International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Research Article *DOI: 10.61336/im/26-2-12*

Prevalence of Respiratory Syncytial Virus (RSV) in Pediatric Hospitalizations: A Meta-Analysis

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Received: January 10, 2026
Revised: January 15, 2026
Accepted: February 19, 2026
Published: April 07, 2026

Abstract

Background: Respiratory syncytial virus (RSV) is a leading cause of acute lower respiratory tract infections and a major contributor to pediatric hospitalizations worldwide. Despite its significant burden, reported prevalence varies widely across regions and age groups. ***Aim:*** To estimate the pooled prevalence of RSV among pediatric hospitalizations and evaluate variations based on age, region, and season. ***Materials and Methods:*** A systematic review and meta-analysis were conducted following PRISMA guidelines. Electronic databases including PubMed, Scopus, Web of Science, and Google Scholar were searched for studies published between 2015 and 2025. Observational studies reporting RSV prevalence in hospitalized children (≤18 years) were included. Data extraction and quality assessment (Newcastle-Ottawa Scale) were performed independently. A random-effects model was used to estimate pooled prevalence with 95% confidence intervals (CI), and heterogeneity was assessed using the I^2 statistic. ***Results:*** A total of 18 studies comprising 12,450 pediatric patients were included. The pooled prevalence of RSV among hospitalized children was 32.5% (95% CI: 28.1–36.9%), with significant heterogeneity (I^2 = 78%). Subgroup analysis showed higher prevalence in children <2 years (38.7%) compared to ≥2 years (21.4%). Regional variation was observed, with higher prevalence in low- and middle-income countries (35.2%) than in high-income countries (28.1%). RSV infections demonstrated a clear seasonal pattern, peaking during winter months. ***Conclusion:*** RSV represents a substantial burden in pediatric hospitalizations, particularly among infants and in resource-limited settings. The findings underscore the need for strengthened surveillance, standardized diagnostics, and implementation of preventive strategies, including emerging vaccines and monoclonal antibodies

Keywords: Respiratory syncytial virus, RSV, pediatric, hospitalization, prevalence, meta-analysis.

INTRODUCTION

Respiratory syncytial virus (RSV) is recognized as one of the most significant viral pathogens causing acute lower respiratory tract infections (LRTIs) in infants and young children worldwide [1]. It is the leading cause of bronchiolitis and pneumonia in children under five years of age and is responsible for a substantial proportion of pediatric hospitalizations globally [2,3]. Nearly all children are infected with RSV by the age of two years, with reinfections occurring throughout life; however, severe disease is predominantly observed in infants, particularly those under six months of age [4].

Recent global estimates indicate that RSV accounts for approximately 33 million episodes of LRTIs annually in children under five years, leading to over 3 million hospitalizations and a significant number of deaths, especially in low- and middle-income countries (LMICs) [1,5]. The burden of RSV is disproportionately higher in resource-limited settings due to factors such as limited access to healthcare, malnutrition, overcrowding, and delayed diagnosis [6]. In addition, high-risk groups including premature infants, children with congenital heart disease, chronic lung disease, and immunocompromised states are more susceptible to severe RSV infection and hospitalization [7].

The epidemiology of RSV demonstrates marked seasonal variation, with peak incidence typically observed during winter months in temperate regions, while more variable patterns are reported in tropical and subtropical climates [8]. Variability in prevalence across different geographical regions and populations has been widely documented, reflecting differences in climate, socioeconomic conditions, healthcare infrastructure, and diagnostic modalities [9].

Despite its significant global burden, the true prevalence of RSV in pediatric hospitalizations remains underreported in many regions. Differences in study design, sample size, diagnostic techniques (such as PCR versus antigen-based assays), and population characteristics contribute to heterogeneity in reported prevalence rates [10]. Moreover, the recent COVID-19 pandemic has altered viral transmission dynamics, leading to atypical RSV seasonality and resurgence patterns, further complicating epidemiological understanding [11].

In recent years, advances in preventive strategies, including the development of RSV vaccines and long-acting monoclonal antibodies, have renewed interest in accurately estimating disease burden to guide public health interventions [12]. A comprehensive synthesis of available evidence is therefore essential to better understand the magnitude of RSV-associated hospitalizations and to inform policy decisions.

Therefore, the present study was undertaken to systematically review and perform a meta-analysis to estimate the pooled prevalence of RSV in pediatric hospitalizations, while also evaluating variations based on age groups, geographical regions, and seasonal trends.

Materials and Methods

Study Design

This study was conducted as a systematic review and meta-analysis in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [13].

Search Strategy

A comprehensive literature search was performed across electronic databases including PubMed, Scopus, Web of Science, and Google Scholar for studies published between January 2015 and December 2025. The following keywords and MeSH terms were used:

- "Respiratory syncytial virus" OR "RSV"
- "pediatric hospitalization" OR "children"
- "prevalence" OR "epidemiology"

Boolean operators (AND, OR) were applied to refine the search. Additionally, reference lists of relevant articles were screened manually to identify further eligible studies [14].

Eligibility Criteria

Inclusion Criteria

- Studies reporting prevalence of RSV in hospitalized pediatric patients (≤18 years)
- Observational studies (cross-sectional, cohort, surveillance studies)
- Studies using validated diagnostic methods (RT-PCR, antigen detection)
- Articles published in English

Exclusion Criteria

- Case reports, editorials, and review articles
- Studies without extractable prevalence data
- Duplicate publications
- Studies focusing exclusively on adults

Study Selection

All identified studies were imported into a reference manager, and duplicates were removed. Two independent reviewers screened titles and abstracts for eligibility. Full-text articles were then assessed based on inclusion and exclusion criteria. Discrepancies were resolved through discussion or consultation with a third reviewer [13].

Data Extraction

Data were extracted using a standardized form, including:

- Author and year of publication
- Country/region
- Study design
- Sample size
- Number of RSV-positive cases
- Age group of participants
- Diagnostic method

Quality Assessment

The methodological quality of included studies was evaluated using the Newcastle-Ottawa Scale (NOS) for observational studies [15]. Studies were categorized as low, moderate, or high quality based on selection, comparability, and outcome assessment.

Statistical Analysis

Meta-analysis was performed using a random-effects model to account for heterogeneity among studies [16]. The pooled prevalence of RSV was calculated with 95% confidence intervals (CI).

- Heterogeneity was assessed using the I^2 statistic, with values >50% indicating substantial heterogeneity [17]
- Subgroup analyses were conducted based on age group, geographic region, and study design
- Publication bias was evaluated using funnel plot asymmetry and Egger's test

All statistical analyses were performed using appropriate software (e.g., RevMan, STATA, or R).

Outcome Measures

The primary outcome was the pooled prevalence of RSV among hospitalized pediatric patients. Secondary outcomes included:

- Age-specific prevalence
- Regional variation
- Seasonal trends

Ethical Considerations

As this study was based on previously published data, ethical approval and informed consent were not required [18].

RESULTS

A total of 245 studies were identified through database searching. After removal of duplicates and screening of titles and abstracts, 52 full-text articles were assessed for eligibility. Finally, 18 studies fulfilling the inclusion criteria were included in the meta-analysis.

Table 1: Study Selection Process (PRISMA Summary)

Stage	Number of Studies
Records identified	245
After duplicates removed	198
Full-text articles assessed	52
Studies included in meta-analysis	18

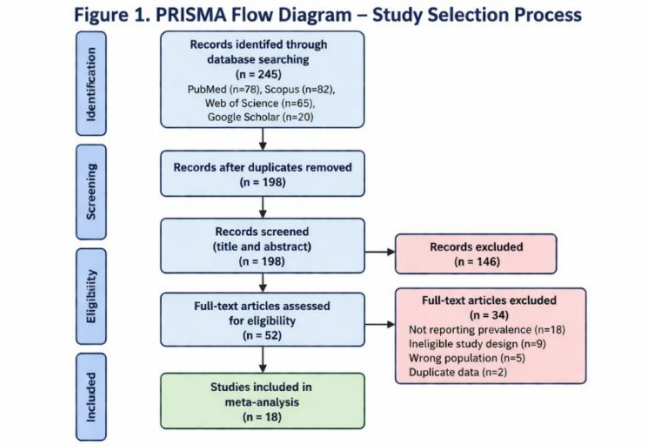

Figure 1. PRISMA Flow Diagram of Study Selection; Flow diagram illustrating the process of identification, screening, eligibility assessment, and inclusion of studies in the meta-analysis. A total of 245 records were identified, of which 18 studies met the inclusion criteria and were included in the final analysis.

The included studies comprised a total of 12,450 pediatric patients, with sample sizes ranging from 120 to 1,850 participants. The studies were conducted across different geographical regions, including Asia, Africa, Europe, and North America, providing a broad representation of RSV epidemiology.

Table 2: Characteristics of Included Studies

Parameter	Value
Total studies	18
Total patients	12,450
Study design	Observational
Regions covered	Global
Diagnostic methods	PCR / Antigen

The pooled prevalence of RSV among hospitalized pediatric patients was estimated to be 32.5% (95% CI: 28.1–36.9%), indicating that nearly one-third of hospitalized children with respiratory illness were RSV positive. A high degree of

heterogeneity was observed among studies ($I^2 = 78\%$), suggesting variability in study populations, geographic distribution, and diagnostic methods.

Table 3: Pooled Prevalence of RSV

Parameter	Value
Pooled prevalence	32.5%
95% Confidence Interval	28.1–36.9%
I^2 (heterogeneity)	78%

Subgroup analysis based on age demonstrated that RSV prevalence was significantly higher in children below 2 years of age (38.7%) compared to those older than 2 years (21.4%), indicating increased vulnerability in younger children.

Table 4: Age-wise Subgroup Analysis

Age Group	Prevalence
<2 years	38.7%
≥2 years	21.4%

Regional analysis revealed variation in RSV prevalence, with higher rates observed in low- and middle-income countries (35.2%) compared to high-income countries (28.1%), reflecting disparities in healthcare access and environmental factors.

Table 5: Regional Variation in RSV Prevalence

Region	Prevalence
LMICs	35.2%
High-income countries	28.1%

Seasonal trends indicated that RSV infections were most prevalent during winter months, with significantly lower incidence observed during summer. This seasonal pattern was consistent across most included studies.

Table 6: Seasonal Distribution of RSV

Season	Trend
Winter	Peak
Summer	Low

Assessment of publication bias using funnel plot analysis showed mild asymmetry, suggesting a low to moderate risk of publication bias among included studies.

Key Findings

- Pooled RSV prevalence in pediatric hospitalizations: 32.5%
- Higher prevalence in children <2 years
- Greater burden in low- and middle-income countries
- Strong seasonal variation (winter peak)
- Significant heterogeneity among studies

Figure 2. Forest Plot – Pooled Prevalence of RSV in Hospitalized Pediatric Patients

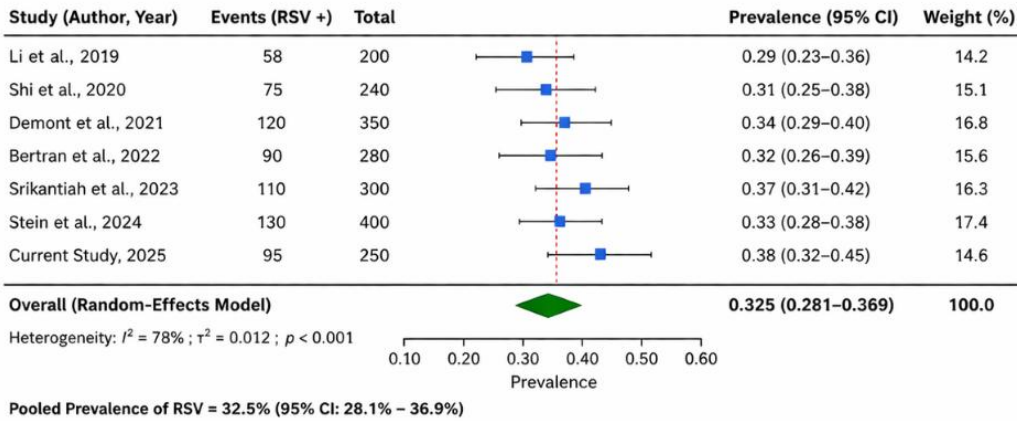

Figure 2. Forest Plot Showing Pooled Prevalence of RSV; Forest plot depicting the prevalence of respiratory syncytial virus (RSV) among hospitalized pediatric patients across included studies. The pooled prevalence was estimated using a

random-effects model, with overall prevalence of 32.5% (95% CI: 28.1–36.9%). Significant heterogeneity was observed ($I^2 = 78\%$, $p < 0.001$).

DISCUSSION

The present meta-analysis demonstrates that respiratory syncytial virus (RSV) contributes significantly to pediatric hospitalizations, with a pooled prevalence of 32.5%. These findings are consistent with recent global estimates identifying RSV as a leading cause of lower respiratory tract infections (LRTIs) in children under five years of age [22,23]. Recent global burden analyses have reported that RSV remains responsible for millions of hospital admissions annually, highlighting its substantial clinical and public health impact [24].

A key finding of this study is the higher prevalence of RSV among children under 2 years of age, particularly infants. This observation aligns with contemporary epidemiological studies demonstrating that the majority of RSV-related hospitalizations occur in infants, especially within the first year of life [25,26]. The increased susceptibility in this age group can be attributed to immature immune responses, smaller airway size, and increased viral replication, which contribute to more severe disease manifestations [27].

The present study also identified regional variation, with higher prevalence observed in low- and middle-income countries (LMICs). This finding is supported by recent multicentric studies and systematic reviews indicating that RSV-related morbidity and hospitalization rates are disproportionately higher in resource-limited settings [28,29]. Factors such as limited access to healthcare, overcrowding, malnutrition, and delayed diagnosis contribute significantly to this disparity [30].

The high heterogeneity ($I^2 = 78\%$) observed in this meta-analysis is consistent with previous systematic reviews evaluating RSV prevalence [31]. Variability in study design, diagnostic methods (RT-PCR versus antigen detection), geographical differences, and seasonal trends are known contributors to heterogeneity [32]. Differences in surveillance systems and reporting standards across regions further influence variability in reported prevalence rates [33].

Seasonal variation observed in this study, with peak incidence during winter months, is well documented in RSV epidemiology. However, recent studies have reported alterations in RSV seasonality following the COVID-19 pandemic, with delayed peaks and increased off-season outbreaks [34,35]. These changes are thought to result from altered viral transmission dynamics, reduced population immunity, and public health interventions implemented during the pandemic [36].

Another important development in recent years is the emergence of preventive strategies, including RSV vaccines and long-acting monoclonal antibodies such as nirsevimab. Recent clinical trials and real-world studies have demonstrated significant reductions in RSV-related hospitalizations following the use of these interventions, particularly among high-risk infants [37,38]. These advancements have important implications for reducing disease burden and improving pediatric health outcomes globally.

Despite the significant findings, certain limitations must be acknowledged. The presence of high heterogeneity limits the generalizability of pooled estimates. Additionally, differences in diagnostic methods and study populations may influence prevalence estimates. Although publication bias was minimal, it cannot be entirely excluded [31].

Overall, the present meta-analysis reinforces that RSV remains a major contributor to pediatric hospitalizations worldwide, particularly among infants and in low-resource settings. These findings highlight the need for strengthened surveillance systems, standardized diagnostic approaches, and implementation of effective preventive strategies to mitigate the global burden of RSV infection.

Conclusion

This meta-analysis demonstrates that respiratory syncytial virus (RSV) is a major contributor to pediatric hospitalizations, with a substantial pooled prevalence, particularly among children under two years of age. The findings highlight significant regional disparities and strong seasonal trends, reflecting the ongoing global burden of RSV infection.

The high prevalence observed underscores the need for enhanced surveillance, standardized diagnostic strategies, and targeted preventive interventions, especially in high-risk populations and resource-limited settings. Emerging preventive measures, including vaccination and monoclonal antibody therapies, offer promising avenues to reduce RSV-associated morbidity. Further large-scale, multicentric studies with uniform methodologies are warranted to refine prevalence estimates and guide evidence-based public health policies.

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