from the global burden of diseases, injuries, and risk factors 2015 study," *JAMA Pediatrics*, vol. 171, no. 6, pp. 573–592, 2017.
- [4] M. Halaji, T. Hashempour, J. Moayedi et al., "Viral etiology of acute respiratory infections in children in southern Iran," *Revista da Sociedade Brasileira de Medicina Tropical*, vol. 52, 2019.
- [5] S. Bicer, T. Giray, D. Çöl et al., "Virological and clinical characterizations of respiratory infections in hospitalized children," *Italian Journal of Pediatrics*, vol. 39, no. 1, p. 22, 2013.
- [6] E. R. da Silva, M. C. Pitrez, E. Arruda et al., "Severe lower respiratory tract infection in infants and toddlers from a non-affluent population: viral etiology and co-detection as risk factors," *BMC Infectious Diseases*, vol. 13, no. 1, 2013.
- [7] United Nations Children's Fund. UNICEF; New York, "The state of the world's children 2016: a fair chance for every child," 2016, [https://www.unicef.org/publications/files/UNICEF\\_SOWC\\_2016.pdf](https://www.unicef.org/publications/files/UNICEF_SOWC_2016.pdf).
- [8] H. Nair, E. A. Simões, I. Rudan et al., "Global and regional burden of hospital admissions for severe acute lower respiratory infections in young children in 2010: a systematic analysis," *The Lancet*, vol. 381, no. 9875, pp. 1380–1390, 2013.
- [9] C. Troeger, M. Forouzanfar, P. C. Rao et al., "Estimates of the global, regional, and national morbidity, mortality, and aetiology of lower respiratory tract infections in 195 countries: a systematic analysis for the Global Burden of Disease Study 2015," *The Lancet Infectious Diseases*, vol. 17, no. 11, pp. 1133–1161, 2017.
- [10] H. Nair, D. J. Nokes, B. D. Gessner et al., "Global burden of acute lower respiratory infections due to respiratory syncytial virus in young children: a systematic review and meta-analysis," *The Lancet*, vol. 375, no. 9725, pp. 1545–1555, 2010.
- [11] L. Rey-Ares, V. Irazola, F. Althabe et al., "Lower tract respiratory infection in children younger than 5 years of age and adverse pregnancy outcomes related to household air pollution in Bariloche (Argentina) and Temuco (Chile)," *Indoor Air*, vol. 26, no. 6, pp. 964–975, 2016.
- [12] S. Srichaenchai, E. Palla, F. L. Pasini, and M. Sanicas, "Epidemiology of respiratory syncytial virus lower respiratory tract infection (RSV-LRTI) in children in developing countries," *J Trop Dis Public Health*, 2016.
- [13] G. Worrall, "Bronchiolitis," *Canadian Family Physician*, vol. 54, no. 5, pp. 742–743, 2008.
- [14] World Health Organization, "The top ten cause of death fact-sheet," 2011, <http://www.who.int/mediacentre/factsheets/fs310/en/index.html>.
- [15] T. Welte, A. Torres, and D. Nathwani, "Clinical and economic burden of community-acquired pneumonia among adults in Europe," *Thorax*, vol. 67, no. 1, pp. 71–79, 2011.
- [16] I. Rudan, C. Boschi-Pinto, Z. Biloglav, K. Mulholland, and H. Campbell, "Epidemiology and etiology of childhood pneumonia," *Bulletin of the World Health Organization*, vol. 86, no. 5, pp. 408–416, 2008.
- [17] V. Singh and S. Aneja, "Pneumonia—management in the developing world," *Paediatric Respiratory Reviews*, vol. 12, no. 1, pp. 52–59, 2011.