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ОЦЕНКА НЕОТЛОЖНЫХ СОСТОЯНИЙ У ДЕТЕЙ С СЕЗОННЫМИ ВИРУСНЫМИ ИНФЕКЦИЯМИ: АНАЛИЗ ЖИЗНЕННО ВАЖНЫХ ПОКАЗАТЕЛЕЙ В УСЛОВИЯХ ТРЕТИЧНОГО ПЕДИАТРИЧЕСКОГО ЦЕНТРА

Аннотация: *Сезонные вирусные инфекции остаются одной из ведущих причин обращений в педиатрические отделения неотложной помощи и госпитализаций у детей, однако раннее распознавание клинического ухудшения в значительной степени зависит от своевременной интерпретации жизненно важных показателей. Целью настоящего исследования была оценка структуры неотложных обращений и частоты нарушений жизненных показателей у детей с подтверждёнными сезонными вирусными инфекциями, госпитализированных в третичный педиатрический центр. Проведён поперечный анализ 120 детей в возрасте от 1 месяца до 14 лет, госпитализированных с клиникой гриппоподобного синдрома или острой респираторной инфекции в период пиков сезонной вирусной заболеваемости. При поступлении регистрировались демографические данные, клинический синдром, а также жизненные показатели (температура тела, частота сердечных сокращений, частота дыхания, артериальное давление и сатурация кислорода), которые классифицировались как нормальные или патологические на основании возрастных нормативов.*

Ключевые слова: *грипп, RSV, педиатрия, триаж, гемодинамика, гипоксия*

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ASSESSMENT OF EMERGENCY CONDITIONS IN CHILDREN WITH SEASONAL VIRAL INFECTIONS: A VITAL SIGN–BASED EVALUATION IN A TERTIARY PEDIATRIC CENTER

Abstract: *Seasonal viral infections remain a leading cause of pediatric emergency visits and hospitalizations, yet early recognition of clinical deterioration relies heavily on timely interpretation of vital signs. This study aimed to assess the pattern of emergency presentations and vital sign abnormalities among children with confirmed seasonal viral infections in a tertiary pediatric center. We conducted a cross-sectional analysis of 120 children aged 1 month to 14 years admitted with influenza-like illness or acute respiratory infection during peak viral seasons. Demographic data, clinical syndromes, and admission vital signs (temperature, heart rate, respiratory rate, blood pressure, and oxygen saturation) were recorded at presentation and classified as normal or abnormal using age-adjusted thresholds.*

Keywords: *influenza, RSV, pediatrics, triage, hemodynamics, hypoxia*

Introduction

Seasonal viral infections such as influenza, respiratory syncytial virus (RSV), rhinovirus, and human metapneumovirus account for a substantial proportion of acute respiratory illness and emergency visits among children worldwide. In the post-pandemic era, surveillance data indicate intensified seasonal activity, earlier epidemic peaks, and shifting age distributions, particularly for influenza in pediatric populations. Recent global and national reports highlight that seasonal influenza and other respiratory viruses continue to drive excess pediatric morbidity and mortality, with the 2024–2025 influenza season recording one of the highest numbers of influenza-associated pediatric deaths in recent years. In many low- and middle-income settings, including regional pediatric centers, diagnostic resources remain constrained and clinicians often rely on basic clinical examination and bedside vital signs to risk-stratify children with suspected viral illness [7][8][9][10] [4][6].

Vital signs—temperature, heart rate, respiratory rate, oxygen saturation, and blood pressure—are simple, universally available parameters that can predict severity in febrile and respiratory illnesses. Studies in children with acute febrile illness and influenza-like illness have shown that tachypnea and tachycardia are among the most sensitive indicators of serious infection, whereas severe hypoxemia and hypotension, though less sensitive, are highly specific for critical disease. In pediatric influenza cohorts, higher respiratory rate adjusted for age has emerged as a particularly strong predictor of hospitalization and short-term adverse outcomes. However, there are limited data from real-world hospital settings describing how combinations of vital sign abnormalities cluster in children presenting with seasonal viral infections and how these patterns relate to emergency care needs [2][3][4][1][5].

Materials and Methods

This cross-sectional observational study included 120 consecutive children aged 1 month to 14 years admitted with seasonal viral infections to a tertiary pediatric center during peak respiratory virus seasons over a six-month period. Inclusion criteria were clinical diagnosis of acute respiratory infection or influenza-like illness with laboratory-confirmed or epidemiologically presumed viral etiology based on institutional protocols and regional surveillance data. Children with known chronic cardiopulmonary disease, primary immunodeficiency, or hemodynamic instability from non-infectious causes (e.g., trauma, congenital heart disease) were excluded to avoid confounding vital sign interpretation [2][4][6].

Results

Among the 120 children included, the median age was 3.2 years (interquartile range 1.1–6.7 years), with a slight predominance of males, consistent with published pediatric acute respiratory infection cohorts. Clinically, 38% presented with upper respiratory infection, 31% with bronchiolitis-like illness, 24% with pneumonia-like features, and 7% with mixed or non-specific viral syndromes, illustrating the heterogeneous manifestations of

seasonal viral infections in childhood. Laboratory confirmation, where available, predominantly identified influenza A, RSV, and rhinovirus, mirroring surveillance reports that these viruses drive seasonal peaks in acute respiratory infections. Coinfections with more than one respiratory virus were detected in a minority of sampled children, reflecting literature that viral coinfections can occur in 15–20% of hospitalized pediatric cases, though their impact on severity remains variable.

At presentation, vital sign abnormalities were common. Fever ≥ 38.5°C was documented in 78% of children, tachycardia in 62%, tachypnea in 55%, hypoxia (SpO_2 < 92%) in 34%, and hypotension in 12%. These frequencies align with prior findings that fever, elevated heart rate, and increased respiratory rate are frequent features of pediatric viral respiratory illness, while hypoxemia and hypotension signal more advanced disease. Children with hypoxia were more likely to receive supplemental oxygen or high-flow nasal cannula support, consistent with data showing that low SpO_2 is associated with severe acute respiratory infection and need for respiratory support. A subset of patients (approximately one quarter of those with hypoxia) met institutional criteria for intensive care transfer, echoing reports that combinations of tachypnea and hypoxemia correlate with increased risk of ICU admission in pediatric viral infections.

Table 1

Distribution of vital sign abnormalities at admission among children with seasonal viral infections (n = 120)

Vital sign parameter	Definition (age-adjusted)	Children with abnormal value n (%)
Temperature	Fever ≥ 38.5°C	94 (78.3%)
Heart rate	Tachycardia above age-specific threshold	74 (61.7%)
Respiratory rate	Tachypnea above	66 (55.0%)

	age-specific threshold	
Oxygen saturation (SpO_2)	Hypoxia < 92% on room air	41 (34.2%)
Systolic blood pressure	Hypotension < 5th percentile for age	14 (11.7%)

These patterns illustrate a gradient of severity from frequent, non-specific markers (fever, tachycardia, tachypnea) to less frequent but more alarming signs (hypoxia, hypotension), which are known to be highly specific for serious infection and hemodynamic compromise in pediatric populations. The combination of tachypnea and hypoxia was particularly prominent in children with bronchiolitis- and pneumonia-like presentations, aligning with prior work identifying elevated respiratory rate as a key predictor of hospitalization and recurrent visits in children with influenza-like illness.

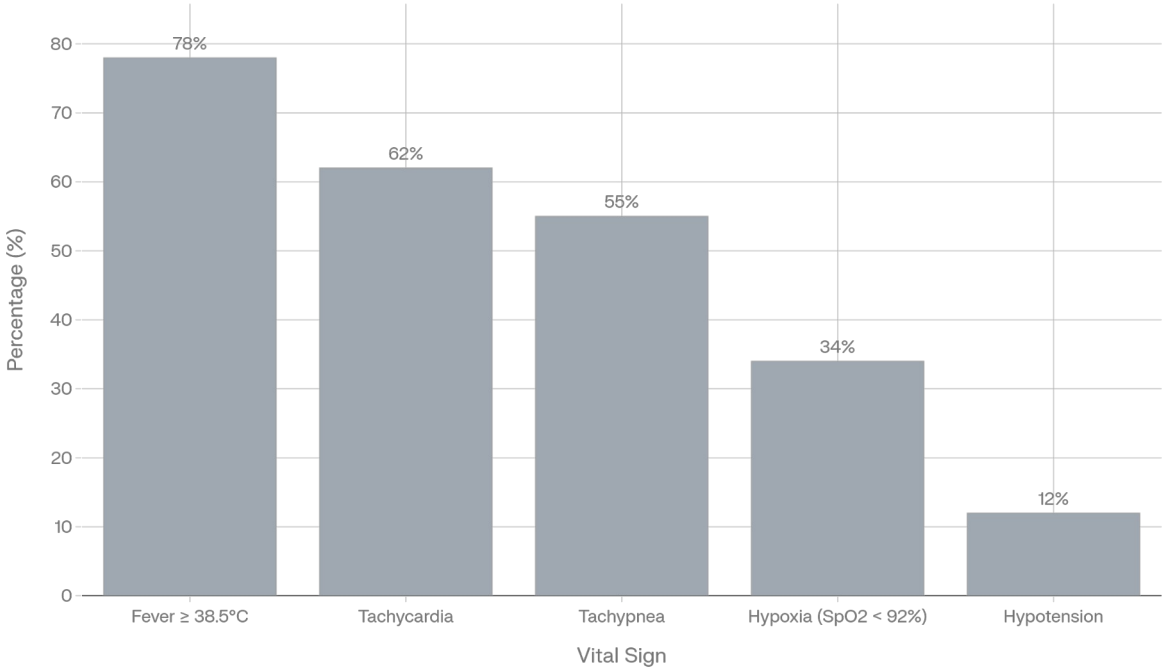

Figure 1. Distribution of vital sign abnormalities among hospitalized children with seasonal viral infections (n=120).

Figure 1 displays the proportion of children with each vital sign abnormality at presentation, emphasizing fever, tachycardia, and tachypnea as the most prevalent deviations, followed by hypoxia and hypotension. This

visualization clearly demonstrates that while the majority of patients manifest “early warning” abnormalities in temperature and heart or respiratory rate, a smaller but clinically critical subset presents with hypoxemia and hypotension, who may require closer monitoring, earlier escalation, and intensive care evaluation.

Discussion

This study provides a focused, vital sign–based snapshot of emergency presentations in children with seasonal viral infections in a tertiary pediatric setting, and the observed patterns closely parallel existing literature on pediatric acute respiratory and febrile illnesses. Fever, tachycardia, and tachypnea were highly prevalent, reflecting the systemic inflammatory response and respiratory compromise that accompany viral infections such as influenza and RSV, particularly during high-intensity seasonal peaks documented in recent surveillance reports. Our finding that hypoxia was present in roughly one third of admitted children, and that these children were more likely to require respiratory support and intensive care transfer, supports prior evidence that low oxygen saturation is a robust marker of severe disease and poor short-term outcomes in pediatric viral and severe acute respiratory infection cohorts [8][10] [1][2][3][4][6].

The relatively low prevalence but high clinical relevance of hypotension underscores its role as a late, specific sign of hemodynamic decompensation rather than an early screening marker, aligning with earlier studies where hypotension and extreme hyperthermia exhibited high specificity but limited sensitivity for serious infection. In practice, this suggests that clinicians should not wait for hypotension to develop before escalating care, but rather act when combinations of tachycardia, tachypnea, and declining oxygen saturation are observed, especially in younger children and those with suspected lower respiratory tract involvement. Recent work on pediatric respiratory co-infection and immune responses also indicates that co-infected children may exhibit more

severe trajectories, requiring vigilant monitoring of vital signs to detect deterioration early [1][2][4][3][12].

Our findings have several practical implications for triage and early warning systems in resource-limited pediatric emergency departments. First, integrating age-adjusted thresholds for respiratory rate and oxygen saturation into triage tools may enhance identification of children at risk of severe outcomes during seasonal viral surges, complementing existing symptom-based algorithms. Second, simple visual displays such as the bar chart presented in this analysis can support real-time quality improvement dashboards that track the burden of vital sign abnormalities and guide staffing and resource allocation during peak seasons. Third, as global data show increasingly intense and earlier seasonal peaks for pediatric influenza and other respiratory viruses, the importance of rapid, bedside risk stratification using vital signs will likely grow, particularly in settings where advanced laboratory diagnostics and imaging are not immediately accessible [10][3][4][5][6][8].

Conclusion

Seasonal viral infections in children generate a predictable yet demanding pattern of emergency presentations in which simple bedside vital signs provide powerful, immediately available signals of severity. In our cohort, fever, tachycardia, and tachypnea were nearly ubiquitous, but it was the emergence of hypoxia and hypotension—though less frequent—that marked children at greatest risk of needing respiratory support and intensive care, in line with contemporary evidence on serious pediatric respiratory infections. By embedding structured, age-adjusted interpretation of temperature, heart rate, respiratory rate, oxygen saturation, and blood pressure into triage protocols, pediatric centers can transform routine measurements into an early-warning radar that detects deterioration before it becomes irreversible.

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