

Original Research Article

Prevalence and associated factors of acute respiratory infections among children aged 1-5 years residing in district Amritsar

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ABSTRACT

Background: Acute respiratory infections (ARI) are one of the commonest causes of deaths in children in developing countries. They are responsible for the estimated 15 million deaths that occur in children under 5 years of age each year. Lower respiratory tract infections (LRTIs) are the leading cause of under-five morbidity globally.

Methods: The present cross-sectional study was conducted in rural and urban areas of the Amritsar district from 01 January 2023 to 31 December 2023 among children aged 1–5 years. A total of 430 study participants, aged between 1–5 years, were included in the sample, with equal urban-rural representation (215 each).

Results: The prevalence of acute respiratory tract infections in last 3 months was found to be 18% with no urban rural difference. ARI was associated with supplementary feeding and skipping meals.

Conclusions: The prevalence of acute respiratory tract infections in last 3 months was found to be 18%.

Keywords: Acute respiratory infection, Under 5 children, Urban slum, Prevalence, Associated factors

INTRODUCTION

In India, the annual reported cases of acute respiratory infections (ARI) reach approximately 40 million. These infections constitute a significant portion of healthcare utilization, accounting for 30-60% of all outpatient visits and 20-40% of paediatric hospital admissions.¹ According to the National Family Health Survey-5 (NFHS-5), ARI impact 2.8% of under-5 children nationally, and 2.5% in Punjab.²

The impact on child mortality is substantial, with ARI contributing to about 15% of all deaths among children U-5 years old in India. This figure is corroborated by an Indian Council of Medical Research (ICMR) multicentric study, which found ARI responsible for 15-30% of childhood deaths. Pneumonia, a severe form of ARI, is particularly lethal, estimated to cause 410,000 deaths annually among children under 5, representing nearly 25% of all child fatalities.³

The risk factors for ARI are diverse and multifaceted. They encompass not only climatic conditions but also housing environment, industrialization levels and social economic development. In developing nations, several factors contribute to high infection rates like overcrowded, living spaces, poor nutrition, lower weight and intense indoor air pollution. Research and developed countries has revealed that younger siblings of school going, children, often experience, high infection rates, as older children introduce pathogens into the household. Children from lower social economic background tend to be more susceptible to these infections. Preschoolers attending daycare centers also are at higher risk. Notably, urban communities generally experience a higher prevalence of these infections as compared to rural areas.¹

Given that diarrhoea and ARI are the leading causes of morbidity and mortality in children U-5, World Health Organization (WHO) and United Nations International Children's Emergency Fund (UNICEF) collaboratively launched the integrated global action plan for pneumonia

and diarrhoea (GAPPD). This comprehensive strategy aims to expedite the control of pneumonia and diarrhoea by implementing a combination of interventions. The GAPPD adopts a three-pronged approach: protecting children from these diseases, preventing their occurrence, and treating affected children. This integrated plan encompasses a range of actions designed to address these two major health threats simultaneously, reflecting a shift towards more holistic and efficient approaches in global child health initiatives.⁴

Keeping this in mind, present study was conducted to estimate the prevalence of ARI among children aged 1-5 years residing in district Amritsar and to determine association (if any) of ARI with socio-cultural and socio-demographic factors.

METHODS

A descriptive cross-sectional study was conducted in rural field practice area and urban slums of Amritsar district among 1-5 years old children. Time period for the study was 1 year (01 January 2023 to 30 December 2023).

Sample size and sampling technique- calculation as per following formula sample size, where N =minimum required sample size, Z_2 =critical value of Z at 95% confidence limit=1.96, P =proportion of interest, and D =absolute precision (5%).

$$N \geq Z_2 \times P \times (1 - P)/D_2$$

Assuming the power of study to be 80%, Z was taken to be 1.96. The prevalence of ARI in Punjab is taken as 4.6% from a study conducted by Hasan et al in 2022.⁵ The absolute precision for the study was assumed to be 5%.

$$N > 1.96 \times 1.96 \times 0.046 \times 0.954 / 0.05 \times 0.05 \quad N > 68$$

Therefore, a total of overall 426 study participants formulated the sample size where equal numbers of study participants were included from all the six selected areas i.e. 71 each from three villages and 71 each from three selected urban slums ($71 \times 6 = 426$). One child aged 1-5 years (the youngest if the family has more number of such children) from every 2nd house with at least one eligible child in all the three villages of rural field practice area of GMC, Amritsar and three selected urban slums of Amritsar city.

Selection of the slums was done by lottery system. A sample of 430 children, 215 each in rural-urban areas was drawn (four study participants, 2 each from largest slum and village were included to get an even distribution of 215 each instead of 213).

Inclusion criteria

Children between 1-5 years of age of either sex were included.

Exclusion criteria

Children less than 1 year and more than 5 years of age at the time of study, children with chronic diseases such as HIV or any congenital anomalies, and cases when parents don't give informed consent/non cooperative parents were excluded.

Data collection tool

A prior information to the either of the parents of the child was given and purpose of study was explained to them according. One to one interview with parents/informant was held by author for recording the information as per predesigned, pre structured and pretested proforma.

Methodology

Besides approval from the Institutional Ethical Committee and permission from Civil Surgeon Amritsar. The rural part of the study was conducted in the descending order of population at all the three villages falling under rural field practice area of GMC, Amritsar, while the urban component was conducted in the selected three urban slums arranged in descending order of population of the city. For selection of 3 slums in the urban area, list of slums both registered as well as unregistered ones, was procured from Civil Surgeon office and selection was made by lottery method. UPHCs/UCHCs under which the selected slums fall, were visited and in a meeting with Medical Officer/Senior Medical Officer in charge, ANM of the area, and ASHAs were explained about the study, and requested for support. The sequence of the study was from the largest to the smallest of the three villages/selected slums. In case, the family had more than one eligible child, the youngest was selected for the study. Two visits were made per week and 7-10 children were studied during each visit. The study continued till the required number of children i.e. 215 from rural and urban areas each were studied.

Statistical analysis

Compilation was done using Microsoft Excel and analysis was done using Epi-info 0.7 (CDC USA). Where frequencies and proportions were calculated for nominal/ordinal and categorical variables. The association of binary outcome variables (yes/no) that is occurrence of diarrhoea in last 3 months was assessed by using chi square test with other variables, where p value < 0.05 was considered to be statistically significant.

RESULTS

Socio-demographic characteristics

Overall 43% of the study participants were from the age group of 12-24 months and the least were from the age group of 49-60 months (12%). As far as sex of the study participant was concerned 54% were males and 46% were

females whereas as the proportion of male was relatively higher, among the urban (61%) in comparison to rural population (47%).

Overall literacy rate of the mother and father of the study participants was 90% and 88%, respectively .96% of the mothers were housewives whereas 71% of the fathers were skilled or unskilled labourers.

Only 3% belong to the upper class. Among the rural study participants' majority i.e. 48% belong to lower middle socio-economic status.

Prevalence of ARI

The prevalence of acute respiratory tract infections in last 3 months was found to be 18% with no urban rural difference (Table 1).

Table 1: Prevalence of acute respiratory tract infection in last 3 months.

Acute respiratory tract infection episodes in last 3 months	Urban (n=215)	Rural (n=215)	Total (n=430)	χ^2 (p value; df)
Yes	39 (18)	38 (18)	77 (18)	0.01 (0.89; 1)
No	176 (82)	177 (82)	353 (82)	

*P<0.05 is considered to be significant

Association of age and sex of study participants with ARI

It was observed that 20% of study participants between age group of 12-24 months and 37-48 months reported the occurrence of ARI episodes in last 3 months whereas only 6% of the study participants in age group of 49-60 months suffered from the same. On the other hand, 19% and 17% of the male and female study participants reported a ARI episode in last 3 months but this variation was not found to be statistically significant.

Association of educational and occupational status of parents of study participants with ARI

Educational status of the mother was not found to be associated with ARI but 26% of the study participants with illiterate mothers reported to have 1 or more episodes of ARI in last 3 months. Prevalence ARI was relatively higher among study participants whose mother was housewives (19%) in comparison to working mothers (6%). No clear trends were observed with educational status of fathers and occurrence of acute respiratory infections but 22% of study participants with illiterate fathers reported to have suffered from ARI. ARI was not found to be associated with father's occupation whereas it was found to be slightly higher among the salaried class (20%) in comparison to labour class (17%).

Association of socio-economic status with ARI

All decreasing trend in prevalence of ARI was seen with decrease in socio-economic of the study participants, where it was 29% among those who belonged to upper class and 16% among those from lower class.

Association of birth history with ARI

Prevalence of ARI was higher among those were with normal birth weight birth weight (20%) in comparison to LBW babies (13%). It was observed that episodes of ARI were higher among home deliveries (36%) in comparison to hospital deliveries (17%). Prevalence of ARI was higher in study participants with birth order ≤ 2 (19%). None of these variables were found to be statistically associated with ARI i.e. 18% among both preterm and term delivery. As far as ARI prevalence among study participants of birth order 2 or more was concerned, it was found to be relatively higher among those born with in a gap of <3 years (20%) from previous deliveries (Table 2).

Table 2: Association of birth history with acute respiratory tract infection (n=430).

Variables	ARI episodes in last 3 months		χ^2 (p value; df)
	Yes (n=77)	No (n=353)	
Birth weight (in kg)			
<2.5	15 (13)	99 (87)	2.38 (0.12;1)
≥ 2.5	62 (20)	254 (80)	
Place of birth			
Hospital	73 (17)	346 (83)	2.61 (0.10;1)
Home	4 (36)	7 (64)	
Birth order of this child			
≤ 2	68 (19)	299 (81)	0.65 (0.41;1)
≥ 3	9 (14)	54 (86)	
Gestational age at delivery (in weeks)			
Pre term (<37)	7 (18)	31 (82)	0.01 (0.99;2)
Term (37-42)	68 (18)	312 (82)	
Post term (>42)	2 (17)	10 (83)	
Gap between births (if birth order ≥ 2) (n=254)			
	Yes (n=45)	No (n=209)	
<3 years	22 (20)	87 (80)	0.79 (0.37;1)
>3 years	23 (16)	122 (84)	

*P<0.05 is considered to be significant

Association of feeding practices during the age of 0-6 months with ARI

Prevalence of ARI was higher in those study participants who did not received colostrum (10%) in comparison to those who did (4%). Breast feeding initiation and EBF was not found to be associated with occurrence of ARI as not much variation was observed. Slight but non-significant

variation was observed between timing of initiation of breast feeding and ARI prevalence where it was 16% among those whose breast feeding was initiated after 4 hours and 20% among those whose breast feeding was initiated within 1 hour. ARI prevalence were slightly higher in those who were not breast feed (19%) and those who were not exclusive breast feed (18%). Prevalence of ARI was significantly higher in those who started supplementary feeding on time (52%) in comparison to those who started it late (15%). It was observed that prevalence of ARI was slightly higher in those who were given mix feed (18%) and bottle feed (19%) in comparison to those who did not (17%) (Table 3).

Table 3: Association of feeding practices during the age of 0-6 months with acute respiratory tract infection (n=430).

Variables	ARI episodes in last 3 months		χ^2 (p value; df)
	Yes (n=77)	No (n=353)	
Breast feeding initiated			
Yes	72 (18)	331 (82)	0.007 (0.93; 1)
No	5 (19)	22 (81)	
Initiation of breast feeding (hours) (n=403)			
	(n=72)	(n=331)	1.18 (0.55; 2)
Within 1	24 (20)	95 (80)	
Within 1-4	6 (22)	21 (78)	
>4	42 (16)	215 (84)	
Colostrum			
Yes	71 (4)	322 (96)	0.43 (0.51; 1)
No	1 (10)	9 (90)	
Exclusive breast feeding up to 6 months			
Yes	24 (17)	114 (83)	0.03 (0.85; 1)
No	48 (18)	217 (82)	
Supplementary feeding			
On time	16 (52)	15 (48)	25.81 (<00001; 1)
Delayed	61 (15)	338 (85)	
Mixed feeding (n=403)			
	(n=72)	(n=331)	0.20 (0.65; 1)
Given	49 (18)	216 (82)	
Not given	23 (17)	115 (83)	
Bottle feeds (n=430)			
	(n=77)	(n=353)	0.34 (0.55; 1)
Given	30 (19)	125 (81)	
Not given	47 (17)	228 (83)	

*P<0.05 is considered to be significant

Association of current feeding practices with ARI

ARI episodes was significantly higher in those study participants who skipped meals (34%) in comparison to those who did not (17%). Surprisingly those study participants who take ≥ 3 meals in day reported higher ARI prevalence (19%) in comparison to those who take ≤ 2 meals in day (16%). No variation was observed as far as consumption of fast food was concerned as prevalence of

ARI was 18% among both who consumed fast food and who did not. ARI was slightly higher among non-vegetarian (Table 4).

Table 4: Association of current feeding practices with acute respiratory tract infection (n=430).

Variables	ARI episodes in last 3 months		χ^2 (p value; df)
	Yes (n=77)	No (n=353)	
No. of meals given in a day			
≤2	22 (16)	113 (84)	0.34 (0.55; 1)
≥3	55 (19)	240 (81)	
Child skipping meals			
Yes	10 (34)	19 (66)	5.81 (0.01; 1)
No	67 (17)	334 (83)	
Dietary habits			
Vegetarian	40 (17)	192 (83)	0.15 (0.69; 1)
Non-vegetarian	37 (19)	161 (81)	
Fast food consumption			
Yes	19 (18)	89 (82)	0.009 (0.92; 1)
No	58 (18)	264 (82)	

*P<0.05 is considered to be significant

Association of nutritional status with ARI

It was observed that occurrence of ARI was higher among those stunted (21%), underweight (24%) and those with MUAC <12.5cm (22%) in comparison to those with normal height for age (16%), weight for age (17%) and those with MUAC>12.5 cm but these variations were not found to be statistically significant (Table 5).

Table 5: Association of nutritional status with acute respiratory tract infection (n=430).

Variables	ARI episodes in last 3 months		χ^2 (p value; df)
	Yes (n=77)	No (n=353)	
Height for age			
Normal	42 (16)	224 (84)	2.12 (0.14; 1)
Stunted	35 (21)	129 (79)	
Weight for age			
Normal	63 (17)	309 (83)	1.77 (0.18; 1)
Underweight	14 (24)	44 (76)	
Mid upper arm circumference			
Normal	67 (17)	317 (83)	0.51 (0.47; 1)
Moderate malnutrition	10 (22)	36 (78)	

*P<0.05 is considered to be significant

DISCUSSION

The study found that the prevalence of ARI over the past three months was 18%. Our study reported lower ARI prevalence compared to a study by Kumar et al in

Puducherry. That study suggested an overall prevalence of 59.1%, with urban and rural prevalence of 63.7% and 53.7%, respectively.⁶ This difference was attributed to variations in temperature, humidity, and air quality, which can affect the transmission and severity of respiratory infections. Similarly, our study reported lower ARI prevalence compared to a study by Ghimire et al in Kathmandu Valley, where the overall prevalence of ARI was 60.8%.⁷ This difference was likely due to different climate and weather conditions.

Our study reveals age-related patterns in ARI among children. ARI occurrence was higher (20%) in the 12-24 and 37-48-month age groups compared to the 49-60-month group (6%). This suggests that younger children may be more susceptible to ARI, possibly due to developing immune systems or increased pathogen exposure in childcare settings. Gender differences in ARI occurrence (19% in males, 17% in females) were not statistically significant, indicating that gender may not be a key risk factor for ARI in this age range.

For instance, Varghese et al reported that ARI was more prevalent in children aged 0–11 months (3.4%) compared to those aged 12–23 months (3.3%), 24–35 months (2.7%), 36–47 months (2.5%), and 48–59 months (2.1%). Male children (3.0%) were more susceptible to ARI than female children (2.5%).⁸ Another study with similar findings is by Savitha et al, which reported that the prevalence of ARI was more among boys (50.6%).⁹ The tendency of male children to play outside the home exposes them to infected aerosols from the surrounding outdoor environment more than female children.

The educational status of mothers did not show a significant association with ARI prevalence; however, a notable 26% of participants with illiterate mothers reported experiencing one or more episodes of ARI in the last 3 months. A study by Patel et al reported that the proportion of ARI in children was greater among mothers who were illiterate (58.6%) compared to those who were literate (41.4%).¹⁰ This suggests that maternal education might play a role in child health, possibly through improved health knowledge and practices. Those whose mothers were housewives had a higher prevalence of ARI (19%) compared to those with working mothers (6%). Regarding father's educational status, no clear trend emerged in relation to ARI occurrence, although 22% of participants with illiterate fathers reported suffering from ARI. Father's occupation did not show a significant association with ARI, although there was a slightly higher prevalence among the salaried class (20%) compared to the labour class (17%). Salaried workers often live in urban areas where pollution levels are higher compared to rural areas where many labourers might reside. Higher exposure to pollutants can increase the risk of respiratory infections.

A surprising trend was observed in the study that the prevalence of ARI decreased as the socio-economic status

of the participants decreased. 29% of study participants from the upper class suffered from ARI, compared to only 16% of those from the lower class. Similar observations were seen in a study by Arun et al. This study suggests that, according to social class, the prevalence of ARI was highest in the upper class (class I), followed by class V and class II, respectively.¹¹ Higher socioeconomic status often correlates with modern housing that may have sealed environments and central heating/cooling systems. These environments can trap indoor pollutants like dust mites, pet dander, and volatile organic compounds (VOCs), which can exacerbate respiratory conditions.

Surprisingly, in our study, ARI prevalence was higher in normal birth weight infants (20%) than in low birth weight (LBW) infants (13%). In contrast, a study by Savitha et al suggests that ARI episodes were more frequently reported in low birth weight babies compared to normal birth weight babies.⁹ Low birth weight babies often receive more intensive medical care and monitoring early in life, which might include preventive measures against infections. They may receive vaccinations and prophylactic treatments more rigorously. Home deliveries showed more ARI episodes (36%) compared to hospital deliveries (17%). Institutional deliveries typically occur in cleaner environments with better sanitation practices. It was observed that ARI episodes were higher among preterm and term babies (18%) compared to post-term babies (17%). A study conducted by Shalini et al suggested that children with preterm birth had an increased frequency of ARI compared to children with term birth.¹² Preterm infants have underdeveloped immune systems, making them less capable of fighting off infections. Their bodies produce fewer antibodies and immune cells, which are crucial for combating pathogens that cause respiratory infections. No statistical association was found between these variables and ARI.

The prevalence of ARI was higher among participants who did not receive colostrum (10%) compared to those who did (4%). Colostrum is rich in antibodies, particularly immunoglobulin A (IgA) coats the mucous membranes of the respiratory tract, providing a protective barrier against pathogens that can cause infections. This direct immune protection reduces the risk of ARIs. The timing of breastfeeding initiation and exclusive breastfeeding (EBF) showed no significant association with ARI occurrence. Specifically, ARI prevalence was 16% for those whose breastfeeding started after 4 hours versus 20% for those who started within 1 hour. Slightly higher ARI rates were noted in participants who were not breastfed (19%) and those not exclusively breastfed (18%). Similar observations were seen in a study by Savitha et al, which suggested that ARI was more frequently reported in non-exclusive breastfeeding children compared to exclusively breastfed children.⁹ A significant finding was that ARI prevalence was higher in participants who began supplementary feeding on time (52%) compared to those who started it late (15%). In contrast, a study by Prajapati et al suggested that children who were initiated on

complementary feeding at the ages of 4 months and 6 months had lower risks of ARIs compared to those who had a delayed start of complementary feeding at 6 months or later.¹³ Additionally, slightly higher ARI rates were observed in those who received mixed feeding (18%) and bottle feeding (19%) compared to those who did not (17%). Similar observations were reported in a study by Vinod et al, which suggested that children who were bottle-fed showed a higher occurrence of ARI compared to non-bottle-fed babies.¹⁴ These results suggest that certain feeding practices, particularly the timing of supplementary feeding, may influence ARI prevalence.

Those who skipped meals showed a significantly higher incidence of ARI (34%) compared to those who maintained regular meal schedules (17%). The study found no discernible difference in ARI prevalence based on fast food consumption, with both consumers and non-consumers of fast food showing 18%. Factors such as exposure to pollution, smoke (including second-hand smoke), and crowded living conditions can equally affect both groups. A slight increase in ARI prevalence was observed among non-vegetarians compared to vegetarians.

Higher occurrences of ARI were observed among participants who were stunted (21%), underweight (24%), and had a mid-upper arm circumference (MUAC) of less than 12.5 cm (22%). In comparison, those with normal height-for-age, weight-for-age, and MUAC greater than 12.5 cm had lower ARI prevalence rates of 16%, 17%, and less than 22%, respectively. A similar finding was reported in the study by Kaushik et al, which suggested that ARIs were more common among malnourished children than well-nourished children.¹⁵ Malnourished children have a compromised immune system due to insufficient intake of essential nutrients like vitamins, minerals, and proteins. These nutrients play a critical role in supporting immune function. A weakened immune system reduces the body's ability to fight off infections, including ARIs.

Limitations

The settings selected for the study included rural areas and urban slums, which may introduce inherent variations due to their distinct population compositions. Rural areas typically have a diverse sociodemographic profile, while urban slums predominantly consist of low-socioeconomic status individuals and migrants. But urban areas were not included due to challenges in access because of standard working hours of urban population and potential reluctance of them to participate. This may limit the generalizability of findings to the broader urban population.

Recall bias could have distorted our research results by introducing inaccuracies in self-reported data. Participants might have misremembered or selectively recalled information, leading to over- or underestimation of events

or exposures. This bias could have created false associations, exaggerated or diminished true relationships, and compromised the validity of study findings. The impact of recall bias underscores the importance of careful study design and interpretation, especially in research relying on retrospective data collection.

CONCLUSION

Prevalence of ARI in last 3 months was found to be 18% with no urban rural difference. ARI was associated with supplementary feeding and skipping meals.

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