DOI: https://doi.org/10.53350/pjmhs02024181694

ORIGINAL ARTICLE

Frequency and Risk Factors of Recurrent Respiratory Tract Infections in Children Attending Pediatric OPD

RABIA SHAMSHAD[1], TAIBA ABBAS[2], SUGHRA WAHID[3], SOBIA NAWAZ[4]
[1]Postgraduate Resident Paediatrics, Children Hospital Multan
[2]Senior Register Paediatrics, Sahiwal Teaching Hospital, Sahiwal
[3]Consultant Pediatrician and Head of the Pediatric Department, KRL Hospital Islamabad
[4]WMO, Rural Dispensary Chak 130/P Sadiqabad, Rahim Yar Khan
Correspondence to: Rabia Shamshad, Email: dr.rabiashamshad@gmail.com, Contact: +923367720016

ABSTRACT

Background: Recurrent respiratory tract infections (RRTIs) are among the most frequent causes of morbidity in children worldwide, especially in developing countries where environmental and nutritional factors play a major role.

Objective: This study aimed to determine the frequency and risk factors of RRTIs among children attending the pediatric outpatient department.

Methods: This cross-sectional study was conducted at Children Hospital Multan from October 2022 To May 2023, included 255 children aged 1 to 14 years presenting with respiratory tract infections. Detailed demographic, environmental, and clinical data were collected through structured questionnaires. Relevant laboratory investigations, including hemoglobin and vitamin D levels, were performed.

Results: The overall frequency of RRTIs was 69.8%. Most affected children were in the 1–5-year age group (42.4%) and predominantly male (55.7%). Upper respiratory tract infections (URTIs) accounted for 69.7% of cases, while lower respiratory tract infections (LRTIs) made up 30.3%. Significant associations were found between RRTIs and undernutrition (38.4%), vitamin D deficiency (34.1%), and anemia (27.1%). Environmental risk factors such as passive smoking (79.5%), overcrowding (80.9%), and exposure to biomass fuels (83.0%) were strongly linked to recurrent infections ($p < 0.05$). Behavioral and preventive factors, including incomplete immunization (84.1%), lack of exclusive breastfeeding (78.3%), and daycare attendance (84.7%), were also significantly associated with RRTIs. The highest frequency of infections occurred during the winter season (67.2%).

Conclusion: Recurrent respiratory tract infections in children are influenced by a combination of nutritional deficiencies, poor environmental conditions, and inadequate preventive practices.

Keywords: Recurrent respiratory tract infections (RRTIs), Patients, Quality of life, Malnutrition, LSTIs.

INTRODUCTION

Recurrent respiratory tract infections (RRTIs) are a major global health concern and constitute one of the leading causes of pediatric morbidity and mortality[1]. They impose a heavy burden on healthcare systems, especially in developing countries where socioeconomic and environmental conditions exacerbate susceptibility to infection[2]. Globally, it is estimated that children under five years of age experience six to eight episodes of respiratory infections per year, and a subset of these children develop recurrent infections that significantly impact their overall growth, development, and quality of life[3]. The issue is particularly pronounced in regions like South Asia, where factors such as urban overcrowding, air pollution, malnutrition, and incomplete immunization contribute to a high prevalence of recurrent infections[4]. Respiratory tract infections are generally classified into upper and lower respiratory tract infections, depending on the anatomical site involved. Upper respiratory tract infections (URTIs) include rhinitis, tonsillitis, pharyngitis, sinusitis, and otitis media, whereas lower respiratory tract infections (LRTIs) involve bronchitis, bronchiolitis, and pneumonia. Although most respiratory infections are viral in origin, bacterial superinfection and poor host defense mechanisms often contribute to recurrence[5]. The frequency of these infections depends on the child's age, exposure history, and immune competence. For example, preschool-aged children, particularly those attending daycare centers, are at higher risk due to close contact with peers and exposure to a variety of pathogens[6]. From a clinical standpoint, RRTIs are defined as multiple episodes of respiratory infections within a given time frame, commonly more than six upper respiratory infections or two or more lower respiratory infections per year in a single child. However, definitions vary depending on the population studied[7]. The persistence or recurrence of these infections may indicate an underlying predisposing factor rather than mere repeated exposure. Understanding whether the recurrence is due to immunological deficiency, environmental exposure, or poor nutritional and hygienic conditions is crucial for appropriate management and prevention[8].

Received on 10-10-2023
Accepted on 26-12-2023

Several risk factors have been consistently linked to the recurrence of respiratory tract infections in children. Host factors include poor nutritional status, iron and vitamin D deficiency, allergic tendencies, and anatomical anomalies such as a deviated septum or enlarged adenoids[9]. In addition, children with congenital or acquired immunodeficiencies are particularly prone to frequent infections. Environmental factors play a significant role in exposure to indoor smoke from biomass fuels, parental smoking, and air pollutants are all known contributors. Furthermore, social determinants such as large family size, poor ventilation, inadequate sanitation, and low socioeconomic status amplify infection rates by promoting pathogen transmission and limiting access to timely healthcare[10].

Breastfeeding has been identified as a key protective factor against respiratory infections due to the presence of maternal antibodies and immune-modulating factors in breast milk. Lack of exclusive breastfeeding during the first six months of life has been shown to increase the risk of respiratory illnesses[11]. Similarly, incomplete immunization leaves children vulnerable to preventable infections such as pertussis, measles, and pneumonia caused by *Streptococcus pneumoniae* and *Haemophilus influenzae* type B. Seasonal variations also influence infection rates, with peaks commonly observed during colder months when children spend more time indoors, and viral transmission is facilitated[12]. The clinical consequences of RRTIs extend beyond physical health. Recurrent illnesses contribute to frequent school absenteeism, increased antibiotic consumption, and a heightened risk of antimicrobial resistance. Families also face emotional and financial stress due to repeated doctor visits, diagnostic investigations, and prolonged medication courses[13]. In the long term, repeated infections can impair pulmonary function, leading to chronic respiratory conditions such as asthma or bronchiectasis in susceptible children[14].

Objective: This study aimed to determine the frequency and risk factors of RRTIs among children attending the pediatric outpatient department.

METHODOLOGY

This was a descriptive cross-sectional study conducted at Children Hospital Multan from October 2022 To May 2023. A total of 255

children aged between 6 months and 12 years were included in the study. The sample size was calculated using the World Health Organization (WHO) sample size calculator, keeping in view the expected prevalence of RRTIs in the pediatric population and a 95% confidence level with a 5% margin of error. Non-probability consecutive sampling was used to recruit participants who fulfilled the inclusion criteria.

Inclusion Criteria:

1. Children aged 6 months to 12 years attending the pediatric OPD with a history of recurrent respiratory tract infections.
2. Children whose parents or guardians provided informed consent.

Exclusion Criteria:

1. Children with congenital anomalies of the respiratory tract.
2. Those with diagnosed immunodeficiency disorders, cystic fibrosis, or chronic systemic illnesses (e.g., congenital heart disease, chronic kidney disease).
3. Children who were on long-term corticosteroid or immunosuppressive therapy.

Data Collection: After obtaining ethical approval from the institutional review board, informed consent was obtained from parents or guardians. A structured questionnaire was used to collect data on demographic details, clinical history, environmental exposures, nutritional status, immunization record, and family history. The information was gathered through direct interviews with caregivers and a review of available medical records. Anthropometric measurements such as weight, height, and mid-upper arm circumference were taken to assess nutritional status using WHO growth standards. Clinical evaluation included a detailed history of frequency, duration, and type of respiratory infections, associated symptoms, and previous hospitalizations. Environmental and social factors such as exposure to indoor smoke, parental smoking, crowding index, ventilation status, and daycare attendance were also recorded. For selected cases, baseline investigations such as complete blood count, serum vitamin D, and serum immunoglobulin levels (IgA, IgG, IgM) were performed when clinically indicated to rule out underlying immunodeficiency or nutritional deficiency.

Data Analysis: Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 26. Quantitative variables such as age, number of infection episodes, and duration of illness were presented as mean ± standard deviation (SD). Qualitative variables such as gender, nutritional status, immunization status, and environmental factors were expressed as frequencies and percentages. The chi-square test was applied to determine the association between RRTIs and potential risk factors, with a p-value ≤ 0.05 considered statistically significant.

RESULTS

Data were collected from 225 patients, aged 1 to 14 years, with a mean age of 5.8 ± 3.1 years. Most participants were between 1–5 years of age (42.4%), followed by 6–10 years (37.6%), and those above 10 years (20.0%). Males constituted a slightly higher proportion (55.7%) compared to females (44.3%). Recurrent respiratory tract infections (RRTIs) were observed in 69.8% of the study population, while 30.2% did not experience recurrence. Among those with RRTIs, upper respiratory tract infections (URTIs) were more frequent (69.7%) compared to lower respiratory tract infections (LRTIs) at 30.3%, indicating a predominance of mild respiratory illnesses in younger children.

Nutritional and hematological assessment revealed that 38.4% of children were underweight, while 61.6% had a normal weight, with the difference showing statistical significance (p = 0.03). Vitamin D deficiency was detected in 34.1% of children, which was also significantly associated with RRTIs (p = 0.02). Anemia was observed in 27.1% of participants, significantly contributing to the occurrence of recurrent infections (p = 0.04).

Environmental analysis showed that exposure to passive smoking was present in 43.9% of children, among whom 79.5% had RRTIs, showing a strong association (p = 0.01). Household overcrowding, defined as more than three persons per room, was reported in 53.3% of families, and 80.9% of those children suffered from RRTIs (p = 0.001). Similarly, exposure to biomass fuels, noted in 36.9% of households, was significantly associated with recurrent infections, with 83.0% of exposed children affected (p < 0.001).

Among fully immunized children (82.7%), 66.8% had RRTIs, whereas the proportion was much higher (84.1%) among those partially immunized or unimmunized (p = 0.04). Lack of exclusive breastfeeding for at least six months was observed in 47.5% of children, of whom 78.3% developed RRTIs (p = 0.01). Furthermore, children attending daycare facilities had a higher frequency of infections (84.7%) compared to those cared for at home (64.6%) (p = 0.02).

Table 1. Demographic Characteristics of Study Population (n = 255)

Variable	Category	n (%) / Mean ± SD
Age group (years)	1–5	108 (42.4)
	6–10	96 (37.6)
	>10	51 (20.0)
Mean age (years)	—	5.8 ± 3.1
Gender	Male	142 (55.7)
	Female	113 (44.3)
Children with RRTIs	Present	178 (69.8)
	Absent	77 (30.2)
Type of infection among RRTI cases	Upper respiratory (URTI)	124 (69.7)
	Lower respiratory (LRTI)	54 (30.3)

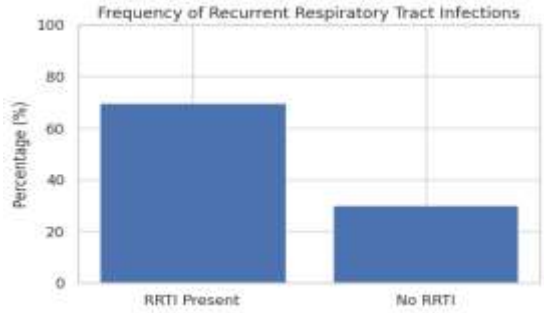

Table 2. Nutritional and Hematological Status of Children (n = 255)

Parameter	Category	n (%)	p-value
Nutritional status	Normal weight	157 (61.6)	—
	Underweight	98 (38.4)	0.03*
Vitamin D level	Normal	168 (65.9)	—
	Deficient	87 (34.1)	0.02*
Hemoglobin status	Normal	186 (72.9)	—
	Anemic	69 (27.1)	0.04*

*Statistically significant at p < 0.05

Table 3. Environmental and Household Risk Factors for RRTIs (n = 255)

Parameter	Category	n (%)	RRTI Present n (%)	p-value
Passive smoking exposure	Yes	112 (43.9)	89 (79.5)	0.01*
	No	143 (56.1)	89 (62.2)	—
Household crowding (>3 persons/room)	Yes	136 (53.3)	110 (80.9)	0.001*
	No	119 (46.7)	68 (57.1)	—
Biomass fuel exposure	Yes	94 (36.9)	78 (83.0)	<0.001*
	No	161 (63.1)	100 (62.1)	—

Table 4. Immunization, Feeding, and Daycare-Related Factors (n = 255)

Parameter	Category	n (%)	RRTI Present n (%)	p-value
Immunization status	Fully immunized	211 (82.7)	141 (66.8)	0.04*
	Partially/unimmunized	44 (17.3)	37 (84.1)	—
Exclusive breastfeeding (≥6 months)	Yes	134 (52.5)	78 (58.2)	0.01*
	No	121 (47.5)	95 (78.3)	—
Day care attendance	Yes	72 (28.2)	61 (84.7)	0.02*
	No	183 (71.8)	117 (64.6)	—

DISCUSSION

The present study assessed the frequency and risk factors associated with recurrent respiratory tract infections (RRTIs) among children attending the pediatric outpatient department, revealing a high prevalence rate of 69.8%. This finding aligns with similar studies conducted in developing regions where RRTIs remain a common health problem due to environmental, nutritional, and socioeconomic determinants. The predominance of cases among younger children aged 1–5 years underscores the vulnerability of this group, as their immune systems are still developing and they are more frequently exposed to infectious agents through social interactions and daycare attendance. A male predominance (55.7%) was observed, consistent with other epidemiological studies that report higher infection rates in boys during early childhood, possibly due to greater outdoor exposure and higher respiratory activity rates. The predominance of upper respiratory tract infections (69.7%) over lower ones mirrors the general pattern of pediatric infections, where conditions such as tonsillitis, pharyngitis, and otitis media occur more frequently and are often self-limiting but recurrent in nature[15].

Malnutrition emerged as a key determinant, with 38.4% of children being underweight and showing a significantly higher rate of RRTIs. Nutritional deficiencies compromise both innate and adaptive immunity, reducing mucosal barrier integrity and antibody production, which enhances susceptibility to infections. Similarly, anemia and vitamin D deficiency showed strong associations with recurrent infections[16]. Vitamin D plays a pivotal role in mucosal immunity and the activation of antimicrobial peptides, while anemia reflects poor nutritional and immune status that predisposes children to repeated infectious insults. These findings agree with previous studies emphasizing the impact of nutritional deficiencies on pediatric respiratory morbidity[17]. Environmental and lifestyle factors were among the strongest predictors of RRTIs in this study. Passive smoking exposure, overcrowded housing, and the use of biomass fuels for cooking were significantly correlated with recurrent infections. Tobacco smoke and biomass combustion produce fine particulate matter that irritates and inflames the airway mucosa, impairing mucociliary clearance and facilitating bacterial colonization[18]. Overcrowding promotes the spread of pathogens through close contact, particularly in households with poor ventilation. These findings are consistent with previous research highlighting the contribution of poor air quality and dense living environments to respiratory disease burden in low- and middle-income settings[19].

Incomplete immunization and lack of exclusive breastfeeding were also significant contributors. The protective effect of breastfeeding is attributed to the presence of maternal antibodies, lactoferrin, and immunomodulatory cytokines that strengthen infant immunity during early life. Similarly, unimmunized children were found to have higher infection rates, underscoring the crucial role of vaccination in reducing the incidence of preventable respiratory infections[20,21]. Daycare attendance, observed in nearly 28.2% of children, also showed a statistically significant relationship with RRTIs, consistent with literature suggesting that group settings facilitate frequent pathogen transmission. Seasonal analysis revealed that RRTIs peaked during winter months (67.2%), a pattern widely reported in temperate and subtropical regions. The colder, drier air during winter may impair mucosal defense mechanisms, while indoor crowding and reduced ventilation increase transmission risk. Additionally, viral pathogens such as influenza and respiratory syncytial virus (RSV) are more prevalent during colder seasons, contributing to this seasonal pattern.

CONCLUSION

It is concluded that recurrent respiratory tract infections remain a major health concern among children, with a frequency of nearly 70% in this study population. The findings demonstrate that multiple interrelated factors including young age, poor nutritional status, vitamin D deficiency, anemia, passive smoking exposure, overcrowded living conditions, and biomass fuel use significantly contribute to the recurrence of infections. Behavioral and preventive factors such as incomplete immunization, lack of exclusive breastfeeding, and daycare attendance further increase susceptibility. The majority of cases occurred during the winter season, reflecting strong seasonal influence on infection patterns.

REFERENCES

1. Michel F, Vacher T, Julien-Marsollier F, Dadure C, Aubineau JV, Lejus C, Sabourdin N, Woodey E, Orliaguet G, Brasher C, Dahmani S. Peri-operative respiratory adverse events in children with upper respiratory tract infections allowed to proceed with anaesthesia: A French national cohort study. Eur J Anaesthesiol. 2018 Dec;35(12):919-928. doi: 10.1097/EJA.0000000000000875. PMID: 30124501.
2. Mitter VR, Håberg SE, Magnus MC. Early childhood respiratory tract infections according to parental subfertility and conception by assisted reproductive technologies. Hum Reprod. 2022 Aug 25;37(9):2113-2125. doi: 10.1093/humrep/deac162. PMID: 35881052; PMCID: PMC9433839.
3. De Martino M, Ballotti S. The child with recurrent respiratory infections: normal or not? Pediatr Allergy Immunol. 2007;18(Suppl 18):13–8. doi:10.1111/j.1399-3038.2007.00625.x.
4. Bellanti JA. Recurrent respiratory tract infections in paediatric patients. Drugs. 1997;54(Suppl 1):1–4. doi:10.2165/00003495-199700541-00003.
5. Raniszewska A, Górska E, Kotuła I, Stelmaszczyk-Emmel A, Popko K, Ciepiela O. Recurrent respiratory tract infections in children: analysis of immunological examinations. Cent Eur J Immunol. 2015;40(2):167–73. doi:10.5114/ceji.2015.52830.
6. Toivonen L, Karppinen S, Schuez-Havupalo L, Teros-Jaakkola T, Vuononvirta J, Mertsola J, et al. Burden of recurrent respiratory tract infections in children: a prospective cohort study. Pediatr Infect Dis J. 2016;35(12):e362–9. doi:10.1097/INF.0000000000001304.
7. De Benedictis FM, Bush A. Recurrent lower respiratory tract infections in children. BMJ. 2018;362:k2698. doi:10.1136/bmj.k2698.
8. Karevold G, Kvestad E, Nafstad P, Kværner KJ. Respiratory infections in schoolchildren: co-morbidity and risk factors. Arch Dis Child. 2006;91(5):391–5. doi:10.1136/adc.2005.083881.
9. Torretta S, Rosazza C, Baselli L, Berti C, Bosi P, Dellepiane RM, et al. Immunological profiles of children with recurrent otitis media with or without tympanic membrane perforation and those with recurrent respiratory infections. Int J Pediatr Otorhinolaryngol. 2022;160:111219. doi:10.1016/j.ijporl.2022.111219.
10. Bush A. Recurrent respiratory infections. Pediatr Clin North Am. 2009;56(1):67–100. doi:10.1016/j.pcl.2008.10.004.
11. Zhou B, Niu W, Liu F, Yuan Y, Wang K, Zhang J, et al. Risk factors for recurrent respiratory tract infection in preschool-aged children. Pediatr Res. 2021;90(2):223–31. doi:10.1038/s41390-020-01233-4.
12. Chiappini E, Santamaria F, Marseglia GL, Marchisio P, Galli L, Cutrera R, et al. Prevention of recurrent respiratory infections. Ital J Pediatr. 2021;47(1):211. doi:10.1186/s13052-021-01150-0.
13. Tuzger N, Milani GP, Folino F, Aldè M, Agostoni C, Torretta S, et al. Referrals for recurrent acute otitis media with and without tympanic membrane perforation during COVID-19: a cross-sectional comparative study. Pediatr Infect Dis J. 2023;42(7):e356–7. doi:10.1097/INF.0000000000003970.
14. Chen L, Miao C, Chen Y, Han X, Lin Z, Ye H, et al. Age-specific risk factors of severe pneumonia among pediatric patients hospitalized with

community-acquired pneumonia. Ital J Pediatr. 2021;47(1):100. doi:10.1186/s13052-021-01042-3.
15. Barbi E, Marzuillo P, Neri E, Naviglio S, Krauss BS. Fever in children: pearls and pitfalls. Children (Basel). 2017;4(9):81. doi:10.3390/children4090081.
16. Mameli C, Picca M, Buzzetti R, Pace ME, Badolato R, Cravidi C, et al. Incidence of acute respiratory infections in preschool children in an outpatient setting before and during COVID-19 pandemic in Lombardy Region, Italy. Ital J Pediatr. 2022;48(1):18. doi:10.1186/s13052-022-01221-w.
17. Picca M, Carrozzo R, Milani GP, Corsello A, Macchi M, Buzzetti R, et al. Leading reasons for antibiotic prescriptions in pediatric respiratory infections: influence of fever in a primary care setting. Ital J Pediatr. 2023;49(1):131. doi:10.1186/s13052-023-01533-5.
18. Murray MT, Neu N, Cohen B, Hutcheon G, Simpser E, Larson E, et al. Developing case definitions for health care–associated infections in pediatric long-term care facilities. Clin Pediatr (Phila). 2015;54(14):1380–2. doi:10.1177/0009922815599379.
19. Morris PS. Upper respiratory tract infections (including otitis media). Pediatr Clin North Am. 2009;56(1):101–17. doi:10.1016/j.pcl.2008.10.009.
20. Asher MI, Grant CC. Infections of the upper respiratory tract. In: Pediatric Respiratory Medicine. 2008;453–80.
21. Epifanio MS, Andrei F, Mancini G, Agostini F, Piombo MA, Spicuzza V, et al. The impact of COVID-19 pandemic and lockdown measures on quality of life among the Italian general population. J Clin Med. 2021;10(2):289. doi:10.3390/jcm10020289.
22. Lieberthal AS, Carroll AE, Chonmaitree T, Ganiats TG, Hoberman A, Jackson MA, et al. The diagnosis and management of acute otitis media. Pediatrics. 2013;131(3):e964–99. doi:10.1542/peds.2012-3488.

This article may be cited as: Shamshad R, Abbas T, Wahid S, Nawaz S; Frequency and Risk Factors of Recurrent Respiratory Tract Infections in Children Attending Pediatric OPD. Pak J Med Health Sci, 2024; 18(01): 694-697.