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STUDY TO ASSESS CLINICAL AND SOCIODEMOGRAPHIC PROFILE OF ACUTE RESPIRATORY INFECTION IN CHILDREN ADMITTED TO TERTIARY CARE CENTER : A RETROSPECTIVE OBSERVATIONAL STUDY"

Neha Pattanshetty*	MBBS, Junior Resident, Pediatrics, Bangalore Medical College And Research Institute, Bangalore, IND *Corresponding Author
Sahana Devadas	Professor And Head, Pediatrics Department, Bangalore Medical College And Research Institute, Bangalore, IND
Gayathri Devi Chinnappa	Professor, Pediatrics Department, Bangalore Medical College And Research Institute, Bangalore, IND
Ambica Rangaiah	Professor, Microbiology, Bangalore Medical College And Research Institute, State Level Virus Research & Diagnostic Laboratory, Bangalore, IND
Shantala G B	Professor, Microbiology, Bangalore Medical College And Research Institute, State Level Virus Research & Diagnostic Laboratory, Bangalore, IND
Lakshmi K	Professor, Pediatrics Department, Bangalore Medical College And Research Institute, Bangalore, IND
Sujatha P	Senior Specialist, Pediatrics Department, Bangalore Medical College And Research Institute, Bangalore, IND

ABSTRACT

Objective : To assess the clinical and sociodemographic profile of children with acute respiratory infection admitted to a tertiary care centre. **Study Design:** In this retrospective observational study, all paediatric patients who met the specified inclusion criteria were enrolled in the research during a period of six months. Data pertaining to demographics such as age, gender, parental occupation, parental educational background and housing situation was gathered. Respiratory specimens (Nasopharyngeal/Throat swabs) were obtained from all patients. Reverse transcription polymerase chain reaction (RT-PCR) technique was employed on the respiratory specimens.The outcomes were assessed based on the length of hospitalization, necessity for intensive care unit (ICU) intervention, occurrence of complications, and patients' immunization statuses. **Results:** In the 6 month study period, there were 450 children admitted with ARI, out of which 186 nasooropharyngeal swabs were sent and RSV was confirmed through RT -PCR in 0/23 in March, 0/31 in April, 0/23 in May, 12/23 in June(52%), 20/36 in July(55%),35/50 (70%) swabs sent in August. 310/450 (68.8 %) children developed pneumonia. 320/450 (71%) cases had malnutrition and 342/450 (76%) cases were immunized upto date. 210/450 (46.6%) and 180/450 (40 %) cases belonged to Lower middle and Upper lower Socioeconomic class as per Modified Kuppuswamy Classification respectively. Out of overall cases, 190/450 (42%) cases had received an antibiotic course for superadded bacterial infection and rest 260/450 (57.7 %) cases were managed symptomatically. All patients recovered completely and were discharged from the hospital. **Conclusion:** Increased preventive methods and treatment which includes good nutrition and immunization are key strategies to reduce outbreak of the disease.

INTRODUCTION

Respiratory syncytial virus (RSV) has been identified as a leading cause of lower respiratory tract infections in young children and elderly. It is an enveloped negative-sense single stranded RNA virus belonging to Genus Orthopneumovirus and Paramyxoviridae family [1, 2]. The structure of RSV is that of a bilipid layer envelope surrounding a ribonucleoprotein core, with several membrane proteins, one of which functions in attachment to host cells and one of which functions in fusion to host cells. There is only one serotype of RSV, classified into two strains A and B, with differences consisting of variation in the structure of several structural proteins especially the attachment protein [1].

In 2005, approximately 33.8 million new episodes of RSV associated ALRI occurred worldwide in younger children aged > 5 years with atleast 3.4 million episodes representing severe RSV associated ALRI necessitating hospital admission [2]. 33.1 million episodes of RSV-acute lower respiratory infection (ALRI) in young children occurred in 2015. The bulk of these episodes, or around 30 million, occurred in low- and middle-income countries. In numerous hospital- and community-based investigations conducted primarily on children in India, the rates of RSV detection range from 5% to 54% and from 8% to 15%, respectively [2,3] .

RSV outbreaks begin in the South and move to the North on a global scale. RSV primarily peaks in North India during the winter, and there has been some association with low temperatures. Group A genotypes GA2, GA5, NA1, and ON1 as well as Group B genotypes GB2, SAB4, and BA have all been described as coming from India [3-5].

Indian studies published during 1991 to 2022 reported variable prevalence of RSV in children with pneumonia, ranging from 14% to 40% and an incidence of RSV 53 per 1,000 children per year [6, 7].

Respiratory syncytial virus (RSV) was first described as 'acute catarrhal bronchitis' in 1901. It was isolated in 1956 and today is responsible for 45%-90% of episodes of bronchiolitis, 15%-35% of pneumonia, 6%-8% of croup, and is also a cause of apnea and otitis media. More than half of all children are infected by their first birthday. By 2 years of age, more than 80% of children have been infected at least once, and half of these children have had RSV twice [8, 9].

The incubation period following RSV vaccination ranges from 2 to 8 days, with a mean incubation of 4 to 6 days, depending on host factors such the patient's age and whether this is the patient's first RSV infection [10, 11]. RSV is transmitted from person to person by respiratory droplets. RSV normally presents as an upper respiratory infection, while the lower respiratory tract may also be affected. RSV symptoms include

rhinorrhea, nasal congestion, coughing, sneezing, and occasionally fever and myalgia if it only affects the upper respiratory tract [12]. RSV will advance to lower respiratory tract involvement in children under the age of two, leading to the characteristic symptoms of bronchiolitis, including tachypnea, accessory muscle usage, wheezes, and delayed expiration. In severe cases, it may also show viral pneumonia, hypoxia, lethargy, apnea, and acute respiratory failure [13, 14].

Supportive care is the cornerstone of treatment for RSV patients. Nasal suction and lubrication, antipyretics for fever, helped hydration in the event of dehydration (assistance may be given orally, intravenously, or through a nasogastric tube) and oxygen for patients who are hypoxic are all included in the spectrum of supportive care[15]. Patients who have a severe presentation and respiratory failure/compromise may need mechanical ventilation, a high-flow nasal cannula, CPAP or intubation as ventilatory support [16,17]. Patients who require breathing support, more fluids, or who are experiencing or at risk for moderate to severe illness should be admitted to a hospital.[18]

There is a need to comprehend the disease burden in these rural communities, particularly those with high infant mortality, as there have been very few recent studies on the burden of RSV illness in lower-middle income countries (LMICs), where majority of paediatric population lives[20-24]. Additionally, given the impending availability of maternal vaccines and monoclonal antibodies to prevent them.[25]

Hence, the present study is being undertaken to assess the clinical and sociodemographic profile of acute respiratory infection in children.

MATERIALS AND METHODS

A retrospective study was carried out from March to August 2023 at the Pediatrics department of Vani Vilas Hospital. All Pediatric patients admitted to Vani Vilas Hospital with clinically consistent acute respiratory infection during study period were considered for inclusion in the research. Cases presenting with symptoms other than respiratory tract involvement admitted during the time period were excluded from the study.

All patients who were admitted to the Department of Pediatrics at Bangalore Medical College and Research Institute (BMCRI) and met the specified inclusion criteria were enrolled in the research. Data pertaining to demographics such as age, gender, parental occupation, parental educational background, and housing situation were gathered. Details regarding the child's immunization status, the onset of fever and respiratory system involvement were also documented. Throat swabs were obtained from all patients exhibiting clinically compatible symptoms. The evaluation methods employed included reverse transcription polymerase chain reaction (RT-PCR) analysis of throat swab samples. The outcomes were assessed based on the length of hospitalization, necessity for intensive care unit (ICU) intervention, occurrence of complications, and patients' immunization statuses.

Inclusion Criteria:

1) All children admitted to Vani Vilas Hospital with acute respiratory infection between March 2023 to August 2023.
2) Parents of children willing to give informed consent.

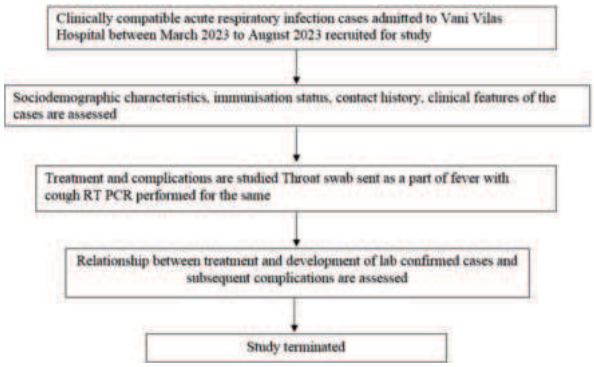
Exclusion Criteria:

1) Cases presenting with symptoms other than respiratory tract involvement admitted during the time period.
2) Parents who did not consent for the same.

Statistical Analysis

SPSS version 21 (IBM Corp., Armonk, NY, USA) was used to perform the statistical analysis. Data was entered in an Excel spreadsheet (Microsoft, Redmond, WA, USA). Descriptive statistics of the explanatory and outcome variables were calculated by mean, standard deviation for quantitative variables, frequency and proportions for qualitative variables. Ethical committee clearance has been obtained for the same.

Study Work Flow Chart



RESULTS

There were 450 children admitted with ARI during the study period, out of which 142 nasooropharyngeal swabs were sent and RSV was confirmed through RT - PCR in 0/23 in March, 0/31 in April, 0/23 in May, 12/23 in June(52%), 20/36 in July(55%),35/50 (70%) swabs sent in August.

According to Table 1, majority of the cases belonged to the age group of 1-5 years (N=150, 33.3%),followed by age group comprising of less than 9 months old (N= 135, 30%), with the lowest being 2 months old which turned out to be RSV positive. After 5 years of age, the number of cases declines (N= 105, 23.3%) and incidence of ARI is least in 9-12 months age group (N= 60, 13.3%).

There is a male predilection of 295/450 cases which constitutes 65.5% as compared to females which constituted 155/450 cases which was 34.4%.

The classical presentation would be cold and cough in all the cases, although pneumonia was seen in 310 (68.8%) of the cases. Malnutrition played a major role as 178 (55.6%) came under moderate acute malnutrition and 142 (45.3%) fall under severe malnutrition. It is important to note that the severely malnourished cases also required PICU care and were treated symptomatically and are currently on follow up.

Majority of the children 210(46.6%) belonged to lower middle class followed by 180(40%), 35(7.7%), 25(5.5%) belonged to upper lower, lower, upper middle class strata as per Modified Kuppuswamy Classification respectively.

According to Table 2, 27 (40.2%) cases belonging to less than 9 months age group tested positive with respect to the total sample sent, followed by 20 (29.8%) of the cases belonging to 1-5 years age group and 15 (22.3%) in the 9-12 months age group. In contrast to the cases admitted during this period, there is a female predilection of cases which constitutes 37 (55.2%) as compared to males which was 30 (44.7%) cases.

The striking similarity between total cases and lab confirmed cases was that majority of the children belonged to moderate acute malnutrition which was 45 (67.1%) cases and 22(32.8%) belonged to severe acute malnutrition. The other similarity was that majority of the cases belonged to lower middle class which comprised 45 (67.1%) followed by upper lower class which included 20 (29.8%) of the cases as per Modified Kuppuswamy Classification respectively.

Among these children as per figure 1, there was a contact history of 290/450 (64.4%) and history of previous similar episode in 368/450 (81.7%). It is important to note that those who had a contact history and similar complaints in the past had no complications and illness was of mild intensity and short duration. 310/450 (68.8%) children developed pneumonia.

186/450 (41.3 %) children needed PICU care and swabs were sent for RT-PCR for all these cases.

As per the Table 3, 342 (76%) children have been immunized upto date followed by partially immunized children who constituted 108 (24%) of the total admitted cases. As per Table 4, as 55 (82%) were immunized upto date and 12 (17.9%) were partially immunized.

Though ARI cases were admitted from the months of March to August, there is a sharp increase in lab confirmed cases of RSV from June to August according to figure 2. But needless to say, we had sent samples of only those cases who needed PICU care which is a drawback to our study.

DISCUSSION

One of the main infections responsible for ARTIs with significant morbidity and fatality rates is RSV, particularly in young infants. For the prevention and control of ARTI, a deeper comprehension of the epidemiological and clinical features of RSV infection is crucial. In this study, we evaluated RSV coinfection with other respiratory viral and bacterial pathogens, investigated the demographics of patients with RSV (aged < 5 years), and identified the differences in epidemiological and clinical characteristics among RSV subgroups using surveillance data on ARTIs from the Chinese mainland from 2014 to 2018.

As per systematic literature review study conducted by Ghia and Rambhad, the epidemiology of RSV infection in India is better understood in young children (ages 0-5) than it is in children of later ages.When compared to children of other ages, younger children (0-5 years) in India have greater rates of RSV detection, ranging from 2.1% to 62.4% in various studies. RSV primarily peaks in India during the wet to early winter months of June through October, with a lesser peak also occurring in December, January, and February[4]. Our study agrees with the above study as we have recorded a trend wherein there is an initial increase of cases between 1- 5 years of age (N=150, 33.3%), which is further followed by a sharp increase in the number of cases in less than 9 months of age (N= 135, 30%), then least number recorded in the age group of 9-12 months. Our study has also demonstrated this seasonal pattern, creating a stronger base to check the trend of RSV in India.

RSV (both hRSV-A and hRSV-B) detection rate was found to be significantly higher in young Indian children (aged 0-5 years old) as compared to older children (aged 6-18 years), which indicates that younger age population are more likely to have RSV infection while no significant gender specific differences were reported in RSV positive cases. Our study showed that there is a male predilection of 65.5% as compared to females which was 34.4% among the total cases and amongst RSV detected cases, there is a female predilection of cases which constitutes 37 (55.2%) as compared to males which was 30 (44.7%) cases.

Schweitzer et al [1] had stated that 90% of children become infected within the first two years of life, while older children and adults are regularly reinfected. The majority of RSV patients will experience upper respiratory tract infection, but a sizeable proportion will also experience lower respiratory illness, primarily bronchiolitis. [1]. Up to 40% of initial infections in children under the age of one result in bronchiolitis, making lower respiratory involvement particularly common in this age group. In our study, URTI was a presenting feature for all cases and pneumonia was seen as a complication in 68.8 % of cases.

The prevalence of respiratory syncytial virus (RSV) infection among severely malnourished children was studied by Nwankwo et al [8] at the University of Benin Teaching Hospital, Benin City, Nigeria at a time when the infection was known to be prevalent in the community. Eight (16%) of the 51 patients who were malnourished were ELISA-positive, four of whom (8%) had nosocomial infection. Fever and rhinitis were the most common presenting features in the RSV-infected malnourished children. None of the children showed any clinical or radiological signs of lower respiratory tract infection. Malnourished children appear not to be at increased risk of RSV infection, and those who contract the infection usually do not manifest severe disease. In contrast to this study, our study showed that Malnutrition played a major role in the background of RSV infection as 178 (55.6%) cases came under moderate acute malnutrition and 142 (44.3%) fall under severe malnutrition amongst the total cases and 45 (67.1%) cases came under moderate acute malnutrition and 22(32.8%) belonged to severe acute malnutrition amongst RSV detected cases admitted during the study period. It is important to note that the severely malnourished cases also required PICU care and were treated symptomatically and are currently on follow up.

August Wrotek et al [11] conducted a systematic search which showed that 111 kids between the ages of 3 months and 22 months were enrolled in the study. 32 children (29%) showed several complications out of the 68 (61%) children who had them. Of the 111 children, acute otitis media occurred in 53 (48%), pneumonia in 37 (33%), and conjunctivitis in 12 (11%) cases. The drawback of this study was that it included only children under 2 years of age. In our study, the notable complication was pneumonia (68.8%) whereas conjunctivitis was not found in any of the cases. Our study offers the advantage that it included children between 0-18 years which adds weightage on the burden of RSV infection across the whole paediatric population.

In the prospective study conducted by Shafik et al [7], the strongest correlation was found between RSV and ALRI, ARI, URI, LRTI, and influenza, which may aid in identifying high-risk patients who can receive an early immunization with a vaccine. Children who have co-infections or superinfections with bacteria have significantly higher rates of morbidity and mortality. As per our study, 342 (76%) children have been immunized upto date followed by partially immunized children who constituted 108 (24%) of the total admitted cases. The data in RSV detected cases is similar, as 55 (82%) were immunized upto date and 12 (17.9%) were partially immunized.

Our study has also tracked socioeconomic profile in contrast to the study done by Satav et al[6] and Shafik et al[7] which according to Kuppuswamy scale, 46.6% belonged to lower middle class 3 and 40% belonged to upper lower class 4 amongst all cases and amongst RSV positive cases, 45 (67.1%) belonged to lower middle class followed by upper lower class which included 20 (29.8%) of the cases as per Modified Kuppuswamy Classification respectively.

- Our study has also shown seasonal variation as there were no RSV cases during March to May and there was a rapid resurgence of cases from June to August.

"What this study adds?"

- Our study included children between 0-18 years which adds weightage on the burden of RSV infection across the whole paediatric population.
- Our study has also tracked socioeconomic profile in contrast to any study done in this respect.

Limitations Of The Study:

1. The swabs were sent for only those cases which required intensive care monitoring, which could have been improvised.

Summary

RSV (both hRSV-A and hRSV-B) detection rate was found to be significantly higher in young Indian children (aged 0-5 years old) as compared to older children (aged 6-18 years), which indicates that younger age population are more likely to have RSV infection while slight male predilection over females were reported in total cases but female prediction was seen in RSV detected cases.

Data from this study reported strongest association between RSV and ALRI, ARI, URI, LRTI, and influenza which may help in identifying high risk patients who can have active immunization with a vaccine at an early stage of infection. Our study showed that around 55.6% were moderate acute malnourished and 44.3% were severely malnourished which emphasizes the fact nutrition along with immunization should be given equal importance in tackling this infection. Most of children affected from RSV belonged to lower middle and upper lower socioeconomic status as per Modified Kuppuswamy Classification (accounting to 86% of cases). There is thus, a need to have rapid, more sensitive, and highly specific diagnostic tests/methods for the detection of RSV. Our study showed that real time RT-PCR (99.3% sensitivity and 95.7% specificity) as the most commonly used diagnostic tests with high sensitivity and specificity for the detection of RSV infection. Morbidity and mortality are greatly increased in children with bacterial co-infections or superinfections. Therefore, early detection of the virus is a critical step in the initiation of proper care, and the prevention of further spread of the virus in community.

Tables

Table 1: Demographic Profile And Clinical Features

Age	**N**	**%**
<9 months	135	30%
9-12 months	60	13.3%
1-5yrs	150	33.3%
>5yrs	105	23.3%
Gender		
Males	295	65.5%
Females	155	34.4%
Classical symptoms		
URTI	445	93.3%
LRTI	323	71.1%
PNEUMONIA	310	68.8%
Socioeconomic status		
Upper Middle	25	5.5%
Lower Middle	210	46.6%
Upper Lower	180	40%
Lower	35	7.7%

N = 450

Table 1 describes the demographic profile and clinical characteristics of the cases.

Table 2: Sociodemographic Profile Of Lab Confirmed Cases Of RSV

Age – LAB CONFIRMED CASES	**N**	**%**
<9 months	27	40.2%
9-12 months	15	22.3%
1-5yrs	20	29.8%
>5yrs	5	7.4%
Gender		
Males	30	44.7%
Females	37	55.2%
Socioeconomic status		
Upper Middle	2	2.9%
Lower Middle	45	67.1%
Upper Lower	20	29.8%
Lower	0	0

N=67

Table 2 describes the sociodemographic profile and clinical characteristics of the lab confirmed cases of RSV considering the sample sent during the study period.

Table 3: Immunization Status

IMMUNIZATION STATUS	**N**	**%**
IMMUNIZED UPTO DATE	342	76%
PARTIALLY IMMUNIZED	108	24%

N = 450

Immunization status of all the admitted cases has been represented in Table 3.

Table 4: Immunization Status Of Lab Confirmed Cases

IMMUNIZATION STATUS OF LAB CONFIRMED CASES	**N**	**%**
IMMUNIZED UPTO DATE	55	82%
PARTIALLY IMMUNIZED	12	17.9%

N = 67

Table 4 reinforces immunization status amongst the lab confirmed cases considering the sample sent during the study period.

Figures

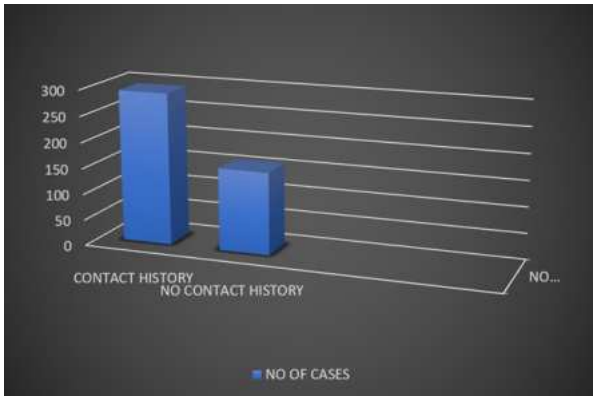
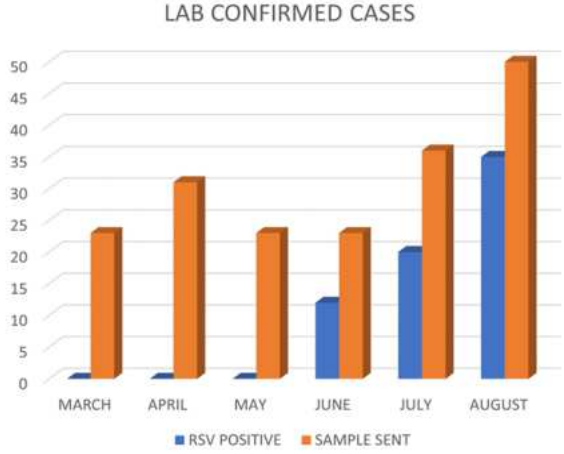


Figure 1: Contact History Of All Cases Admitted To Tertiary Care Center



Blue Bar: RSV positive **Orange Bar:** Sample sent
Figure 2 : Lab Confirmed Cases Of Rsv

Abbreviations

ALRI – Acute Lower Respiratory Infection
ARI- Acute Respiratory Infection
RSV – Respiratory Syncytial Virus
RT PCR – Real Time Reverse Transcriptase Polymerase Chain Reaction

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