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MOLECULAR EPIDEMIOLOGY, CLINICAL SPECTRUM, AND DISEASE BURDEN OF RESPIRATORY SYNCYTIAL VIRUS INFECTION AMONG CHILDREN AGED 1–60 MONTHS WITH ACUTE RESPIRATORY ILLNESS.

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ABSTRACT **Background:** Respiratory syncytial virus (RSV) is a leading viral cause of lower respiratory infection and hospitalization in young children. Local data from under-studied regions are essential to inform prevention and clinical care. **Objective:** To determine the prevalence of RSV among children aged 1–60 months hospitalised with ARI at a tertiary centre in Bundelkhand, India, and to describe associated clinico-epidemiological features and short-term outcomes. **Methods:** Prospective observational study conducted at the Department of Pediatrics, Government Bundelkhand Medical College, Sagar, between July 2023 and September 2024. Children aged 1–60 months admitted with ARI (WHO criteria) were enrolled after parental consent. Nasopharyngeal/throat swabs were obtained and tested in the institutional virology laboratory (RT-PCR). Demographic, perinatal, environmental, clinical and outcome data were recorded on a preformed. Statistical analysis used chi-square tests and logistic regression (SPSS v21); $p<0.05$ was considered significant. **Results:** Of 182 enrolled ARI patients, 48 (26.3%) were RSV positive. Age distribution among RSV positives: 1–6 months 33.4% (n=16), 7–24 months 45.8% (n=22), 25–60 months 20.8% (n=10). Male: female ratio among RSV positives ~2.7:1. Significant associations with RSV positivity included overcrowding (OR 2.02; p=0.044), household use of wood/dung fuel (OR 2.02; p=0.049), prematurity (<37 weeks) (OR 2.31; p=0.014), history of O2 requirement during neonatal NICU stay (OR 5.63; p=0.005), bottle feeding (OR 2.10; p=0.032), mixed feeding (OR 1.81; p=0.047), and similar illness in siblings (OR 3.53; p=0.011). Clinical course: oxygen administered in 77% (n=37), mechanical ventilation in 14.5% (n=7). Complications were observed in 35% (n=17); mortality among RSV positives was 4.2% (n=2). Mean hospital stay: 7.65 days 1. **Conclusion:** RSV accounted for approximately one quarter of hospitalized ARI in this tertiary centre. Younger age, prematurity, household crowding and biomass fuel exposure were important correlates and should inform local prevention and clinical management strategies. Larger multicentre studies are needed to generalise findings.

KEYWORDS : Respiratory syncytial virus; prevalence; bronchiolitis; acute respiratory infection; children; India; epidemiology

INTRODUCTION

Acute respiratory illnesses (ARI) remain a major cause of childhood morbidity and mortality worldwide, particularly in low- and middle-income settings. Viral pathogens, notably Respiratory Syncytial Virus (RSV), are dominant causes of paediatric lower respiratory tract infection and hospitalisation in infants and young children.[2,3] RSV is associated with bronchiolitis and viral pneumonia and generates seasonal epidemics that burden health services.[3] In India, reported detection rates of RSV in hospital-based studies vary widely, reflecting geographic and methodological heterogeneity[5,6]

The Bundelkhand region has relatively limited published data on respiratory viral disease despite known socio-economic vulnerability in parts of the population. Local prevalence estimates and descriptions of clinic epidemiological correlates of RSV infection are essential for resource planning and for targeting preventive measures, including supportive care strategies and, in future, vaccine/crenulated antibody deployment.[8]

We conducted a prospective observational study to estimate the prevalence of RSV among children aged 1–60 months hospitalized with ARI at a tertiary referral centre in Sagar, Madhya Pradesh, and to describe their clinical profile, risk factors and short-term outcomes.

OBJECTIVE

Primary objective: estimate the prevalence of RSV among children aged 1–60 months hospitalised with ARI.

Secondary objectives: describe clinic epidemiological profile of RSV-positive children and compare short-term outcomes with RSV-Negative ARI cases

MATERIALS AND METHODS

Study Design and Setting

This prospective observational study was conducted in the Department of Pediatrics at Government Bundelkhand Medical College, Sagar, a tertiary care referral centre serving the Bundelkhand region. The study was carried out over a period of 15 months, from July 2023 to September 2024.

Eligibility Criteria and Enrollment

Children aged 1–60 months admitted with acute respiratory infection (ARI) were eligible for inclusion. ARI was defined according to World Health Organization (WHO) criteria as the acute onset of cough and/or difficulty breathing, with or without fever.[1]

Inclusion Criteria

- Children aged 1–60 months
- Hospital admission with clinical features of ARI
- Written informed consent obtained from parent or legal guardian

Exclusion Criteria

- Age less than 1 month or more than 60 months
- Absence of ARI symptoms
- Refusal or inability to obtain consent

Data Collection and Definitions

A structured and pre-tested preformed was used to collect relevant information including:

- Demographic characteristics
- Socioeconomic status assessed using the Modified Kuppuswamy Scale[10]
- Environmental risk factors such as household crowding, type of cooking fuel, passive smoking exposure, and ventilation
- Natal history, including birth weight, gestational age, NICU admission, and requirement of neonatal oxygen therapy, mechanical ventilation, or surfactant
- Feeding practices, including exclusive breastfeeding, top feeding, mixed feeding, and bottle feeding
- Past respiratory illness history
- Family history of atopy or similar illness among siblings

Clinical presentation, physical examination findings, laboratory investigations, and treatment modalities (oxygen therapy, antibiotics, mechanical ventilation, and mobilization) were documented. Short-term outcomes such as complications, duration of hospital stay, discharge status, referral/transfer, leave against medical advice (LAMA), and mortality were also recorded. Severe acute malnutrition (SAM) and moderate acute malnutrition (MAM) were classified according to WHO guidelines.[1,2]

Specimen Collection and Virological Testing

Nasopharyngeal and throat swab samples were collected from all enrolled children under aseptic precautions. The samples were transported to the institutional virology laboratory for analysis.[11]

Detection of Respiratory Syncytial Virus (RSV) was performed using reverse transcription polymerase chain reaction (RT-PCR) according to the standard operating procedures of the laboratory, including RNA

extraction and amplification protocols.[12,13,15]

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 21.0.

- Descriptive statistics were presented as frequency, percentage, mean, and standard deviation where appropriate.
- Associations between categorical variables were assessed using the Chi-square test.
- Bivariate and multivariable logistic regression analysis were performed to estimate odds ratios (ORs) with 95% confidence intervals (CIs).
- A two-tailed p value <0.05 was considered statistically significant.

Ethical Considerations

The study protocol was approved by the Institutional Ethics Committee of Government Bundelkhand Medical College, Sagar. Written informed consent was obtained from the parents or legal guardians of all participating children prior to enrollment.

RESULTS

Participant Flow and Overall Prevalence

During the study period, a total of 1,244 children aged <5 years were admitted to the pediatric department. Among these, 316 children were diagnosed with acute respiratory infection (ARI). After applying the eligibility criteria, 182 children were enrolled in the study.

Out of the 182 enrolled ARI cases, RSV infection was detected in 48 children (26.3%), while 134 children (73.7%) tested negative for RSV.

Table 1. Key Study Characteristics

Parameter	Value
Study design	Prospective observational
Study period	July 2023 – September 2024
Study setting	Department of Pediatrics, Bundelkhand Medical College, Sagar
Total ARI cases enrolled	182
RSV positive	48 (26.3%)
RSV negative	134 (73.7%)

Table 2. Comparison of RSV-Positive and RSV-Negative Cases

Variable	RSV Positive (n=48)	RSV Negative (n=134)	Odds Ratio	p-value
Overcrowding	28	49	2.02	0.044
Wood/dung cooking fuel	20	35	2.02	0.049
Prematurity	15	22	2.31	0.014
NICU oxygen requirement	8/11	9/28	5.63	0.005
Bottle feeding	20	34	2.10	0.032
Mixed feeding	10	17	1.81	0.047
Similar illness in siblings	17	18	3.53	0.011

Several factors including overcrowding, biomass fuel exposure, prematurity, neonatal oxygen requirement, bottle feeding, mixed feeding and similar illness in siblings were significantly associated with RSV infection.

Table 3. Socioeconomic and household/environmental factors among RSV-positive children (n = 48)

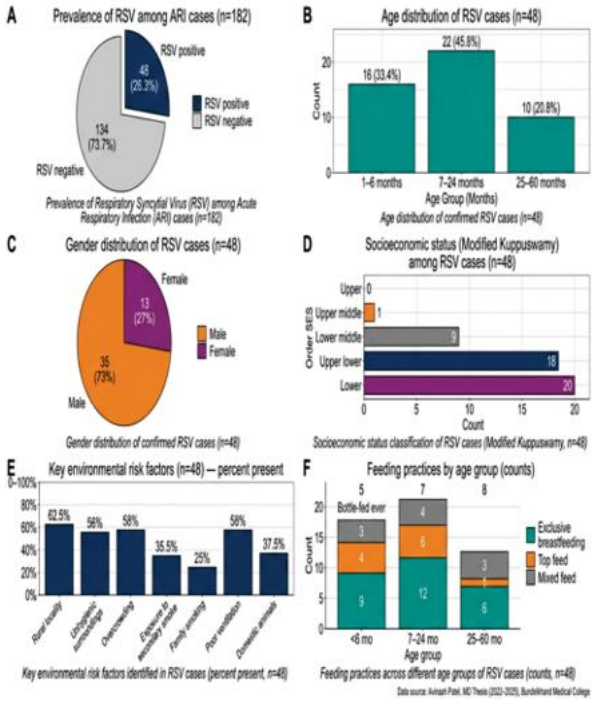
variable	n	%
Socioeconomic class — Lower	20	41.7%
Socioeconomic class — Upper lower	18	37.5%
Socioeconomic class — Lower middle	9	18.8%
Socioeconomic class — Upper middle	1	2.1%
Residence — Rural	30	62.5%
Residence — Urban	18	37.5%
Surroundings — Unhygienic	27	56.3%
Overcrowding — Present	28	58.3%
Cooking fuel — Wood/dung	20	41.7%
Cooking fuel — Kerosene	16	33.3%
Cooking fuel — Gas	9	18.8%
Cooking fuel — Electricity	3	6.3%
Exposure to secondary smoke — Present	17	35.4%
History of smoking in family — Present	12	25.0%
Poor ventilation (home)	28	58.3%
Domestic animals — Present	18	37.5%

Table 4. Prenatal and early- infancy factors among RSV- Positive children (n = 48)

Variable	n	%
Birth weight < 2.5 kg	21	43.8%
Birth weight ≥ 2.5 kg	27	56.3%
Gestational age — Preterm (<37 wks)	15	31.3%
Gestational age — Term	33	68.8%
NICU admission (neonatal)	11	22.9%
— Among NICU admissions (n=11): O2 required	8	72.7% (of NICU)
— Among NICU admissions (n=11): Mechanical ventilation	3	27.3% (of NICU)
— Among NICU admissions (n=11): Surfactant given	1	9.1% (of NICU)

Table 5A. Presenting symptoms (RSV- Positive, n = 48)

Symptom	n	%
Cough	41	85.4%
Rhinorrhoea	34	70.8%
Fever	32	66.7%
Fast breathing	30	62.5%
Difficulty breathing	28	58.3%
Dullness/lethargy	24	50.0%
Vomiting	15	31.3%
Loose stools	7	14.6%
Convulsions	5	10.4%
Throat pain	6	12.5%



DISCUSSION

Principal Findings

This prospective hospital-based study demonstrated that RSV accounted for 26.3% of ARI cases among children aged 1–60 months admitted to a tertiary care hospital in the Bundelkhand region. The infection predominantly affected infants and toddlers, with a male predominance. Environmental and prenatal factors such as household overcrowding, biomass fuel exposure, prematurity and neonatal oxygen therapy were significantly associated with RSV infection.

Comparison With Previous Studies

The prevalence observed in the present study is consistent with previous Indian studies reporting RSV detection rates between 15% and 35% among hospitalized children with acute lower respiratory infections.[16,20] Seasonal peaks observed during the rainy and early winter months are also comparable to patterns reported from other regions of India.[18,19]

Male predominance has been observed in several previous studies and may reflect both biological susceptibility and health-seeking behavior

patterns.[16,17]

Environmental and Prenatal Risk Factors

Household overcrowding and biomass fuel exposure likely increase exposure to respiratory pathogens and indoor air pollution, contributing to increased susceptibility to RSV infection. Prematurity and neonatal oxygen therapy are well-recognized risk factors for severe RSV disease, and the strong association observed in this study supports the need for targeted monitoring of these high-risk infants.

Feeding Practices

Bottle feeding and mixed feeding were associated with increased RSV detection in this study. Exclusive breastfeeding may offer protective benefits through passive immunity and improved mucosal defense, although observational studies remain susceptible to confounding factors.

Clinical Course and Outcomes

A high proportion of RSV-positive children required oxygen therapy (77%), and 14.5% required mechanical ventilation, indicating a substantial burden on healthcare resources. The observed complication rate and mortality were similar to findings reported in other hospital-based studies in resource-limited settings.

Strengths and Limitations

Strengths

- Prospective study design
- Use of RT-PCR for RSV detection
- Comprehensive data collection including demographic, environmental, and clinical variables
- Provides regional epidemiological data from Bundelkhand

Limitations

- Single-center study, limiting Generalizability
- Moderate sample size
- Inclusion of only hospitalized cases, which may over represent severe disease
- Lack of long-term follow-up data

Implications and Recommendations

The findings highlight RSV as a major contributor to pediatric ARI hospitalizations in the region. Public health strategies should focus on:

- Reducing household overcrowding and indoor air pollution
- Promoting exclusive breastfeeding
- Close monitoring of preterm and high-risk infants
- Strengthening RSV surveillance programs

Future multicenter studies including community-based surveillance are needed to better estimate the true burden and seasonality of RSV infection in India.

REFERENCES

1. World Health Organization. Revised WHO classification and treatment of childhood pneumonia at health facilities: evidence summaries. Geneva: WHO; 2014.
2. World Health Organization. Integrated Management of Childhood Illness (IMCI): chart booklet. Geneva: WHO; 2014.
3. Shi T, McAllister DA, O'Brien KL, Simoes EAF, Madhi SA, Gessner BD, et al. Global, regional, and national disease burden estimates of acute lower respiratory infections due to respiratory syncytial virus in young children in 2015: a systematic review and modelling study. Lancet. 2017;390(10098):946–958.
4. Nair H, Nokes DJ, Gessner BD, Dherani M, Madhi SA, Singleton RJ, et al. Global burden of acute lower respiratory infections due to respiratory syncytial virus in young children: a systematic review and meta-analysis. Lancet. 2010;375(9725):1545–1555.
5. Indian Council of Medical Research. Annual report and VRDL network data on respiratory viral infections in India. New Delhi: ICMR; various years.
6. Broor S, Parveen S, Maheshwari M, et al. A prospective three-year cohort study of the epidemiology and virology of acute respiratory infections of children in rural India. PLoS One. 2007;2(6):e491.
7. Saha S, Chowdhury MA, Arifeen SE, et al. Causes and incidence of community-acquired serious infections among young children in South Asia (ANISA): an observational cohort study. Lancet. 2018;392(10142):145–159.
8. Simões EAF, Cherian T, Chandran A, et al. Challenges and opportunities in developing respiratory syncytial virus therapeutics. J Infect Dis. 2015;211(Suppl 1):S1–S20.
9. Rudan I, O'Brien KL, Nair H, et al. Epidemiology and etiology of childhood pneumonia. Bull World Health Organ. 2008;86:408–416.
10. Kuppuswamy B. Manual of socioeconomic status (urban). Delhi: Manasayan; updated versions used (Modified Kuppuswamy Scale).
11. World Health Organization. WHO guidelines for the collection of human specimens for laboratory diagnosis of respiratory virus infections. Geneva: WHO; 2005.
12. Centers for Disease Control and Prevention. Real-Time RT-PCR Panel for Detection and Typing of Respiratory Syncytial Virus. Atlanta: CDC; 2019.
13. Indian Council of Medical Research. Standard Operating Procedures for VRDLs for detection of respiratory viruses including RSV by RT-PCR. New Delhi: ICMR; latest edition.
14. Hall CB, Weinberg GA, Blumkin AK, et al. Respiratory syncytial virus–associated hospitalizations among children less than 24 months of age. Pediatrics. 2013;132(2):e341–e348.
15. Mahony JB. Detection of respiratory viruses by molecular methods. Clin Microbiol Rev. 2008;21(4):716–747.
16. Broor S, Parveen S, Bharaj P, Prasad VS, Srinivasulu KN, Sumanth KM, et al. A prospective three-year cohort study of the epidemiology and virology of acute respiratory infections of children in rural India. PLoS One. 2007;2(6):e491.
17. Nair H, Simões EAF, Rudan I, Gessner BD, Azziz-Baumgartner E, Zhang JS, et al. Global and regional burden of hospital admissions for severe acute lower respiratory infections in young children in 2010: a systematic analysis. Lancet. 2013;381(9875):1380–1390.
18. Saha S, Chadha M, Al Mamun A, Rahman M, Sturm-Ramirez K, Chittaganpitch M, et al. Influenza and respiratory syncytial virus–associated hospitalization among children in South Asia. J Infect Dis. 2014;209(Suppl 3):S121–S128.
19. Hirve S, Krishnan A, Dawood FS, Lele P, Saha S, Rai S, et al. Incidence of respiratory syncytial virus–associated acute lower respiratory infections in India: a multi-site prospective study. J Glob Health. 2016;6(2):020415.
20. Rath B, Jain A, Parida S, et al. Epidemiology of respiratory syncytial virus infection in children in India: systematic review and meta-analysis. Indian J Med Res. 2019;149(3):297–307.