Prevalence and Risk Factors of Acute Respiratory Infections among Under-Five Children in Urban Slums of North Kerala

Ardra Merin George[1*], Sivakumar CP[2], Biju George[3], Athira T[4]

[1]Department of Community Medicine, Tagore Medical College and Hospital, Chennai, Tamil Nadu, India
[2]Department of Community Medicine, Government Medical College, Kozhikode, Kerala, India
[3]Department of Community Medicine, Government Medical College, Kannur, Kerala, India
[4]Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum, Kerala, India

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ABSTRACT

Background: Acute respiratory infections (ARI) are a leading cause of morbidity and mortality among under-five children, particularly in urban slum settings. Evidence from Kerala's urban slums remains limited, necessitating context-specific research.

Methods: A community-based cross-sectional study was conducted across ten urban slums of Kozhikode Municipal Corporation from July 2020 to July 2021. Using cluster sampling, 150 children aged ≤5 years were enrolled. ARI prevalence was assessed using two-week symptom recall. Associations between risk factors and ARI were evaluated using chi-square tests and odds ratios.

Results: ARI prevalence was 38% (95% CI: 23.3–55.1%), with upper respiratory tract infections predominating (75.4%). Birth order greater than two (OR: 2.4; p=0.03), contact with an ARI case (OR: 5.8; p=0.017), and low maternal educational status (OR: 2.6; p=0.008) showed significant associations in bivariate analysis. However, no independent predictor was identified in multivariate logistic regression.

Conclusion: ARI burden among under-five children in urban slums is shaped by overlapping sociodemographic determinants. Targeted interventions addressing maternal education, household exposure reduction, and improved surveillance are essential to mitigate ARI in vulnerable urban populations.

Keywords: Respiratory illness, Immunization, Socioeconomic Determinants, Maternal Education, Urban Poor Communities, Childhood Morbidity

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***Correspondence:** Ardra Merin George (Email: ardrameringeorge@gmail.com)

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Introduction

Acute respiratory infections (ARI) account for nearly 20.0% of deaths among Under-Five children worldwide.[1] In 2019, acute respiratory tract infection (ARI) contributed to 4.0% of global disability-adjusted life-years (DALYs) and caused approximately 2.5 million deaths.[2] Children are at a higher risk with an estimated 740000 deaths of children younger than five years attributable to ARIs in 2019.[2] Prior to the COVID-19 pandemic, low- and middle-income countries accounted for approximately 83% of global acute respiratory infection-related deaths.[2] India continues to report a high prevalence of ARI among children. According to recent national estimates based on NFHS-5 (2019-21), the prevalence of ARI among Under-Five children was 2.8%, with significant interstate variations.[3] Studies also highlight persistent regional inequalities in ARI prevalence, and identify sociodemographic and environmental determinants such as maternal education, child nutritional status, household fuel use, and ambient air pollution that significantly influence risk across India.[4,5] Urban slums constitute a particularly vulnerable setting due to overcrowding, poor ventilation, indoor air pollution, inadequate sanitation, and limited access to timely healthcare. According to the 2011 Census, 17.4% of India's urban population resided in slums[6], living under conditions conducive to rapid transmission of respiratory infections. Kozhikode Municipal Corporation includes several densely populated slum clusters, where these risk factors are highly prevalent, making children especially susceptible to recurrent respiratory infections. Although multiple studies from different parts of India have explored ARI prevalence and risk factors among slum-dwelling children, there is a marked paucity of evidence from Kerala, particularly from North Kerala. Most existing studies are either hospital-based or conducted in rural settings, leaving a critical knowledge gap regarding environmental and social determinants specific to urban slum communities.[7,8] This gap limits the ability of local health authorities to design targeted, context-specific preventive interventions.

The present study aims to address this gap by assessing the risk factors associated with ARI among Under-Five children residing in slum areas of Kozhikode Municipal Corporation. The findings are expected to provide evidence to strengthen urban primary healthcare services, inform preventive strategies, and support policy decisions aimed at reducing the ARI burden in vulnerable urban populations.

Methodology

Study design and setting: A community-based cross-sectional study was conducted in the urban slum areas of Kozhikode Municipal Corporation, Kerala, India. Kozhikode is a coastal district located on the southwest coast of India. The Corporation includes 62 notified slums, accommodating approximately 12% of the city's population, with a substantial proportion located along the 15-km coastal belt. Ten urban slums were selected for the study. The study was conducted from July 2020 to July 2021

Study participants: The study population comprised children aged ≤5 years who were permanent residents of the selected slums (defined as families residing for ≥6 months).

Eligibility criteria: Households with at least one child aged ≤5 years and families residing in the slum for ≥6 months were included in the study. Children whose parents/guardians did not provide consent or children who were not available even after two follow-up visits during household survey were excluded.

If more than one eligible child was present in a household, all were included.

Sample size calculation: As it is a cross-sectional study, the sample size was calculated using the standard prevalence formula taking prevalence of ARI (p) 59.1% (Kumar SG et al[9], Puducherry study) and absolute precision 10%. At 95% confidence interval the calculated sample size was 99.68 ≈ 100.

Since cluster sampling was used, the sample was adjusted using design effect $D=1+(b-1)\rho$, where b is 15 (cluster size decided for feasibility) and ρ is intra-cluster correlation coefficient 0.02. So the design effect D is 1.28. Hence, the sample size was 128. After adding additional 10% for non-response or sample loss, the final rounded sample size taken as 150. To obtain 150 participants with a cluster size of 15, 10 clusters (slums) were selected.

Sampling procedure: Selection of clusters: There are about 62 slums in Kozhikode Municipal Corporation. Each slum was considered as a cluster. List of these slums were taken. From these listed slums, 10 slums were selected by simple random sampling.

Selection of households: From a major junction within the selected slum, the number of roads from the junction will be counted. The road to proceed was selected randomly. The first household on the selected road was included in the study. The adjacent houses on the same side were the subsequent houses included in the study, till the required sample was obtained from each slum. In case of households on both side of the road, one was selected randomly using a coin and adjacent houses on same side of selected house was included. If a second junction was seen on the road selected, the direction to proceed will be chosen randomly and same procedure will be followed. At the point where the road ends, another major junction was identified. The households in which there is at least one child aged ≤ 5 years, were selected for the study.

Selection of study participants: From each of the selected households, children aged ≤5years were enrolled in the study after following inclusion and exclusion criteria. If an eligible child was not present at the time of survey, a maximum of two follow up visits were done to ascertain their inclusion in the study. The children who were not available even after 2 visits, were excluded from the study. If a household contained more than one under 5 children, all of them were included in the study. This method was continued till 15 participants were obtained from each cluster.

Data collection tools: A pre tested semi structured interview schedule was used for collecting details of socio-demographic and other characteristic, 2-week symptom recall for ARI and the risk factors for development of ARI.

The interview scheduled had 5 sections. **Section 1):** Socio demographic characteristics of study participants including age, gender, type of family, number of members including children in the household, socio economic status. **Section 2):** Antenatal /Natal and post-natal details including age at conception, health care facility approached and services availed, type and place of delivery, complications during pregnancy and postnatal period, birth weight of child and breastfeeding. **Section 3):** Details regarding immunization like immunization status, health facility approached, source of information and adverse events following immunization. **Section 4):** Prevalence of ARI using 2-week symptom recall. Details regarding treatment, health facility approached, total ARI episodes in a year. **Section 5):** Anthropometric measurements like height, weight were measured to the nearest 0.1cm, 0.1kg using the standard method prescribed in WHO field manual.

Methods of data collection: The selected participants and their guardian were met in person at their place of residence. After establishing a good rapport with the child and guardian, purpose of the study was explained to the guardian in detail. Informed consent was obtained from the guardian and they were interviewed by one-to-one interview method. Data was collected using study tools. Each interview lasted for 30-40 minutes.

Height was measured using a Stadiometer (Portable Height -length measuring board) participant was asked to stand on the board facing the investigator keeping their feet together, heels against the back board and knees straight. The participant was told to look straight ahead and not to look up, making the eyes at the same level as ears. The measuring plate was moved down and placed on top of head. Height was read in centimeters to the nearest 0.1cm.

Weight is measured using Health sense. Weighing Scale. Product code PS 117 with high precision of 0.1kg. Measurement was taken on a level and hard surface. Participant was asked to remove foot ware, and step on to the scale putting one foot on each of the foot prints and stand still facing forward and arms on the side and wait until told to step off. The weight was measured in kilograms to the nearest of 0.1 kg.

Variables under the study included Socio demographic details, Antenatal, natal, and postnatal details, Immunization details, Developmental assessment, Parental risk factors, Environmental risk factors, and Prevalence of ARI using 2-week recall.

Data analysis: Data was coded, entered in Microsoft Excel and analyzed using SPSS software version 18. Qualitative variables were expressed in frequency and percentages and quantitative variables were expressed as mean and standard deviation. Prevalence of ARI was expressed in percentage and confidence interval of prevalence was calculated by Cochran's procedure using WinPepi software. Association of selected variables with prevalence of ARI was statistically tested using Pearson chi square test and strength of association was expressed as odds ratio and 95%confidenceinterval. The level of significance of association was set at p value<0.05.

Ethical aspects: Study protocol was approved by the Institutional Research Committee and the Institutional Ethics Committee of Government Medical College, Kozhikode (GMCKKD/RP2019/IEC/255). Permission was obtained from the Mayor, Kozhikode Municipal Corporation. Informed consent was obtained from the guardian of the study participants. The information collected was used only for the purpose of study and strict confidentiality was maintained throughout the study. The children who were found to have respiratory symptoms were referred to the nearby health facility for further evaluation and appropriate management.

RESULTS

Socio-demographic Profile: Among the children studied, 48.7% were boys and 51.3% were girls, with ages ranging from 4.5 months to 5 years. The majority (56.0%) belonged to the 3-5-year age group, with an almost equal distribution between boys and girls. The mean age of the study population was 2.6 ± 1.4 years, with boys having a mean age of 2.7 ± 1.2 years and girls 2.5 ± 1.5 years. Most families were joint families (44.7%), followed by nuclear families (23.2%). Households in urban slums had an average of 7.1 ± 2.8 members, with the majority (59.3%) having two or more children. Socioeconomically, most households (76.7%) belonged to the lower-middle class, followed by the upper-lower class (20.7%) and upper-middle class (2.6%).

Antenatal history: The mean age of the mothers at conception was 25 ± 4.5 years, with ages ranging from 18 to 42 years. Majority 148(98.7%) had completed minimum of 4 antenatal checkups. (Table 1).

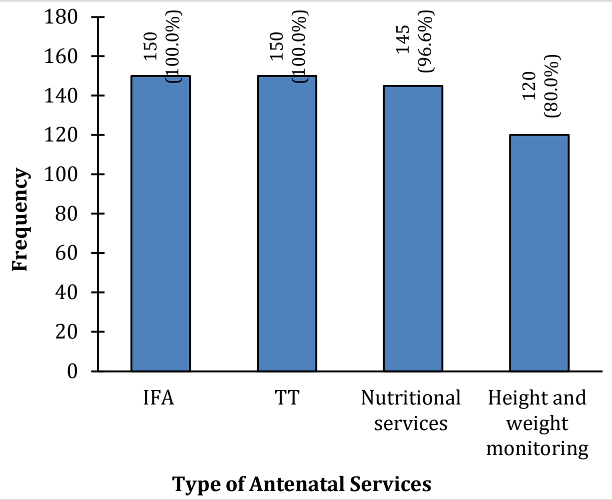
Most of the mothers were visited by AWW (49.3%) followed by ASHA worker (23.3%), whereas 5.3 % of the mothers were not visited by any of the field staffs. Iron and Folic Acid (IFA) supplementation and Tetanus Toxoid (TT) vaccination had 100% coverage each (Figure 1).

Table 1: Number of antenatal check-ups done during pregnancy

Number of antenatal checkups	Frequency (%)
<4	2(1.3)
5-10	92(61.3)
>10	56(37.4)
Total	150 (100)

Among the mothers, 123 (82.0%) experienced weight gain of at least 10 kg during pregnancy. Additionally, 26.6% had associated conditions, including gestational diabetes mellitus (19 cases, 51.3%), hyperthyroidism (5.4%), hypotension (2.7%), and COVID-19 (2.7%).

Natal and Postnatal History: The mean birth weight of the study participants was 2.9 ± 0.4 kg, ranging from 1.6 to 4 kg. Low birth weight (<2.5 kg) was observed in 16 (10.6%) cases. Nearly half of the mothers had full-term vaginal deliveries (46.0%), while 54.0% underwent lower segment caesarean section (LSCS). A majority (80.0%) of children had an uneventful postnatal period, whereas 10.6% experienced neonatal jaundice. Exclusive breastfeeding was reported in 127 (84.7%) of infants, while 7.3% were partially immunized due to reasons such as minor illness, forgetfulness, or lack of proper information. Most households relied on government facilities for both delivery (83.3%) and immunization (96.0%).



*IFA= Iron-Folic acid tablets, TT= Tetanus toxoid

Figure 1: Type of Antenatal services availed during pregnancy (n=150)

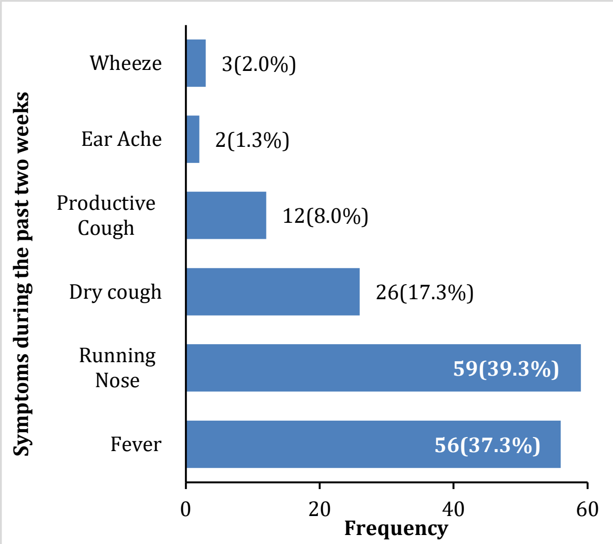


Figure 2: Symptoms during the past two weeks (n=72)

Table 2: Household, demographic and maternal factors associated with ARI

Variable	ARI present (n=57) (%)	ARI absent (n=93) (%)	OR (95%CI)	p-value
Type of family				
Extended	46(40.0)	69(60.0)	1.4(0.6-3.2)	0.8 (0.3)
Nuclear	11(31.4)	24(68.6)	Ref	
Number of members in the family				
≥5 members	49(36.0)	87(64.0)	0.4 (0.13-1.2)	2.4 (0.12)
<5 members	8(57.1)	6(42.9)	Ref	
Overcrowding				
Present	45(42.5)	61(57.5)	1.9(0.9-4.2)	3 (0.08)
Absent	12(27.3)	32(72.7)	Ref	
Birth order				
>2	48(42.9)	64(57.1)	2.4 (1-5.5)	4.4 **(0.03)**
≤2	9(23.7)	29(76.3)	Ref	
Contact with an ARI case				
Contact present	27(93.1)	2(6.9)	5.8 (1.2-28)	5.7 **(0.017)**
No contact	30(69.8)	13(30.2)	Ref	
Number of children in the household				
>2	30(37.5)	50(62.5)	0.9 (0.5-1.8)	0.01 (0.8)
>2	27(38.6)	43(61.4)	Ref	
Maternal education				
Low educational status ‡	43(46.2)	50(53.8)	2.6 (1.2-5.4)	7.04 **(0.008)**
High educational status §	14(24.6)	43(75.4)	Ref	

†ARI= Acute Respiratory Infections, OR= Odds ratio, 95% CI= 95% Confidence Interval

Table 3: Environmental and nutritional risk factors associated with ARI

Variable	ARI present (n=57) (%)	ARI absent (n=93) (%)	OR (95%CI)	Chi square (p-value)
Pets at home				
Present	7(25.9)	20(74.1)	0.5 (0.2-1.2)	2.03 (0.15)
Absent	50(40.7)	73(59.3)	Ref	
Indoor smoke				
Present	16(40.0)	69(62.7)	0.8 (0.4-1.8)	0.09 (0.7)
Absent	24(37.5)	24(60.0)	Ref	
Burning of solid waste				
Yes	24(37.5)	40(62.5)	0.9 (0.4-1.8)	0.01 (0.9)
No	33(38.4)	53(61.6)	Ref	
Low weight for age				
Present	3(25.0)	9(75.0)	0.5 (0.13-2)	0.53 (0.3)
Absent	54(39.1)	84(60.9)	Ref	
Low height for age				
Present	6(28.6)	15(71.4)	0.6 (0.2-1.6)	0.9 (0.3)
Absent (n=129)	51(39.5)	78(60.5)	Ref	

†ARI= Acute Respiratory Infections, OR= Odds ratio, 95% CI= 95% Confidence Interval

ARI and Risk Factors: Based on the symptom recall method, ARI was detected in 57 (38%; 95% CI = 23.3-55.1%) participants, of whom 43 (75.4%) had upper respiratory tract infections and 14 (24.5%) had lower respiratory tract infections. Running nose was the most common symptom, affecting 59 children (39.3%), followed closely by fever in 56 children (37.3%) (Figure 2)

Among children with ARI, 92.9% received treatment, with 11.4% requiring hospitalization due to severe respiratory infection. Nearly half (44.4%) of those exposed to a known ARI case had contact with their siblings. Over the past year, the average number of ARI episodes per child was 2.6 ± 1.8, with a maximum of 10 episodes recorded. The average hospital admissions per child were 1.1 ± 0.3. Additionally, 4% of children had low weight for age, and 6% had low height for age (WHO Z score >3SD). Birth order more than 2 was significantly associated with ARI and Contact with an ARI case showed the strongest association. The analysis showed that among environmental and maternal factors, maternal education was significantly associated with ARI. Children of mothers with low educational status had significantly higher ARI prevalence (Table 2). But none of these factors retained significance in the multivariate logistic regression analysis.

Study couldn't establish a statistically significant association with environmental risk factors and nutritional risk factors for the development of ARI (Table 3).

Discussion

The prevalence of ARI in the present study was 38% (95 C.I -23.3-55.1%), comparable to finding from study by Majumdar A et al[10] (50.4%), Savitha et al[11] (41.6%), Murarkar et al[12] (46.7%), and Vijayan B et al[7] (31.9%). However, this study reported a higher prevalence than studies by Mir A et al[13] (21.4%), Nirmolia N et al[14] (16.34%), Prajapati B et al[15] (22%). Some studies have reported high prevalence rates when compared to the present study.[9] Variations in prevalence may be influenced by difference in study settings, sample sizes and methodologies, and the socio-demographic characteristics of the populations.

The prevalence of ARI in India reported in NFHS-5 was 2.8%, which was significantly lower than the findings of the present study.[3]

In this study 42% of mothers were educated up to high school, and 94.7% were home makers. All mothers were literate (100%), a figure comparable to NFHS 5 Kerala which reported a literacy rate of 95.5%.[16].A significant association($p<0.05$) was observed between maternal literacy and the development of ARI, as established in multiple studies.[13,15,17],[18]However, this association was not confirmed in studies by Sharma et al[10] and Arun et al.[19]

In this study, although ARI cases were more frequent in households with overcrowding, the association was not statistically significant, contradicting findings by Ramani VK et al.[20] Conversely, Prajapati B et al[15] reported overcrowding in 53.2% of households, with a statistically significant association to development of ARI. Multiple studies also have identified overcrowding a significant risk factor for ARI.[9,10,21]

In the present study, no statistically significant difference was observed between age categories and ARI development, whereas some studies have reported a higher prevalence among infants.[18]

Females (28%) were more affected by ARI than males (20.6%),aligning with findings from Islam F et al,[21] Prajapati B et al.[15] Conversely, studies by Sharma et al,[10] Ramani VK et al,[20] Mandal S et al,[22] Arun et al[19] reported a higher prevalence among male children(54.1%). Children with a birth order greater than two has a higher likelihood of developing ARI, with increasing birth order correlating with a greater risk.[15]

Exposure to individuals with ARI symptoms was identified as a significant risk factor for ARI development, as established in the study by Ramani et al.[20] Children, due to their close proximity to family members, are particularly vulnerable to respiratory infections. Among those exposed to an ARI case, the majority had contact with their siblings- a variable not widely considered in previous studies.

Although more children with ARI belonged to lower socioeconomic class, no significant association found in the present study. However previous studies have reported a higher prevalence of ARI found among lower Socio economic class.[19,23]

While multiple studies have established a statistically significant association between parental smoking and ARI development,[8,10,17,22,23] the current study couldn't establish an association. This may be attributed to the lower prevalence of smoking in indoors among parents in Kerala.Indoor smoke has been identified as a significant risk factor for ARI in several studies,[8,17,19,22] but no significant association was observed in the present study.Although previous research has demonstrated a significant link between malnutrition and ARI,[10,17-19] this study did not establish such an association probably due to the lower number of malnourished children in the study population.

Although several variables showed significant associations in bivariate analysis, including higher birth order, maternal low educational status, and history of contact with an ARI case, none of these factors retained significance in the multivariate logistic regression model. This suggests that the observed associations may be confounded by overlapping social and environmental determinants inherent to urban slum settings.

Overall, the findings highlight that ARI among Under-Five children in urban slums is driven by a complex interplay of household, maternal, and environmental factors, many of which coexist. Although no variable emerged as an independent predictor in multivariate analysis, the trends observed underscore the need for strengthened maternal awareness, improved child-care practices, and enhanced surveillance in crowded urban settings. Emphasis on early detection, reducing household exposure, and improving living conditions remains crucial in mitigating ARI burden among vulnerable slum populations.

Strength and Limitations

One of the major strengths of this study lies in its focus on a highly vulnerable and under-researched population Under-Five children residing in the urban slums of Kozhikod Municipal Corporation. The use of a community-based cross-sectional design combined with a cluster sampling method enhances the representativeness and validity of the findings by capturing data from diverse slum settings. The study employed rigorous data collection procedures and a comprehensive analytical approach, enabling a robust assessment of the determinants of Acute Respiratory Infections (ARI).

Furthermore, the study's inclusion of a wide range of socio-demographic, environmental, nutritional, and parental factors provide a holistic understanding of the multifactorial nature of ARI. This integrative approach adds novel insight to the limited body of evidence on child health in urban slum settings, thereby enhancing the reliability, relevance, and broader public health significance of the findings. The study may have overestimated ARI prevalence due to the overlap with the COVID-19 pandemic, which could have influenced healthcare-seeking behavior and reporting. Being a cross-sectional study, it cannot establish causal relationships between risk factors and ARI. Additionally, as the research was confined to urban slum areas of Kozhikode, the findings may have limited generalizability to other settings. Nevertheless, the study offers valuable insights to guide targeted interventions and public health strategies for under-five children.

Conclusion

This study identified higher birth order, lack of maternal education, contact with an ARI case, and household overcrowding are associated with ARI among Under-Five children in urban slums. These findings highlight the strong influence of socio-demographic and environmental factors on ARI risk. Addressing these determinants through targeted community-level interventions may help reduce the burden of ARI in similar vulnerable settings.

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Availability of Data: The datasets generated and/or analysed during the current study are available from the corresponding author upon reasonable request.

Declaration of Non-use of Generative AI Tools: This article was prepared without the use of generative AI tools for content creation, analysis, or data generation. All findings and interpretations are based solely on the authors' independent work and expertise.

References

1. Oluwaseun A, Seun-Addie FK. Reducing acute respiratory infections in under-five children in Nigeria through the mirror of risk factors: a cross-sectional study. BMC Public Health. 2025 May 27;25(1):1948. DOI: https://doi.org/10.1186/s12889-025-23148-7 PMid:40426124 PMCid:PMC12107796
2. Ross I, Bick S, Ayieko P, Dreibelbis R, Wolf J, Freeman MC, et al. Effectiveness of handwashing with soap for preventing acute respiratory infections in low-income and middle-income countries: a systematic review and meta-analysis. Lancet. 2023 May 20;401(10389):1681-1690. DOI: https://doi.org/10.1016/S0140-6736(23)00021-1 PMid:37121242
3. Varghese JS, Muhammad T. Prevalence, potential determinants, and treatment-seeking behavior of acute respiratory infection among children under age five in India: Findings from the National Family Health Survey, 2019-21. BMC Pulm Med. 2023 Jun 6;23(1):195. DOI: https://doi.org/10.1186/s12890-023-02487-4 PMid:37280601 PMCid:PMC10243276
4. Hasan MM, Saha KK, Yunus RM, Alam K. Prevalence of acute respiratory infections among children in India: Regional inequalities and risk factors. Matern Child Health J. 2022 Jul 1;26(7):1594-1602. DOI: https://doi.org/10.1007/s10995-022-03424-3 PMid:35435580 PMCid:PMC9174316
5. Balasubramani K, Prasad KA, Kodali NK, Abdul Rasheed NK, Chellappan S, Sarma DK, et al. Spatial epidemiology of acute respiratory infections in children under 5 years and associated risk factors in India: District-level analysis of health, household, and environmental datasets. Front Public Health. 2022 Dec 13;10:906248. DOI: https://doi.org/10.3389/fpubh.2022.906248 PMid:36582369 PMCid:PMC9792853
6. Government of India, Ministry of Housing and Urban Poverty Alleviation, National Buildings Organization. Slums in India: A Statistical Compendium 2015 [Internet]. New Delhi: NBO; 2015 [cited 2024 May 22]. Available from: https://nbo.gov.in/pdf/SLUMS_IN_INDIA_Slum_Compendium_2015_English.pdf
7. Vijayan B, L DT, Johnson LR. Prevalence of acute respiratory infections among under five children in a rural area of Kozhikode district, Kerala. Int J Community Med Public Health. 2019 May 27;6(6):2666-2671. DOI: https://doi.org/10.18203/2394-6040.ijcmph20192341
8. Sebastian SR. Epidemiology of acute respiratory infections among under-fives in a rural community of Trivandrum district, Kerala. Int J Community Med Public Health. 2018 Jul 23;5(8):3459-63. DOI: https://doi.org/10.18203/2394-6040.ijcmph20183081
9. Kumar SG, Majumdar A, Kumar V, Naik BN, Selvaraj K, Balajee K. Prevalence of acute respiratory infection among under-five children in urban and rural areas of puducherry, India. J Nat Sci Biol Med. 2015;6(1):3-6. DOI: https://doi.org/10.4103/0976-9668.149069 PMid:25810626 PMCid:PMC4367064
10. Majumdar A, Premarajan KC, Ganesh KS, Veerakumar AM, Ramaswamy G. Rural Urban Differentials of Treatment Seeking Behavior for Acute Respiratory Infection Among Children in Puducherry. Natl J Community Med. 2014;5(3):325-358.
11. Savitha AK, Gopalakrishnan S. Determinants of acute respiratory infections among under five children in a rural area of Tamil Nadu, India. J Family Med Prim Care. 2018 Nov-Dec;7(6):1268-1273. DOI: https://doi.org/10.4103/jfmpc.jfmpc_131_18 PMid:30613509 PMCid:PMC6293935
12. Murarkar S, Gothankar J, Doke P, Dhumale G, Pore PD, Lalwani S, et al. Prevalence of the Acute Respiratory Infections and Associated Factors in the Rural Areas and Urban Slum Areas of Western Maharashtra, India: A Community-Based Cross-Sectional Study. Front Public Health. 2021 Oct 26;9:723807. DOI: https://doi.org/10.3389/fpubh.2021.723807 PMid:34765581 PMCid:PMC8576147
13. Abid A, Mir I, Fazili A, Bhat J, Jabeen R, Salathia A. Prevalence and Risk Factor Analysis of Acute Respiratory tract Infections in Rural areas of Kashmir valley under 5 Years of Age. Int J Med Public Health. 2012;2(3):47-52.
14. Nirmolia N, Mahanta TG, Boruah M, Rasaily R, Kotoky RP, Bora R. Prevalence and risk factors of pneumonia in under five children living in slums of Dibrugarh town. Clin Epidemiol Glob Health. 2018 Mar 1;6(1):1-4. DOI: https://doi.org/10.1016/j.cegh.2017.07.004
15. Prajapati B, Talsania NJ, Lala MK, Sonalia KN. A study of risk factors of acute respiratory tract infection (ARI) of under five age group in uban and rural communities of Ahmedabad district, Gujarat. Vol. 3. 2012;3(1)-52-58. DOI: https://doi.org/10.5455/ijmsph.2012.1.52-58
16. Ministry of Health and Family Welfare (IN). National Family Health Survey (NFHS-5), 2019–21: Compendium of Fact Sheets-India and 14 States/UTs (Phase-II) [Internet]. New Delhi: Government of India; 2021 [cited 2025 Oct 21]. Available from: https://www.mohfw.gov.in/sites/default/files/NFHS-5_Phase-II_0.pdf
17. Taksande AM, Yeole M. Risk factors of Acute Respiratory Infection (ARI) in under-fives in a rural hospital of Central India. J Pediatr Neonatal Individ Med JPNIM. 2016;5(1):e050105.
18. Azad KMAK. Risk Factors for Acute Respiratory Infections (ARI) Among Under-five Children in Bangladesh. J Sci Res. 2009;1(1):72-81. DOI: https://doi.org/10.3329/jsr.v1i1.1055
19. Arun A, Gupta P, Sachan B, Srivastava JP. Study on prevalence of acute respiratory tract infections (ARI) in under five children in Lucknow district. Natl J Med Res. 2014 Dec 31;4(04):298-302.
20. Ramani VK, Pattankar J, Puttahonnappa SK. Acute Respiratory Infections among Under-Five Age Group Children at Urban Slums of Gulbarga City: A Longitudinal Study. J Clin Diagn Res. 2016 May;10(5):LC08-13. DOI: https://doi.org/10.7860/JCDR/2016/15509.7779 PMid:27437249 PMCid:PMC4948425
21. Islam M, Sultana ZZ, Iqbal A, Ali M, Hossain A. Effect of in-house crowding on childhood hospital admissions for acute respiratory infection: A matched case-control study in Bangladesh. Int J Infect Dis. 2021 Apr 1;105:639-645. DOI: https://doi.org/10.1016/j.ijid.2021.03.002 PMid:33684561
22. Mandal S, Zaveri A, Mallick R, Chouhan P. Impact of domestic smokes on the prevalence of acute respiratory infection (ARI) among under-five children: Evidence from India. Child Youth Serv Rev. 2020 Jul;114:105046. DOI: https://doi.org/10.1016/j.childyouth.2020.105046
23. Puspitasari MD, Rahardja MB. Family Health Behavior: Preventive Measures against Acute Respiratory Infections in Under-5 Children. Int J Prev Med. 2021 Jul 29;12:99. DOI: https://doi.org/10.4103/ijpvm.IJPVM_580_20 PMid:34584664 PMCid:PMC8428312