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ACUTE RESPIRATORY ILLNESS AMONG UNDER-FIVE CHILDREN IN SULLIA TALUK, DAKSHINA KANNADA DISTRICT: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Acute respiratory infections (ARI) are a leading cause of morbidity and mortality among children under five years globally, accounting for nearly 20% of all under-five deaths. India bears a disproportionately high share of this burden, with ARI responsible for 30–50% of paediatric outpatient visits and 20–40% of hospital admissions.**Objectives:** To estimate the prevalence of ARI among under-five children in Sullia Taluk, Dakshina Kannada District, Karnataka, and to identify associated socio-demographic and household risk factors. **Methods:** A community-based, cross-sectional study was conducted from January to March 2024 among 380 children aged under five years who had resided in Sullia Taluk for at least six months. Data were collected through structured caregiver interviews and clinical examination. Chi-square tests were used for statistical analysis ($p < 0.05$ considered significant).**Results:** The overall prevalence of ARI was 55.26% (210/380). Running nose and cough were the most common symptoms. Statistically significant associations were found with age group (highest in 0–12 months, 62%), household overcrowding, birth order, number of siblings, maternal literacy, and breastfeeding duration (all $p < 0.05$). Birth weight below 2.5 kg was not significantly associated with ARI. **Conclusion:** ARI burden among under-five children in Sullia Taluk is substantial. Multi-pronged, low-cost interventions exclusive breastfeeding promotion, hand hygiene education, full immunization coverage, reduction of indoor air pollution, and alleviation of household overcrowding are essential to reduce this burden and improve child survival outcomes in the region.

KEYWORDS : Acute respiratory infections, Under five children, Sullia Taluk, Dakshina Kannada, Prevalence, Risk factors, Cross sectional study, Commnity based study

INTRODUCTION:

Acute respiratory infections (ARI) remain one of the foremost public health threats to young children worldwide. Globally, ARI is responsible for nearly 20% of all deaths among children under five years of age, with lower respiratory tract infections (LRTIs) — principally pneumonia — ranking as the leading cause of under-five morbidity and mortality.[10] Despite significant progress in child survival over the past two decades, the ARI burden remains overwhelmingly concentrated in low- and middle-income countries, where deficiencies in nutrition, sanitation, and healthcare access converge to amplify disease risk.[9]

South Asia bears a particularly disproportionate share of global ARI mortality. Bangladesh, India, Indonesia, and Nepal together account for approximately 40% of global ARI deaths.[5] India alone contributes the highest absolute number of ARI-related deaths, accounting for approximately 20% of global under-five pneumonia mortality.[9,10] Within India, ARI constitutes 30–50% of paediatric outpatient visits and 20–40% of all hospital admissions in the under-five age group.[3] In urban slum settings, ARI accounts for over two-thirds of all childhood illnesses.[4]

National-level data from India's fifth National Family Health Survey (NFHS-5, 2019–21) indicate that ARI prevalence in the two weeks preceding the survey remained at approximately 13% among under-five children, unchanged from NFHS-4, signalling a persistent plateau in progress despite advances in immunization coverage.[6] Regional analyses have further demonstrated substantial inter-state and intra-state heterogeneity in ARI prevalence, underscoring the importance of district- and taluk-level data to guide targeted interventions.[7,8]

Key risk factors for ARI identified in the literature include young age (particularly infancy), household overcrowding, low birth weight, suboptimal breastfeeding, higher birth order, indoor air pollution from biomass fuel use, incomplete immunization, and maternal illiteracy.[1,2,9] Despite the scale of this problem, community-level data from rural coastal Karnataka — including semi-urban and tribal areas such as Sullia Taluk in Dakshina Kannada District — remain sparse. This study was therefore designed to estimate the local prevalence of ARI and characterize the socio-demographic and household risk factors in this understudied population.

Objectives:

1. To estimate the prevalence of Acute Respiratory Infection (ARI) among under-five children in Sullia Taluk, Dakshina Kannada District, Karnataka.
2. To determine the socio-demographic and household factors associated with ARI in this population.

Methodology:

Study Design and Setting

A community-based, cross-sectional study was conducted in Sullia Taluk, Dakshina Kannada District, Karnataka, India, between January 2024 and March 2024. Sullia Taluk is a semi-rural, hilly region with a mixed tribal and non-tribal population, located in the Western Ghats of coastal Karnataka.

Study Population and Eligibility Criteria

The study population comprised children aged less than 5 years who had been residing in Sullia Taluk for a minimum of six continuous months prior to enrolment. Children whose caregivers were unavailable or declined consent were excluded. Only one child per household was selected where multiple eligible children were present.

Sample Size and Data Collection

A total of 380 children were enrolled using systematic sampling across the taluk. Data were collected through structured, pre-tested, interviewer-administered questionnaires administered to caregivers (preferably mothers). Information was gathered on child's age, sex, birth weight, birth order, number of siblings, breastfeeding practices, immunization status, and household characteristics including overcrowding. Clinical examination was performed to document symptoms of ARI.

Case Definition
ARI was operationally defined in accordance with WHO/IMCI criteria as the presence of at least one of the following symptoms in the two weeks preceding the interview: cough, runny nose, ear discharge, sore throat, or fast/difficult breathing, with or without fever.[10] Cases were further sub-classified as upper respiratory tract infection (URTI) or lower respiratory tract infection (LRTI) based on the presence or absence of fast breathing, chest in-drawing, or wheeze.

Statistical Analysis
Data were entered and analysed using SPSS version 20.0. Descriptive statistics were used to report prevalence and distribution of variables. Chi-square tests were performed to assess the association between categorical variables and ARI occurrence. A p-value of less than 0.05 was considered statistically significant.

RESULTS:
Overall Prevalence and Symptom Profile
Of the 380 children enrolled, 210 (55.26%) were found to have ARI at the time of or in the two weeks preceding the study. Running nose and cough were the most frequently reported symptoms, consistent with predominance of upper respiratory tract involvement — a pattern also documented in comparable community-based studies in South India.[1,4]

Table 1: Gender distribution among study population

Gender	Total Subjects (n=380)	Subjects with ARI
Male	199 (52.3%)	101 (51%)
Female	181 (48%)	71 (39%)

Males constituted 52.3% of the study population. ARI prevalence was 51% among males and 39% among females, suggesting a higher susceptibility in male children, a finding consistent with patterns reported in NFHS-5 national data.

Age Distribution and ARI
ARI prevalence was highest in the 0–12 month age group (62%), highlighting the heightened vulnerability of infants. The immature immune system in neonates and young infants, combined with greater dependence on breastfeeding for passive immunity, likely explains this differential risk.9,10 Chi-square analysis confirmed a statistically significant association ($x^2 = 56.7$, $p = 0.000$).

Table 2: Age distribution among study population ($^2 = 56.7$, $p = 0.000$*)

Age (months)	Total Subjects	Subjects with ARI
0–12	98 (26%)	60 (62%)
13–24	73 (19.2%)	37 (50.6%)
25–60	209 (55%)	123 (59%)

Household Overcrowding
Overcrowding was present in 148 (38.9%) households. Children in overcrowded homes had a substantially higher ARI prevalence (67.5%) compared to those in non-overcrowded settings (50.8%), with a statistically significant association ($^2 = 84.9$, $p = 0.018$). This finding aligns with systematic review data demonstrating that households with more than 7 persons carry nearly double the odds of severe lower respiratory tract infection.[9] Overcrowding facilitates droplet transmission and viral spread, particularly in poorly ventilated homes.[2,8]

Table 3: Overcrowding among study population ($x^2 = 84.9$, $p = 0.018$*)

Overcrowding	Total Subjects	Subjects with ARI
Present	148 (38.9%)	100 (67.5%)
Absent	232 (61%)	118 (50.8%)

Birth Weight
Children with low birth weight (LBW, < 2.5 kg) constituted 41.1% of the sample. ARI prevalence was 58.9% in the LBW group versus 54% in children of normal birth weight, though this difference did not reach statistical significance ($^2 = 88.2$, $p = 0.634$). While LBW has been established as a significant predictor of severe ARI in meta-analytic evidence9, the lack of significance in this study may reflect the relatively small sample size and the use of the broad ARI case definition, which captures mild URTI alongside more severe LRTI.

Table 4: Birth weight distribution ($x^2 = 88.2$, $p = 0.634$; not significant)

Birth Weight	Total Subjects	Subjects with ARI
< 2.5 kg	156 (41.1%)	92 (58.9%)
≥ 2.5 kg	224 (58.9%)	123 (54%)

Maternal Education
The majority of mothers (93.9%) were literate. ARI prevalence was 54.9% among children of literate mothers and 34.7% among those of illiterate mothers, with a significant chi-square result ($^2 = 58.65$, $p = 0.049$). While counter-intuitive, this finding likely reflects higher absolute numbers in the literate group and may be confounded by household wealth, healthcare-seeking behaviour, and child's exposure to other children. Studies from NFHS-5 and comparative community surveys in India have similarly reported complex, context-dependent relationships between maternal education and ARI prevalence.[6,7]

Table 5: Maternal education and ARI ($x^2 = 58.65$, $p = 0.049$*)

Mother's Education	Total Subjects	Subjects with ARI
Illiterate	23 (6.1%)	8 (34.7%)
Literate	357 (93.9%)	196 (54.9%)

Number of Siblings and Birth Order
ARI prevalence was broadly similar in children with and without siblings (55.7% vs 56.6%), but the chi-square association remained statistically significant ($^2 = 67.2$, $p = 0.030$). Second-born or later-born children showed a modestly higher ARI prevalence (58.6%) than first-borns (51%), a difference also significant ($^2 = 112.2$, $p = 0.045$). This likely reflects greater household infectious load and shared contact exposure as family size increases, mirroring findings from the Puducherry study and NFHS-5 analyses.[1,6]

Table 6: Number of siblings and ARI ($x^2 = 67.2$, $p = 0.030$*)

Siblings	Total Subjects	Subjects with ARI
No siblings	120 (31.6%)	68 (56.6%)
1 or more	260 (68.4%)	145 (55.7%)

Table 7: Birth order and ARI ($x^2 = 112.2$, $p = 0.045$*)

Birth Order	Total Subjects	Subjects with ARI
First born	206 (54.2%)	105 (51%)
Second or later	174 (45.7%)	102 (58.6%)

Breastfeeding Status
Among children exclusively breastfed for 6 months, ARI prevalence was 54.5%; among those breastfed up to 2 years, it was 51.5%. The association between breastfeeding duration and ARI was statistically significant ($x^2 = 11.5$, $p = 0.003$). These data are consistent with the robust literature demonstrating the protective immunological role of breast milk. Secretory IgA, lactoferrin, and other bioactive components in breast milk confer passive mucosal immunity and attenuate the severity of respiratory infections in infants.[5,9]

Table 8: Breastfeeding status and ARI ($x^2 = 11.5$, $p = 0.003$*)

Exclusive Breastfeeding Duration	Total Subjects	Subjects with ARI
6 months	22 (6%)	12 (54.5%)
Up to 2 years	64 (17%)	33 (51.5%)

* p-value < 0.05 considered statistically significant

DISCUSSION:

The overall ARI prevalence of 55.26% observed in this study is substantially higher than the national two-week period prevalence of approximately 13% reported in NFHS-5[6] and closer to findings from community-based cross-sectional studies that use similar symptom-based case definitions over the same two-week recall period. For instance, Kumar et al. reported a prevalence of 59.1% in Puducherry,[1] and Pajapti et al. observed comparable rates in Ahmedabad.[4] The discrepancy with NFHS-5 estimates is partly methodological: NFHS uses a single point-in-time interview for a nationally representative sample, while community-based studies with dedicated field investigators tend to capture a broader clinical spectrum.[7]

The elevated ARI burden among the 0–12 month age group (62%) is biologically plausible. Infants have immature humoral and cellular immune responses, reduced mucociliary clearance, and smaller airway calibre, all of which predispose them to respiratory infections.[9,10] The NFHS-5 national analysis by Varghese and Muhammad similarly identified younger age as one of the strongest independent predictors of ARI in the under-five cohort.[6]

Household overcrowding emerged as one of the most significant modifiable risk factors in this study, with children in crowded homes experiencing an ARI prevalence of 67.5% compared to 50.8% in non-crowded homes. This association is well-documented globally.[9] Balasubramani et al., in their district-level spatial analysis of ARI in India, identified household density as a key environmental predictor, particularly in southern districts.[8] Overcrowding not only increases the probability of droplet-mediated transmission but also correlates with indoor air pollution from biomass cooking fuel use, another established independent risk factor for ARI.[2,3]

Although birth weight below 2.5 kg was not significantly associated with ARI in this study, systematic meta-analytic evidence consistently identifies LBW as a strong predictor of severe ARI, with odds ratios of approximately 3.18 in pooled analyses.[9] The absence of significance here may be attributable to the cross-sectional design's inability to distinguish severity gradations within the broad ARI case definition. Future studies with sufficient power and LRTI-specific outcomes would better elucidate this relationship.

Exclusive breastfeeding is one of the most cost-effective preventive interventions against ARI. The immunological constituents of human milk — secretory IgA, lactoferrin, lysozyme, oligosaccharides, and cytokines — provide mucosal barrier protection and modulate the neonatal innate immune response. Evidence from developing countries consistently demonstrates that exclusively breastfed children experience a 30–42% lower incidence of ARI.[5] Despite the established benefits, NFHS-5 data reveal that only 63.7% of children in Karnataka were exclusively breastfed for the first six months, leaving a substantial proportion vulnerable.[6] Community-based frontline health worker programmes — through ASHAs and ICDS functionaries — offer a practical channel for breastfeeding counselling in Sullia Taluk.

Higher birth order and the presence of siblings were both significantly associated with ARI in this study. Siblings serve as reservoirs and vectors for respiratory pathogens, increasing household viral load, particularly during the peak respiratory virus season. This is particularly pertinent for younger index children who lack prior immunity.[1,2] These findings are consistent with the national NFHS-5 multivariate analysis that identified birth order as an independent predictor of ARI even after adjusting for confounders.[6]

Immunization — particularly the pentavalent vaccine (covering Haemophilus influenzae type b and pertussis) and pneumococcal conjugate vaccine (PCV) — plays a critical role in reducing severe ARI and ARI-related mortality.[3,10] Full immunization coverage nationally improved from 62% to 77% between NFHS-4 and NFHS-5, but significant sub-district level gaps persist, especially in remote and tribal blocks of taluks such as Sullia.[6] Ensuring robust cold chain infrastructure and outreach immunization camps for hard-to-reach communities should be a district health priority.

Limitations:

This study has several limitations that should be acknowledged. First, the cross-sectional design limits causal inference; associations identified here are not necessarily causal. Second, the case definition relied on caregiver-reported symptoms over a two-week recall period, which may be subject to recall bias. Third, indoor air pollution exposure, nutritional status, and immunization records were not systematically captured in the present analysis, potentially leaving important confounders unaccounted for. Fourth, the relatively limited sample size may have reduced statistical power to detect weaker associations, particularly for birth weight. Future longitudinal studies incorporating these variables are recommended to build upon these findings.

Conclusion and Recommendations:

ARI prevalence among under-five children in Sullia Taluk (55.26%) is substantial and warrants urgent public health attention. Young infant age, household overcrowding, higher birth order, suboptimal breastfeeding, and the presence of siblings were the most significant risk factors identified. These findings converge with national and regional evidence[1,2,6,7,8] and reinforce the need for a holistic, community-based approach to ARI prevention.

The following evidence-based recommendations are proposed for the local health administration:

1. Strengthen exclusive breastfeeding promotion through ASHA workers and ICDS anganwadi centres, targeting mothers during antenatal and postnatal contacts.
2. Prioritize full immunization coverage, particularly pentavalent and PCV vaccines, in remote and tribal sub-blocks of Sullia Taluk through dedicated outreach immunization sessions.
3. Integrate handwashing-with-soap promotion into existing school health and community health programmes, leveraging evidence that regular hand hygiene can meaningfully reduce respiratory infection incidence.
4. Address household overcrowding through convergence with rural housing schemes and sanitation programmes under PMAY-G and SBM-G.
5. Promote transition to clean cooking fuels to reduce indoor air pollution, which is an established, independently modifiable risk factor for lower respiratory tract infections in this age group.
6. Conduct larger, longitudinal follow-up studies incorporating nutritional markers, immunization status, and indoor air quality measurements to better characterize the full risk factor profile.

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