Seasonal Burden of Pediatric Otorhinolaryngologic Diseases: Comparative Patterns of Viral Infections, Acute Otitis Media, and Allergic Rhinitis

Egamberdieva Gulnarakhon Nematovna
Fergana Medical Institute of Public Health, Fergana, Uzbekistan

Abstract

Seasonal diseases of the upper airway represent a major burden in pediatric otorhinolaryngology, with distinct patterns for viral infections, acute otitis media, and allergic rhinitis across the year. This narrative review compares the seasonality, age distribution, clinical manifestations, and preventive strategies of key pediatric ENT conditions, focusing on viral upper respiratory infections, acute otitis media, and seasonal allergic rhinitis., We synthesize recent epidemiological data from long-term surveillance cohorts and post-COVID era studies to highlight shifts in classical winter peaks and the emerging importance of human contact patterns alongside climate in shaping viral seasonality. Understanding these dynamics can refine anticipatory guidance for families, optimize timing of vaccination and prophylaxis, and inform clinic resource allocation in pediatric ENT services.

Keywords: pediatrics, otorhinolaryngology, seasonality, respiratory infections, otitis, rhinitis, viruses, allergy

Introduction

Seasonal variation is a defining feature of many pediatric otorhinolaryngologic diseases, particularly viral upper respiratory tract infections (URTIs), acute otitis media (AOM), and allergic rhinitis. Long-term data from temperate regions show that respiratory viruses such as respiratory syncytial virus (RSV), influenza, adenovirus, and rhinovirus display characteristic peaks, with RSV and influenza predominating in winter and other pathogens showing spring or autumn maxima. These viral epidemics strongly influence the incidence of AOM, which often complicates URTIs and follows similar winter-dominant patterns in young children., In parallel, allergic rhinitis affects approximately 10–20% or more of children in many populations, with a substantial proportion exhibiting intermittent or strictly seasonal symptoms linked to pollen exposure. Recent post-COVID reports further suggest that public health measures and changes in social behavior can disrupt classical seasonal patterns, with off-season surges of RSV and influenza in children once restrictions are relaxed.

In daily pediatric ENT practice, clinicians must distinguish between infectious and allergic etiologies of nasal and middle-ear disease, anticipate seasonal workload, and

implement targeted prevention and counseling for families. This article adopts an IMRAD structure to compare the main seasonal pediatric ENT diseases, emphasizing differences in timing, clinical profile, and prevention, and to discuss implications for modern pediatric otorhinolaryngology.

Methods

This review is narrative in design and focuses on common pediatric ENT conditions with clear seasonal signatures: viral URTIs (including bronchiolitis and laryngotracheitis presentations relevant to ENT), acute otitis media, and allergic rhinitis. We considered recent epidemiological and clinical studies from temperate-climate settings, including long-term virological surveillance, systematic reviews of allergic rhinitis, and analyses of AOM seasonality. Selection emphasized articles describing pediatric populations, seasonal distribution, and implications for clinical care or prevention. Data were synthesized descriptively rather than meta-analyzed, with particular attention to typical peak seasons, age groups most affected, and how COVID-related non-pharmaceutical interventions altered traditional patterns.

Results

Seasonal patterns across major pediatric ENT diseases

Viral URTIs in children demonstrate pronounced winter predominance, with large multi-year cohorts indicating the highest overall positivity rates for respiratory viruses during cold months and lower activity in summer. RSV is repeatedly identified as a leading pathogen in infants and toddlers, typically peaking in late autumn and winter, while influenza A and B generally show winter peaks, with school-age children often driving influenza spread. By contrast, rhinovirus tends to circulate year-round with increased detection in spring and autumn, and agents such as Mycoplasma pneumoniae may show relative summer surges, creating a more complex pattern of non-winter respiratory illness.

Acute otitis media closely mirrors the seasonality of viral URTIs, reflecting its pathophysiological link as a frequent complication of upper respiratory infections in young children. Population-based time-series analyses have shown that periods of high RSV, human metapneumovirus, and influenza activity are temporally associated with increased AOM visits, with RSV-associated URTIs carrying particularly high risk of middle-ear involvement. In some cohorts, over half of children with RSV infection developed AOM, compared with lower but still substantial proportions for influenza and other respiratory viruses, highlighting RSV's central role in winter ENT morbidity., This clustering of AOM in late autumn and winter has direct implications for outpatient workload, antibiotic prescriptions, and surgical planning for tympanostomy tubes in pediatric ENT practice.,

Allergic rhinitis in children shows a dual pattern of perennial and seasonal disease, with seasonal forms commonly driven by tree, grass, and weed pollens, leading to spring and/or autumn peaks depending on local flora. Systematic reviews and regional prevalence studies report that approximately 10–20% or more of children may have physician-diagnosed allergic rhinitis, with an even higher proportion reporting current rhinitic symptoms. In some cohorts, intermittent (seasonal) phenotypes account for around one-third of pediatric allergic rhinitis, while the remainder have persistent symptoms related to indoor allergens. Seasonal allergic rhinitis often peaks in school-age children and early adolescents, coinciding with critical periods for schooling and academic performance, and can significantly affect sleep, mood, and daily functioning.

Comparison of key clinical and seasonal features

The three major disease groups differ in peak season, predominant age, symptom profile, and key complications relevant to ENT. Table 1 summarizes these contrasts to highlight clinical decision points through the year.

Table 1. Seasonal pediatric ENT diseases: epidemiologic and clinical contrasts

Dimension	Viral URTIs / bronchiolitis	Acute otitis media (AOM)	Seasonal allergic rhinitis
Typical peak season (temperate)	Winter; some pathogens spring/autumn , ,	Winter, paralleling RSV/influenza waves , ,	Spring and/or autumn, pollen-dependent , ,
Key pathogens / triggers	RSV, influenza A/B, adenovirus, rhinovirus, MP ,	Viral URTIs (RSV, hMPV, influenza as drivers) , ,	Outdoor pollens; sometimes molds; occasional overlap with URTIs , ,
Predominant age group	Infants and preschool children ,	Infants and toddlers; preschoolers at highest risk ,	School-age children and adolescents , ,
Leading ENT manifestations	Nasal congestion, rhinorrhea, sore throat, stridor	Ear pain, fever, conductive hearing loss, irritability ,	Paroxysmal sneezing, clear rhinorrhea, nasal itch, congestion ,
Important complications	Bronchiolitis, pneumonia, AOM ,	Recurrent AOM, OME, speech delay, need for tubes ,	Sleep disturbance, learning and behavioral impact , ,
Main prevention strategies	Vaccination, hand hygiene, crowding reduction , ,	Vaccination via upstream viral prevention, risk-factor control ,	Allergen avoidance, pharmacotherapy, immunotherapy , , ,

URTIs and AOM share a strong winter seasonality driven by viral circulation, whereas seasonal allergic rhinitis is more tightly linked to pollen calendars and may peak when viral pressure is relatively low. Clinically, fever and purulent nasal discharge favor infectious etiologies, while itchy nose, sneezing, and clear rhinorrhea with eye symptoms are more characteristic of allergic rhinitis, aiding differential diagnosis during overlapping spring and autumn periods. From a health-system perspective, winter months require preparedness for high volumes of febrile children with URTI and AOM, while spring may see an increased demand for allergy evaluation and long-term rhinitis management in school-age patients.

Impact of COVID-19 on pediatric respiratory seasonality

The COVID-19 pandemic provided a natural experiment in how non-pharmaceutical interventions (NPIs) reshape pediatric respiratory disease seasonality. Several reports describe a near-elimination of typical winter peaks of RSV and influenza in children during periods of strict distancing, masking, and school closure, followed by delayed or off-season surges once restrictions were relaxed. For example, some centers documented RSV re-emerging in summer or autumn 2021, with higher median age at infection compared with pre-pandemic seasons, likely reflecting an immunity gap in older infants and toddlers., These shifts underscore the role of human contact patterns, in addition to climate, as major drivers of pediatric respiratory viral seasonality.,

For pediatric ENT services, these disruptions translated into atypical timing of bronchiolitis, URTI-related wheeze, and AOM presentations, challenging traditional assumptions about “quiet” and “busy” months. In some series, severity patterns also changed, with indications that older children could experience more severe RSV disease when first exposed after missed early-life seasons., The altered timing of respiratory viral peaks complicates planning for surgical lists, staffing, and bed capacity in hospitals, and highlights the need for flexible, real-time surveillance to anticipate ENT caseloads. Moreover, the experience suggests that targeted NPIs could be strategically deployed in future severe seasons to reduce the burden of pediatric respiratory and middle-ear disease without continuous year-round restrictions.,

Discussion

This review emphasizes three key themes for pediatric otorhinolaryngology: winter dominance of viral URTIs and AOM, pollen-linked peaks of seasonal allergic rhinitis, and the modifiability of seasonality by social behavior and public health measures. Long-term surveillance has consistently demonstrated that RSV, influenza, and other respiratory viruses drive a winter surge in URTI and AOM, particularly in infants and preschool children., Because AOM episodes show strong temporal association with viral circulation, vaccinations targeting influenza and RSV, along with general infection-control measures, have the potential not only to reduce lower respiratory

morbidity but also to substantially decrease ENT workload associated with middle-ear disease. For clinicians, understanding the viral landscape in a given season can guide diagnostic suspicion, decisions on tympanostomy tube timing, and counseling regarding the risk of recurrent AOM over the winter months.

Allergic rhinitis, although less acutely severe than viral lower respiratory infections, imposes a significant chronic burden, particularly when symptoms cluster seasonally during critical school periods. High prevalence estimates in children, reaching or exceeding 10–20% in many populations, alongside data showing major impacts on sleep and academic performance, argue for active identification and treatment of seasonal allergic rhinitis in ENT and pediatric clinics. Distinguishing between infectious and allergic rhinitis is particularly important during spring and autumn, when rhinovirus circulation may overlap with pollen exposure, and misclassification can lead to inappropriate antibiotic use or under-treatment of allergy. Comprehensive management, combining allergen avoidance, pharmacologic therapy, and, when indicated, allergen immunotherapy, has been shown to be highly effective and can reduce long-term disease burden and comorbidities such as asthma.

The post-COVID disruption of classical seasonal patterns offers both challenges and opportunities. Data showing off-season peaks and age shifts in RSV and influenza reinforce that seasonality is not a fixed attribute but emerges from interactions between climate, population immunity, and human contact networks. For pediatric ENT, this means that traditional seasonal expectations may need revision, and future planning should incorporate dynamic surveillance data rather than static calendars. At the same time, the clear suppression of pediatric respiratory viruses during periods of intense NPIs confirms that targeted interventions—such as temporary masking or enhanced hygiene in daycare and schools during peak RSV or influenza weeks—could be strategically deployed to mitigate the winter burden of URTIs and AOM without long-term disruption.

Finally, these insights should inform anticipatory guidance for families. Parents can be counseled that infants and toddlers are at greatest risk of viral URTIs and AOM in winter, that school-age children may experience seasonal allergic flares in spring and autumn, and that preventive measures such as vaccination, hand hygiene, smoke-free environments, and early allergy evaluation can materially change outcomes. For health systems, aligning outpatient and emergency ENT resources with expected seasonal patterns—while remaining responsive to real-time deviations—will be crucial to manage workload, rationalize antibiotic use, and improve quality of care.

Conclusion

Seasonal diseases of the upper airway remain a central theme in pediatric otorhinolaryngology, with winter-dominant viral URTIs and AOM and pollen-driven

seasonal allergic rhinitis shaping the clinical landscape differently across age groups. The strong temporal coupling between respiratory viruses and AOM highlights the indirect ENT benefits of upstream viral prevention, particularly RSV and influenza vaccination, while the high prevalence and educational impact of seasonal allergic rhinitis demand proactive diagnosis and treatment strategies. The COVID-19 era has revealed that pediatric respiratory seasonality is highly sensitive to changes in social behavior, suggesting that smart, time-limited public health measures could strategically reduce the burden of ENT disease in future severe seasons. Together, these insights support a more anticipatory, season-aware approach to pediatric ENT care, in which clinicians, families, and health systems collaborate to turn predictable seasonal risks into opportunities for targeted prevention and optimized resource planning.

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