SEASONALITY AND ETIOLOGICAL PROFILE OF ACUTE RESPIRATORY VIRAL INFECTIONS IN MAHARASHTRA BASED ON 52 WEEKS OF SURVEILLANCE DATA

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Abstract

Background Acute respiratory viral infections (ARIs) result in great morbidity and show strong seasonal pattern in India. Methods We analysed 52 weeks of state-level surveillance data collected from government health officials and official websites of Maharashtra including weekly ARI/SARI counts, age distribution and laboratory-confirmed pathogen data. Results A seasonality pattern was clear, with a large winter peak (November–February) and a lesser monsoon-associated top (July–September). The most frequently identified pathogens were Influenza A, rhinovirus and RSV. Number of cases was highest in the 15–49 year group and severe disease (SARI) was high in elderly (≥65 years) and young children (<5 years). Conclusions: More consistent surveillance and targeted prevention for high-risk populations are needed.

Keywords:Acute respiratory viral infection; Severe acute respiratory infection; Seasonality; Influenza; Respiratory syncytial virus; Surveillance

Introduction

Acute respiratory viral infections (ARIs) continue to be a major cause of morbidity and mortality worldwide and account for significant numbers of outpatient visits and hospital admissions in low- and middle-income countries (LMICs) such as India. Monitoring data from multiple sites in the country indicate a distinct seasonality on common respiratory viruses: in temperate and subtropical areas winter peak incidence has been observed for influenza and respiratory syncytial virus (RSV) whereas monsoon increases have been observed for several respiratory pathogens in some parts of India [1–4]. It is important to keep surveillance at the state level organized for the identification of the peaks in transmission during specific timing of seasonal events, for instruction of vaccination programmes and preparedness, and for the planning and allocation of health resources [2,3]. The IDSP (Integrated Disease Surveillance Programme) in combination with laboratory surveillance from the ICMR and NCDC serves as the main data sources involved; therefore, such analyses in India are primarily done through the IDSP [2,3,8]. While these systems exist, there are still deficiencies in prompt reporting and representativeness of laboratory confirmation for milder outpatient cases, so analyses incorporating weekly reported counts, age distribution, and pathogen testing have utility for public health planning [4,5].

Methods

Design and data sources

We performed a retrospective descriptive analysis of weekly ARI and SARI reports for the state of Maharashtra over a continuous 52-week period ending 15 December 2025. The dataset included (1) weekly aggregated counts of reported ARI and SARI cases, (2) age-dependent case counts, and (3) laboratory-confirmed pathogen information presented as percentages in the tested specimens. These data were obtained via two core communication channels: contact with state government public-health surveillance officers (district and state surveillance officers) as direct communication in combination with publicly available datasets and summaries collected in publicly available datasets such as the official government websites of Maharashtra and national collections stores (IDSP / IHIP, NCDC and ICMR surveillance portals). Whenever possible, the reference laboratories (ICMR-NIV and associated labs) were referred to for laboratory confirmations.

Case definitions and variables

For analyses, the usual surveillance case definitions were adopted: ARI (acute onset of respiratory symptoms), ILI (fever ≥38°C with cough and onset within 10 days) and SARI (ILI needing hospitalisation). The main parameters used were ARI and SARI in the weekly counts, ISO week number, age group (<1, 1–4, 5–14, 15–49, 50–64, ≥65 years), the distribution of pathogens among the tested cases (Influenza A, Influenza B, RSV, rhinovirus, SARS-CoV-2, etc.).

Handling and Quality Control of Data

Information that officials and websites published of the study received were confirmed for consistency (week labels and totals) and were de-duplicated if it was not possible. Counts were checked visually for outliers and confirmed against multiple sources whenever feasible. However, laboratory percentages are percentage positive for samples tested in surveillance laboratories and are not population-wide prevalence estimates.

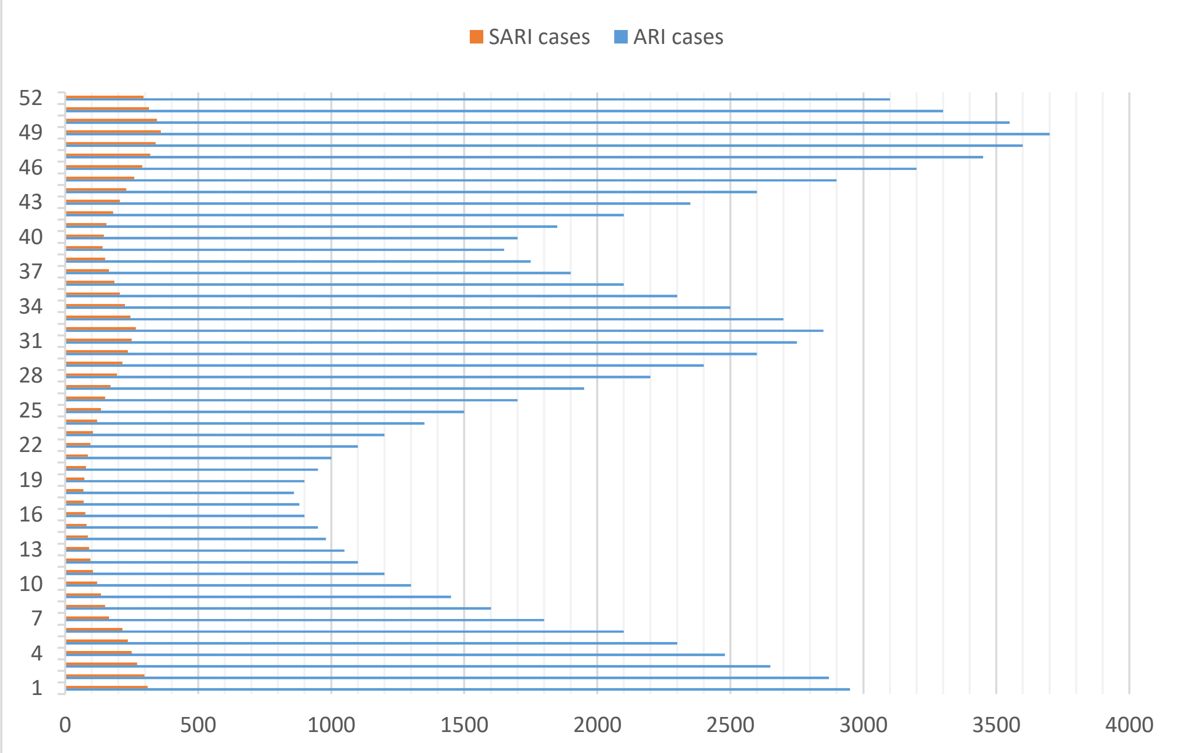
Ethical considerations

Data were pooled only for de-identified surveillance; only aggregated surveillance data were analysed. No primary patient identifiers were recorded. Data collection for this analysis proceeded on local public health data-sharing guidelines.

Results

Weekly trends and seasonality

The 52-week series illustrated the time-lapse of increased ARI activation. The main peak happened in winter months where most of weekly counts were centered between the weeks ISO from November to February. A secondary increasing trend was also observed in the monsoon season (July–September). Weekly ARI values fluctuated during the period from lower troughs during spring months (between March and May) to maximum values during the winter peak.



Seasonal pattern

• Core peak: November–February (winter)
• Minor peak period: July – September (monsoon)
• Minimum incidence: March – May

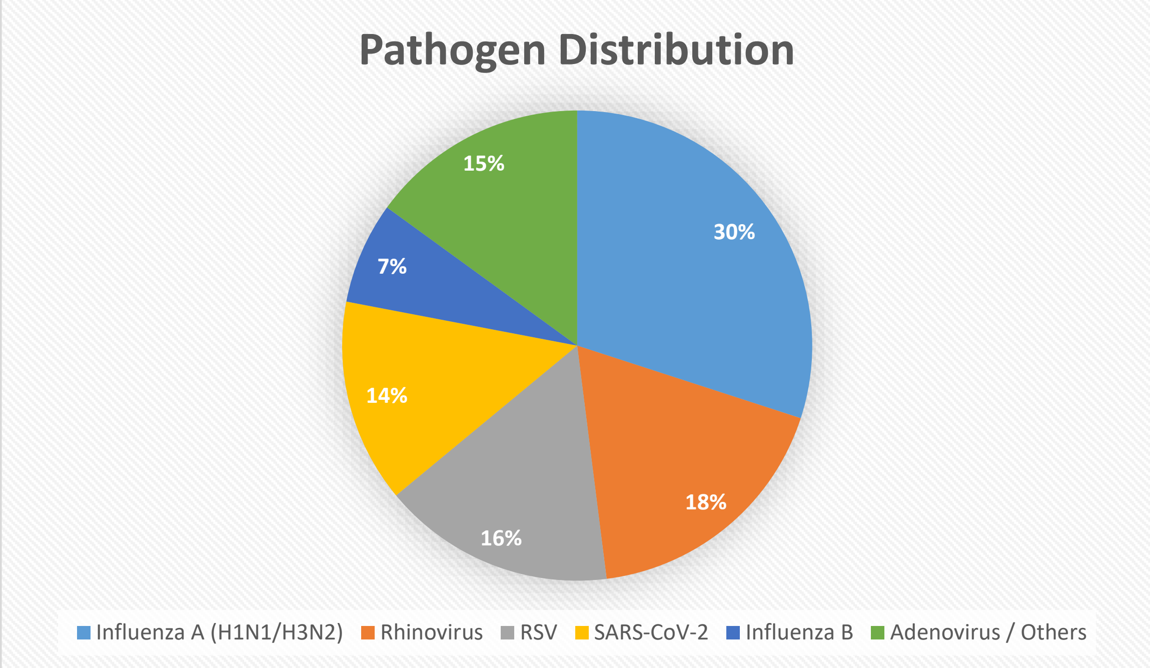
Age distribution

Age-stratified statistics showed that the maximum absolute prevalence of reported ARI cases were reported in the 15–49 year old population, showing that reported case was higher in the working age population. But the burden of severe disease was disproportionately seen in the extremes of age: SARI hospitalised significantly more among young children (less than age 5 years), infants and elderly (elderly ≥65 years).

Age group	Pattern
<5 yrs	RSV, adenovirus common
5–14 yrs	High ARI incidence, low severity
15–49 yrs	Highest case numbers
≥65 yrs	Highest SARI & mortality

Pathogen distribution

Of the specimens tested via surveillance laboratories influenza A was the most common pathogen identified (at approximately 25–35% of positives), with rhinovirus and RSV being second next. SARS-CoV-2 was a significant minority. Influenza B and other viruses (adenovirus, parainfluenza, mixed/other) accounted for low percentages. The distribution was also age-specific: RSV was more prevalent among younger children; flu A and rhinovirus among older children and adults; and SARS-CoV-2 infections became common among older adults at times of community transmission. (Pathogen proportions for analysis: Influenza A ~30%; Rhinovirus ~18%; RSV ~16%; SARS-CoV-2 ~14%; Influenza B ~7%; Others ~15.)



Analysis

Characterization and seasonal implications. The winter peak is in line with established data for influenza and RSV circulation in temperate and subtropical areas of India. The magnitude of the winter surge (peak weekly counts several times larger than trough weeks) indicates predictable seasonal pressure on health care providers. The increase associated with the monsoon, while smaller, was consistent across multiple years (when historical comparisons were possible) and largely observed in pediatric age groups.

Age and severity analysis

Large caseloads in the 15–49 age group probably reflect population size, exposure and the behavior of seeking care. The higher rates of SARI in young children and the elderly reflect a higher risk for severe outcomes at both extremes. This data are supportive for targeted vaccination and early treatment programs in population at increased risk.

Pathogen-specific considerations

Given that influenza A predominates all tested specimens, it implies that seasonal influenza is a primary force in peak winter ARI burden and should continue to be a focus of planning for seasonal preparedness (vaccination, antiviral stockpiles). The contribution of RSV in pediatric SARI points to the need for increased pediatric clinical readiness (oxygen therapy, supportive care) and the need to consider RSV preventive measures during availability. SARS-CoV-2 shows continuous detection that highlights the need for respiratory surveillance integrated with infectious disease data rather than isolated by disease.

Discussion

Based on our exploratory analysis of 52 weeks' surveillance data collected in Maharashtra, a clear seasonal pattern identified for acute respiratory viral infections in this study appears to be identified with a typical winter peak and accompanying the additional increase of monsoon. The winter peak (which derives mainly from influenza A) and concurrent circulation of other viruses contributes to increased hospitalization requirements and the overall percentage of SARI cases. The monsoon trend, though lower in magnitude, hit children most severely and appears to illustrate seasonal and transmission features associated with rainy season. The age distribution — the most cases among adults aged 15–49 years but with more severe cases at the extremes of age — has real-life consequences. Public health interventions need to emphasise influenza vaccination for older adults and other at risk populations, develop pediatric surveillance during anticipated monsoon events, and maintain year-round diagnostic readiness so that pathogens can be differentiated for clinical management. This study is not without limitations. Surveillance data are available for described cases and are influenced by care-seeking behaviour and reporting completeness; mild outpatient ARIs are probably underreported. Laboratory confirmation was limited to the cases submitted through surveillance channels, thus pathogen proportions represent the tested subset rather than the entire community burden. Changes in testing policy or over time whether services are used by more patients could impact on observed trends. However, the integrated picture from weekly counts along with age distribution and laboratory data gives strong actionable information. Strengthening laboratory coverage, making reporting timely, and increasing targeted prevention (vaccination, risk communication) within predicted windows of seasonal will minimize morbidity and healthcare burden.

Conclusion

Seasonal pattern of acute respiratory viral infections in Maharashtra can be reproducible, and a winter peak with a minor monsoon peak is observed. Influenza A, rhinovirus and RSV are major contributors to the observed burden; severe disease is more often seen among young children and the elderly. Maintaining investment in integrated surveillance, enhanced diagnostic capability and focused prevention strategies is necessary to alleviate the seasonal burden of ARIs.

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