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Quantifying the Burden of Selected Severe Acute Respiratory Illnesses (SARI) in Sri Lankan Hospitals: A 2025 eIMMR ICD-10 Data Study

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ABSTRACT

Background and aim: Severe acute respiratory infection (SARI) is a syndromic concept widely used for respiratory disease surveillance and burden estimation. In settings where routine clinical case definition fields are not consistently recorded, ICD-10 discharge diagnoses can be used as a pragmatic proxy to quantify inpatient burden and severe outcomes. The aim is to describe the 2025 inpatient burden, outcomes, sex distribution, and seasonal patterns of selected respiratory diseases commonly used to represent SARI in Sri Lanka.

Method: The eIMMR (electronic Indoor Morbidity and Mortality Register) data extracted from January–December 2025, containing monthly aggregated inpatient admissions by discharge outcome and sex for four ICD-10 groupings aligned to SARI: influenza (J09–J11), pneumonia (J12–J18), other acute lower respiratory infections (ALRI; J20–J22), and ARDS (J80). A hierarchical SARI grouping was defined for analysis and reporting. The annual admissions and deaths, case fatality proportion (CFP; deaths/admissions), transfers, leave against medical advice (LAMA), sex distribution, and peak months were summerized.

Results: In 2025, the selected SARI-coded respiratory diagnoses accounted for 232,679 admissions and 6,432 in-hospital deaths (overall CFP 2.8%); 49.2% of admissions were female. Other ALRI (J20–J22) contributed 83.9% of admissions (195,237) but 12.6% of deaths (812; CFP 0.4%). Pneumonia (J12–J18) accounted for 14.0% of admissions (32,543) yet 86.6% of deaths (5,573; CFP 17.1%). Influenza (J09–J11) comprised 4,700 admissions (CFP 0.3%). ARDS (J80) was uncommon (199 admissions) but had high CFP (16.6%). Admissions peaked in April–May (seasonal maximum May: 29,908) and showed a secondary rise in October–November.

Conclusion: In 2025, SARI-proxy inpatient burden in Sri Lanka was dominated by ALRI volume, while mortality was overwhelmingly concentrated among pneumonia-coded admissions. Strengthening pneumonia prevention, early severity recognition, oxygen/critical care readiness, and improving etiologic diagnosis and coding completeness are key priorities for reducing SARI-associated mortality and improving surveillance precision.

KEYWORDS: Burden of Selected Severe Acute Respiratory Illnesses (SARI), eIMMR data, ICD-10 Data Study.

INTRODUCTION

Severe acute respiratory infection (SARI) is a clinically defined syndrome that has become central to global respiratory disease surveillance because it captures episodes of acute, serious respiratory illness requiring hospitalization. The World Health Organization (WHO) defines SARI as an acute respiratory infection with a history of fever or measured fever ≥ 38 °C, cough, symptom onset within the previous 10 days, and the need for inpatient care (1). This standardized definition allows consistent monitoring of severe respiratory disease across countries and over time and serves as a core platform for surveillance of pathogens such as seasonal influenza, SARS-CoV-2, and respiratory syncytial virus (RSV), which collectively account for substantial global morbidity and mortality (2–4).

SARI surveillance is particularly valuable because severe respiratory infections frequently result in significant healthcare utilization, hospital crowding, and preventable deaths, especially among young children, older adults, and individuals with comorbidities (5,6). Reliable estimation of the burden of these illnesses is therefore essential for guiding vaccination strategies, clinical preparedness, and resource allocation (7). However, applying the clinical SARI case definition at scale is challenging in routine hospital

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information systems. Key clinical variables such as measured temperature, cough history, or exact symptom onset dates are often not recorded in structured electronic formats, limiting the direct use of syndromic definitions for large administrative datasets (8).

To address these limitations, many surveillance systems use hospital discharge diagnoses coded using the International Classification of Diseases, 10th Revision (ICD-10), as a practical proxy for identifying severe respiratory disease (9). ICD-10 coding provides a standardized, routinely collected, and nationally comparable data source that enables retrospective and prospective assessment of admission trends and outcomes. Although ICD-10-based approaches cannot fully replicate the clinical SARI definition, they offer a consistent and scalable method to approximate disease burden, particularly when focused on diagnostic categories representing acute lower respiratory infections (ALRI), pneumonia, influenza, bronchiolitis, and severe complications such as acute respiratory distress syndrome (ARDS) (10,11).

Several studies have demonstrated that ICD-10 codes for influenza (J09–J11), pneumonia (J12–J18), and other lower respiratory infections correlate well with laboratory-confirmed severe respiratory infections and can reliably track seasonal epidemics and pandemic waves (12,13). These proxy approaches have been widely used in national surveillance systems in Europe and other settings to estimate hospitalization rates, describe age and sex distributions, and quantify in-hospital mortality attributable to severe respiratory pathogens (14). Consequently, ICD-10-based surveillance has become an accepted and practical complement to sentinel clinical SARI surveillance, particularly in settings where complete symptom data are unavailable (15).

In Sri Lanka, the public sector inpatient morbidity and mortality reporting system—electronic Indoor Morbidity and Mortality Reporting (eIMMR)—collects aggregated hospital discharge data with ICD-10 diagnoses from government hospitals nationwide. This system provides a valuable opportunity to examine national-level patterns in hospital admissions and outcomes for major respiratory diseases. Understanding which diagnostic groupings contribute most to admission volume and which are associated with higher in-hospital mortality is critical for prioritizing prevention strategies, strengthening clinical management pathways, optimizing referral systems, and improving seasonal preparedness for respiratory epidemics.

Accordingly, this study describes the 2025 disease burden of selected respiratory diseases categorized as SARI proxies in Sri Lanka using aggregated eIMMR ICD-10 hospital data. By focusing on hospital admission counts and discharge outcomes, and examining differences by sex and seasonality, this analysis aims to provide a comprehensive picture of the relative contributions of major respiratory diagnostic categories to hospital workload and mortality. Such evidence is essential for strengthening respiratory surveillance and informing data-driven public health planning and resource allocation within the Sri Lankan health system.

JUSTIFICATION

Severe respiratory infections remain a leading cause of hospitalization and mortality worldwide, particularly among children, older adults, pregnant women, and individuals with chronic comorbidities (16,17). In low- and middle-income countries, the burden is often amplified by seasonal surges, delayed healthcare seeking, limited critical care capacity, and constrained diagnostic resources, resulting in preventable complications and deaths (18). Despite this recognized burden, reliable national estimates of severe acute respiratory infection (SARI)–related hospitalizations are frequently unavailable because many health systems lack structured clinical surveillance capable of capturing symptom-based case definitions at scale (19).

In Sri Lanka, while respiratory infections are consistently reported among the leading causes of inpatient morbidity within the government sector, detailed analyses that quantify the contribution of specific respiratory diagnostic categories to hospital workload and in-hospital outcomes remain limited. Routine administrative datasets are underutilized for epidemiologic assessment, even though they provide comprehensive nationwide coverage and standardized diagnostic coding (20). The electronic Indoor Morbidity and Mortality Reporting (eIMMR) system, which aggregates ICD-10 discharge diagnoses from public hospitals, represents a valuable yet largely untapped source for estimating disease burden and monitoring temporal patterns in severe respiratory illness.

Using ICD-10–coded hospital discharge data as proxies for SARI provides several practical advantages. First, these data enable continuous, population-level surveillance without the need for additional data collection infrastructure, thereby improving feasibility and sustainability (21). Second, ICD-based methods allow rapid assessment of admission volumes, mortality, and demographic distributions, supporting early detection of seasonal increases or unusual respiratory events (22). Third, such analyses facilitate evidence-based resource allocation by identifying high-burden diagnostic groups that may require strengthened vaccination strategies, clinical protocols, oxygen and intensive care capacity, and referral mechanisms (23). Countries that have implemented administrative data–based respiratory surveillance have demonstrated improved situational awareness and more timely public health responses during influenza epidemics and the COVID-19 pandemic (24).

For Sri Lanka specifically, understanding the national burden of SARI-proxy conditions is critical for several reasons. Seasonal respiratory epidemics contribute to fluctuations in bed occupancy and strain on tertiary facilities, while high-risk populations may experience disproportionate mortality (25). Quantifying admission and outcome patterns by sex and season can inform targeted preventive strategies, including immunization campaigns, risk communication, and hospital preparedness planning. Furthermore, establishing baseline trends using 2025 eIMMR data will provide a reference point for evaluating future interventions, emerging pathogens, and health system resilience.

Therefore, a systematic analysis of aggregated ICD-10 hospital admissions data to estimate the burden of selected respiratory diseases categorized as SARI proxies is both timely and necessary. Such evidence will strengthen national respiratory surveillance, enhance policy planning, and support data-driven decision-making aimed at reducing avoidable morbidity and mortality in Sri Lanka

OBJECTIVES

To quantifying the burden of selected severe acute respiratory illnesses (sari) in Sri Lankan hospitals using 2025 eIMMR ICD-10 data study.

METHODS

Study design and data source

We conducted a descriptive analysis of January–December 2025 monthly aggregated inpatient admissions extracted from eIMMR analytics. The extract contained monthly counts of admissions by discharge outcome (live discharge, in-hospital death, transfer, leave against medical advice [LAMA], missing outcome) and sex (male/female) for selected ICD-10 groupings.

ICD-10 groupings and SARI proxy definition

Because SARI is a syndromic definition rather than a single ICD-10 diagnosis, we used four ICD-10 groupings commonly employed as proxies for SARI-related hospitalizations: influenza (J09–J11), pneumonia (J12–J18), other ALRI (J20–J22), and ARDS (J80). We defined a hierarchical classification for analytic clarity and to align with severity-first interpretation (Table 1).

Outcomes and measures

Primary measures were total admissions, in-hospital deaths, case fatality proportion (CFP = deaths/admissions), sex distribution, transfers, LAMA, and month of peak admissions. We also examined monthly time patterns for total SARI-proxy admissions and deaths.

Analysis

We summarized annual totals and proportions for each ICD-10 grouping and for the combined SARI-proxy envelope. Month names were standardized and ordered chronologically. All analyses were performed on aggregated data; therefore, age, district, comorbidity profiles, ICU admission, ventilation, and length of stay could not be evaluated.

Ethical considerations

This analysis used aggregated, non-identifiable routine health information system outputs for descriptive public health reporting; no individual-level patient data were accessed.

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Table 1. ICD-10 groupings used as SARI proxies and hierarchical classification applied in analysis

Level	Group (mutually exclusive in reporting)	ICD-10 codes included	Rationale / interpretation
Step 1 (highest severity)	ARDS	**J80**	Severe respiratory complication indicating critical illness; small volume but high fatality.
Step 2	Influenza	**J09–J11**	Influenza admissions (identified/unspecified) commonly monitored within SARI surveillance.
Step 3	Pneumonia	**J12–J18**	Core SARI burden category; typically highest mortality among acute respiratory diagnoses.
Step 4	Other ALRI	**J20–J22**	Captures acute bronchitis, bronchiolitis, and unspecified acute lower respiratory infection; often high volume.

Note: In this dataset, each ICD-10 grouping was available as a separate monthly aggregate; the hierarchy is provided to frame severity and to standardize reporting across SARI proxy categories.

RESULTS

Overall, SARI-proxy admissions and deaths (2025)

Across the four selected SARI-proxy diagnostic groupings, there were 232,679 inpatient admissions recorded in 2025 and 6,432 in-hospital deaths, yielding an overall CFP of 2.8%. Admissions were nearly sex-balanced (49.2% female).

Admissions showed a clear seasonal pattern, peaking during April–May (highest month May: 29,908 admissions; April: 29,658) and reaching a minimum in December (9,741), with August–September also relatively low. A secondary rise was observed in October–November (19,539 and 20,427 admissions, respectively). Deaths followed a similar pattern, highest in May (969) and elevated in March–April (712–729).

Burden by diagnostic grouping

The distribution of admissions and deaths differed markedly by diagnosis group (Table 2).

Influenza (J09–J11)

contributed 4,700 admissions (2.0%) with 14 deaths (CFP 0.3%). Influenza admissions peaked in October (930), aligning with the secondary rise in total respiratory admissions during October–November.

Pneumonia (J12–J18)

represented a smaller portion of admissions (32,543; 14.0%) but overwhelmingly dominated mortality (5,573 deaths; 86.6% of all deaths), with a very high CFP (17.1%). Pneumonia admissions peaked in May (4,097), and pneumonia deaths were the main driver of the May mortality peak.

Other ALRI (J20–J22) accounted for the vast majority of admissions (195,237; 83.9%) but a small share of deaths (812; 12.6%), reflecting low CFP (0.4%). This group drove the seasonal volume peak, with a maximum in April (25,301 admissions).

ARDS (J80) was rare (199 admissions) but had high CFP (16.6%) and a peak in April (38 admissions), consistent with its role as a marker of critical illness.

Transfers, LAMA, and sex distribution

Transfers were most prominent in Other ALRI (11,964 transfers) and Pneumonia (1,813 transfers), likely reflecting referral flows for severity escalation and availability of specialized care. LAMA was also most frequent in Other ALRI (7,013), consistent with high patient volume categories. Male admissions were slightly higher than female across all groups, most notably in ARDS (male 63.3%).

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Table 2. 2025 admissions and outcomes for selected SARI-proxy respiratory diagnoses in Sri Lanka (hospital admissions, aggregated)

Group	Admissions	% of all SARI-proxy admissions	Male %	Female %	Deaths	CFP % (deaths/ admissions)	% of all SARI-proxy deaths	Transfers	LAMA	Peak month (admissions)
ARDS (J80)	199	0.1	63.3	36.7	33	16.6	0.5	17	2	April (38)
Influenza (J09–J11)	4,700	2.0	51.6	48.4	14	0.3	0.2	79	47	October (930)
Pneumonia (J12–J18)	32,543	14.0	51.7	48.3	5,573	17.1	86.6	1,813	351	May (4,097)
Other ALRI (J20–J22)	195,237	83.9	50.6	49.4	812	0.4	12.6	11,964	7,013	April (25,301)
Total	**232,679**	**100.0**	**50.8**	**49.2**	**6,432**	**2.8**	**100.0**	—	—	**May (29,908)**

DISCUSSION

This national analysis of 2025 eIMMR hospital discharge data provides one of the first comprehensive descriptions of the burden of severe acute respiratory infection (SARI)–proxy respiratory diseases in Sri Lanka using ICD-10–coded inpatient data. Overall, more than 230,000 admissions and over 6,400 in-hospital deaths were attributed to four selected SARI-proxy diagnostic groupings, yielding a case fatality proportion (CFP) of 2.8%. These findings highlight the substantial contribution of severe respiratory illnesses to hospital workload and mortality in the public sector and underscore the value of administrative hospital data for routine respiratory surveillance, particularly in settings where syndromic clinical definitions cannot be consistently applied (21,22,26).

Overall burden and seasonality

The clear seasonal pattern observed, with peaks during April–May and a secondary increase in October–November, aligns with known influenza and respiratory virus circulation patterns in tropical and subtropical settings, where bimodal or monsoon-associated peaks are frequently described rather than a single winter surge typical of temperate climates (27,28). Similar seasonal fluctuations in SARI admissions have been reported across South and Southeast Asia, where climatic factors, school cycles, and population mixing influence transmission dynamics (29). The close temporal alignment between admission peaks and mortality peaks further supports the interpretation that increased transmission of respiratory pathogens directly translates into greater healthcare demand and worse outcomes during high-burden months.

These findings reinforce the importance of seasonal preparedness measures, including surge bed capacity, oxygen availability, vaccination campaigns, and early case management protocols, to mitigate excess mortality during predictable respiratory peaks (7,24,30).

Diagnostic grouping patterns and mortality concentration

A key observation of this study is the marked heterogeneity in disease burden across diagnostic groupings. Although “Other ALRI” accounted for the overwhelming majority of admissions, this category was associated with very low CFP, suggesting that many admissions represent milder or self-limiting lower respiratory infections requiring supportive care. Similar patterns have been reported in hospital administrative datasets in Europe and Asia, where large volumes of bronchitis and bronchiolitis admissions contribute substantially to bed occupancy but relatively little to mortality (12,31).

In contrast, pneumonia contributed a smaller share of admissions yet accounted for nearly nine in ten deaths, with a notably high CFP. This concentration of mortality within pneumonia diagnoses is consistent with global evidence identifying pneumonia as the leading cause of severe respiratory infection–related death across age groups (5,16,32). Hospital-based studies have similarly shown that pneumonia admissions disproportionately require advanced care, oxygen therapy, and intensive monitoring, which explains their stronger association with fatal outcomes (33). From a policy perspective, these findings suggest that targeted improvements in pneumonia prevention—such as vaccination, early antibiotic treatment, and standardized clinical pathways—may yield the greatest mortality reductions relative to overall respiratory admissions.

ARDS, although rare, demonstrated a very high CFP, reflecting its role as a marker of critical illness rather than a primary diagnosis. This is consistent with international data showing that ARDS is typically associated with severe viral or bacterial pneumonia and carries substantial mortality despite intensive care support (34). Therefore, the presence of ARDS codes within administrative data may serve as an indicator of the most severe end of the respiratory disease spectrum and may be useful for monitoring critical care burden.

Influenza and epidemic signals

Influenza admissions represented a small proportion of total admissions and deaths, yet showed a distinct peak in October, corresponding to the secondary rise in overall respiratory admissions. This pattern suggests that influenza likely contributes to seasonal surges but may be underrepresented in administrative data due to under-testing, limited laboratory confirmation, or non-specific coding practices. Similar underestimation of influenza burden when relying solely on discharge diagnoses has been documented in other settings, where laboratory surveillance often identifies a higher true burden than administrative codes alone (13,35). Consequently, ICD-10 influenza codes may best be interpreted as markers of epidemic timing rather than absolute burden.

Transfers, LAMA, and health system implications

The high number of inter-facility transfers, particularly within the pneumonia and ALRI groups, likely reflects referral of severe cases from peripheral hospitals to higher-level centers. Such patterns highlight the importance of regional referral networks and may signal disparities in access to advanced respiratory care, including oxygen therapy and intensive care services. Similarly, the relatively frequent "leave against medical advice" (LAMA) outcomes within high-volume categories may indicate social or financial barriers to prolonged inpatient care. These system-level indicators, captured through administrative data, provide valuable operational insights beyond clinical outcomes alone (22,23).

The near sex balance in admissions, with slightly higher male representation, aligns with prior reports indicating modest male predominance in respiratory infection hospitalizations, potentially related to differential exposure risks, smoking prevalence, and health-seeking behavior (36).

Implications for surveillance and policy

Taken together, these findings support the use of ICD-10–based SARI proxy surveillance as a feasible and informative approach for monitoring severe respiratory disease burden at national scale. While such data cannot fully substitute for clinical or laboratory surveillance, they provide continuous, population-wide coverage and enable timely estimation of hospital workload, mortality, and seasonal trends (9,26). Integrating administrative data analysis with sentinel laboratory surveillance could therefore strengthen Sri Lanka's respiratory disease early warning capacity and inform resource planning.

Importantly, the disproportionate mortality associated with pneumonia suggests that prevention and early management strategies should prioritize this diagnostic group. Interventions such as vaccination, standardized treatment protocols, improved oxygen systems, and strengthened referral pathways may have the greatest potential to reduce deaths. Establishing routine annual analyses of eIMMR respiratory admissions could further support trend monitoring and evaluation of public health interventions over time.

LIMITATIONS

This study has several limitations inherent to the use of aggregated administrative hospital discharge data. First, the identification of SARI cases relied on ICD-10 diagnostic codes rather than the clinical syndromic definition, and therefore may have resulted in misclassification, as codes cannot capture symptom onset, measured fever, or laboratory confirmation (9,21,37). Second, variability

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in clinician documentation and hospital coding practices may introduce under- or over-estimation of certain diagnoses, particularly influenza, which is often underdiagnosed without routine testing (13,35). Third, the use of aggregated data limited patient-level analyses, precluding adjustment for age, comorbidities, severity markers, or readmissions, which are known determinants of outcomes in severe respiratory infections (32,33). Additionally, outcomes such as transfers and leave-against-medical-advice (LAMA) may obscure final clinical status if deaths occur after referral or discharge. Finally, the findings primarily reflect the public sector and may not fully represent private hospital admissions. Despite these constraints, administrative datasets remain a pragmatic and scalable source for estimating national burden and temporal trends where comprehensive clinical surveillance is not feasible (22,26,38)

CONCLUSION AND RECOMMENDATIONS

This nationwide analysis demonstrates that SARI-proxy respiratory diseases contribute substantially to hospital admissions and mortality in Sri Lanka, with clear seasonal peaks and marked differences in severity across diagnostic groupings. Although most admissions were attributable to other acute lower respiratory infections, pneumonia accounted for the overwhelming majority of deaths, highlighting its disproportionate contribution to severe outcomes. The concentration of mortality within a relatively small subset of diagnoses underscores the need for focused prevention and early management strategies. Importantly, the study shows that routinely collected eIMMR ICD-10 data can provide meaningful insights into national respiratory disease burden, seasonal trends, and healthcare utilization, thereby serving as a practical complement to sentinel clinical and laboratory surveillance systems.

Based on these findings, several programmatic actions are recommended. First, strengthening pneumonia prevention and management—including vaccination, early diagnosis, standardized treatment protocols, and improved oxygen and critical care capacity—should be prioritized to reduce mortality. Second, routine annual analysis of eIMMR respiratory admissions should be institutionalized to support early detection of seasonal surges and guide preparedness planning. Third, integrating administrative data with laboratory and sentinel SARI surveillance would enhance accuracy and enable pathogen-specific assessments. Finally, improving coding quality, expanding digital data capture, and incorporating key clinical variables into hospital information systems would further refine burden estimation and strengthen evidence-based public health decision-making. Together, these measures can enhance Sri Lanka's capacity to anticipate, monitor, and mitigate the impact of severe respiratory infections on the health system and population.

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