

# Acute Diarrhea and Acute Respiratory Infection among Less than 5 Year Old Children: A Cross-Sectional Study

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## Abstract

**Introduction:** Diarrhea and acute respiratory infections (ARI) are the major causes of morbidity and mortality in the developing nations. Diarrhea accounts for 9% of all the <5 year old children in 2012. The current estimates suggest that there are around 1.4 billion episodes of diarrhea per year with 9 million hospitalizations worldwide. ARI is responsible for about 30-50% of the visits to health facilities and about 20-40% of admissions to hospitals.

**Objectives:** (1) To estimate the prevalence of diarrhea and ARI among <5 year old children in a rural area. (2) To find out the association of certain demographic, socioeconomic, and environmental factors among <5 year of children with diarrhea and ARI.

**Methodology:** This cross-sectional study was done in Primary Health Centre, Nemam Tiruvallur district, Tamil Nadu. It included all the <5 years old children are residing in the area. The data was collected among 370 <5 year old children over a period of 3-month extending from November 2012 to January 2013 by simple random sampling.

**Results:** Among the selected 370 under 5 children, 51.1% were males, and 48.9% were females. The Prevalence of Diarrhea was 7.6%. The prevalence of ARI was 12.2%. The number of episodes for the past 1 year among <5 years old children was 1.64 episodes of diarrhea (standard deviation [SD] 1.1, median 2) and 2.58 episodes of ARI (median 2, SD 1.65).

**Conclusion:** The two major killers of children ARI and diarrhea are preventable by simple interventions like maintaining good personal hygiene and sanitation.

**Key words:** Diarrhea, Prevalence, Rural

## INTRODUCTION

The brunt of the health problems of our country is often felt by the vulnerable groups, i.e., mothers and children. Children under 5 years of age are the most affected by various common morbidities, some of which also lead to mortality in this vulnerable population. Around 10.6 million children in the world die every year before reaching their fifth birthday.<sup>1</sup> Diarrhea and acute respiratory infections

(ARI) are the major causes of morbidity and mortality in the developing nations. ARI is responsible for about 30-50% of the visits to health facilities and about 20-40% of admissions to hospitals.<sup>2</sup> More than 1.1 children under 5 years die from pneumonia every year, almost 17% of the under 5 deaths worldwide. In India, hospital records, from states with high infant mortality rate, show 13% of the inpatient deaths are due to ARI. Pneumonia was responsible for 18% of the under 5 deaths in India in 2014.<sup>3</sup> Diarrhea accounts for 9% of all the under 5 deaths in 2012.<sup>4</sup> Even though the overall diarrheal mortality has declined over the past few decades, the incidence of diarrhea has not changed much. The current estimates suggest that there are around 1.4 billion episodes of diarrhea per year with 9 million hospitalizations worldwide.<sup>5</sup> In India, diarrhea accounts for around 8% of deaths in <5 years old children's.<sup>6</sup>

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The top two major killers of <5 year old children is ARI and diarrhea which together accounts for 30% of all under 5 deaths, which amounts to 2.2 million deaths globally<sup>7</sup> by UN IGME in 2012. Although India has succeeded child mortality to considerable extent, considerable number of children are dying due to these two diseases due to piecemeal approach to service and provision and those at greatest risk are not being identified and reached<sup>8</sup> by UNICEF in 2013. This prompts the importance of taking up this study which will throw light on the prevalence of diarrhea and ARI among <5 year old children in the rural area of Tamil Nadu, India which will help to improve in the long run, the health status of children and the quality of life in rural India.

### Objectives

1. To estimate the prevalence of diarrhea and ARI among <5 year old children in a rural area
2. To find out the association of certain demographic, socioeconomic, and environmental factors among <5 year old children with diarrhea and ARI.

## METHODOLOGY

### Study Design

Population based cross-sectional study. Study area: This study was done at the Primary Health Centre area of Nemam belonging to Poonamallee block in the Tiruvallur district, Tamil Nadu, India. The Primary Health Centre, Nemam has 3 HSCs namely Nemam, Kuthambakkam, and Pappanchathram. Study population: It included all the <5 years old children's residing in the Nemam PHC area. It has a total of 2373 <5 year old children residing in the area, of which, 841 from Nemam Sub Centre, 541 children from Kuthambakkam, and 991 children from Pappanchathram. Study period: The data was collected over a period of 3-month extending from November 2012 to January 2012. Sample size: With available literature, the prevalence of diarrhea among <5 year old children according to National Family Health Survey 9% which was used to estimate the sample size. With the Limit of accuracy as 30% of anticipated prevalence and with Z (1- $\alpha$ /2) value of 1.96, the sample size calculated was 328. About 10% of sample size was added to take care of the refusal and non-participants. Hence, the total sample size arrived as 370. Sampling method: The sampling frame consisted of serially numbered children under 5 years of age listed out from the village wise family register of the each of the 3 sub-centers. Based on the population of <5 years old children's in each HSC, 131 children from Nemam HSC, 84 children from Kuthambakkam HSC, and 155 children from Pappanchathram HSC were selected using simple

random sampling method. The 370 random numbers were generated from the website [www.random.org](http://www.random.org)

## RESULTS

Among the selected under 5 children, 51.1% were males, and 48.9% were females. The mean age was 32.38 months (standard deviation [SD] 15.58) ranging from 1 to 60 months. Age group and sex distribution of the selected <5 years old children's is given in Table 1.

Among the selected 370 children, 70.8% of them were from nuclear family, followed by joint family 27.3% and 1.9% belonged to the extended nuclear family. The average family size was 1.87 ranging from 1 to 5. Their mean per capita income was Rs. 1373.5, with a median of Rs. 1250 (SD 806.4), with a range of Rs. 200-5000.

The mean birth weight of the <5 year old children was 2708.2 g (SD 514.7) ranging from a minimum of 1150-5000 g. The proportion of low birth weight was 14.3% (n53).

Among the 370 selected children, 3 of them had congenital anomalies. 1 child had Down's syndrome, and the other 2 had congenital heart defects. The immunization status was obtained for children aged 1-2 years ( $n = 113$ ). 82.3% of the children were fully immunized, and 17.7% children were partially immunized. Information about vitamin A supplementation was obtained for children more than 6 months of age ( $n = 359$ ). Among them, 80.5% had received vitamin A within the last 6 months, and the remaining 16.5% had not received any dose of vitamin A.

As per the criteria given by WHO,<sup>9</sup> a child was classified as at risk if any one of the 13 criteria were present. Among the selected 370 children, 207 (55.9%) were found to be at risk with a 95% CI of 53.32-58.48.

Personal hygiene was satisfactory among 59.2% of the caregivers and not satisfactory among the remaining 40.8% of the caregivers. Overcrowding was present in 42.4% of the houses, and the remaining 57.6% of the houses were not overcrowded. The sanitary latrine was

**Table 1: Age and sex distribution of under five children**

Age of the child (months)	n (%)		Number of children (n)
	Male	Female	
0-6	19 (48.7)	20 (51.3)	39
7-24	53 (62.4)	32 (37.6)	85
25-60	41 (48.8)	43 (51.2)	84
Total	189 (51.1)	181 (48.9)	370

**Table 2: Details of diarrhea and ARI**

Age of the child (months)	n (%)					
	Diarrhea			ARI		
	Male	Female	Total	Male	Female	Total
0-6	0 (0)	0 (0)	0 (0)	3 (100)	0 (0)	3 (21.4)
7-24	7 (58.3)	5 (41.7)	12 (10.9)	12 (66.7)	6 (33.3)	18 (16.4)
25-60	8 (47.1)	9 (52.9)	17 (6.9)	13 (54.2)	11 (45.8)	24 (9.8)
Total	15 (51.7)	14 (48.3)	29 (7.8)	28 (62.2)	17 (37.8)	45 (12.2)

ARI: Acute respiratory infections

present in only 26.8% of the houses and absent in the remaining 76.2%.

**Details of Diarrhea and ARI**

Prevalence of diarrhea was estimated by asking the respondent about having episodes of loose stools within the last 2 weeks. Among the selected 370 children, 7.6% of them had diarrhea within the last 2 weeks (Table 2). Among those children, who had diarrhea, the majority of them (29.6%) were taken to the Nemam PHC for treatment, followed by home treatment (25.9%), 22.2% of them were taken to the Poonamalle District hospital, 14.9% were treated in private hospital, and the remaining 7.4% were treated in the HSC. The respondents were enquired about the number of episodes of diarrhea in the past 1 year, and it was found that 89.2% had <3 episodes of diarrhea. The details of the number of episodes of diarrhea are given in Table 3.

The prevalence of ARI was estimated by asking the caregiver of the child, whether the selected child had been ill with a cough accompanied by short, rapid breathing which was chest related in the last 2 weeks preceding the survey. The prevalence of ARI was 12.2% (Table 2). Among those children with ARI, the majority of the children 46.9% were taken to Nemam PHC for treatment, 25% of them were managed at home, 18.7% were taken to Poonamallee Hospital, 6.3% of them were treated in the HSC, and 3.1% were treated in private hospital. Details regarding the number of episodes of diarrhea and ARI in the past 1 year was collected, and it was found that the children had an average of 1.64 episodes of diarrhea (SD 1.1, median 2) and 2.58 episodes of ARI (median 2, SD 1.65); the details given in Table 3. Details about the association of diarrhea and ARI with the socioeconomic and environmental factors are given in Tables 4 and 5, respectively.

**DISCUSSION**

The 2-weekly prevalence of diarrhea and ARI in this study was 7.6% and 12.2%, respectively. Similarly, the 2-weekly prevalence of diarrhea and ARI in under 5 children was

**Table 3: Details of number of episodes of diarrhea and ARI**

Number of episodes	n (%)	
	Diarrhea	ARI
<3	330 (89.2)	211 (57)
3-5	32 (8.6)	101 (27.3)
>5	8 (2.2)	58 (15.7)

ARI: Acute respiratory infections

**Table 4: Association of diarrhea and demographic, socioeconomic and environmental factors**

Particulars	Diarrhea		OR	95% CI	P value
	Yes	No			
Sex of the child					
Male	15	174	1.03	0.5-2.2	0.56
Female	14	167			
Modified Prasad's socioeconomic class*					
Class 3	3	9			
Class 4	7	72			
Class 5	28	342			
Immunization status of the child					
Partially immunized	2	18	1.04	0.2-5.2	0.62
Fully immunized	9	84			
Vitamin A supplementation					
Not given	2	49	0.42	0.09-1.8	0.19
Given	27	281			
Overcrowding					
Present	18	139	2.37	1.09-5.2	0.022
Absent	11	202			
Personal hygiene of the care giver					
Not satisfactory	17	134	2.19	1.01-4.7	0.034
Satisfactory	12	207			
Sanitary latrine					
Absent	24	245	1.88	0.7-5.1	0.12
Present	5	96			
At risk child					
Yes	15	192	0.83	0.4-1.8	0.63
No	14	149			

ARI: Acute respiratory infections, OR: Odds ratio, CI: Confidence interval, \* $\chi^2$  for linear trend is 7.92, df=2, P=0.019

found to be 11.9% and 15.5% in Chaturvedi *et al.*<sup>10</sup> Panwar and Nandan.<sup>11</sup> reported the 2-week prevalence of diarrhea and ARI as 13.6% and 24.1%, respectively. DLHS 4 and 3 reported the prevalence of diarrhea and ARI as 5.5% and 5.7% and as 5.5% and 8.9%, respectively.

**Table 5: Association of ARI and demographic, socioeconomic and environmental factors**

Particulars	ARI		OR	95% CI	P value
	Yes	No			
Sex of the child					
Male	28	161	1.68	0.9-3.2	0.075
Female	17	164			
Modified Prasad's socioeconomic class*					
Class 3	0	10			
Class 4	6	73			
Class 5	25	256			
Immunization status of the child					
Partially immunized	1	19	0.43	0.05-3.6	0.38
Fully immunized	10	83			
Congenital anomaly					
Present	2	2	7.5	1.03-54.7	0.02
Absent	43	323			
Vitamin A supplementation					
Not given	10	41	2.03	0.93-4.4	0.06
Given	33	275			
Overcrowding					
Present	26	131	2.02	1.08-3.8	0.02
Absent	19	194			
Personal hygiene of the care giver					
Not satisfactory	34	117	5.49	2.9-11.3	<0.01
Satisfactory	11	208			
Sanitary latrine					
Absent	32	239	0.185	0.08-0.4	0.43
Present	13	18			
At risk child					
Yes	33	174	2.4	1.2-4.8	0.012
No	12	152			

ARI: Acute respiratory infections, OR: Odds ratio, CI: Confidence interval, \* $\chi^2$  for linear trend is 1.076, df=2,  $P=0.58$

Diarrhea was more common in 7-24 month age group than in 0-6 months or more than 25 months age group, though not statistically significant ( $P > 0.05$ ). Similar observations made in Stanly *et al.*<sup>12</sup> The reason could be due to weaning and exposure of children to various environmental conditions as the child begins to crawl and walk. ARI was more common in the infant age group (0-6 months). Though not statistically significant, similar results were observed in Kumar *et al.*<sup>13</sup>

The present study shows <5 year old children suffer about 2.58 episodes of ARI and 1.64 episodes of diarrhea per child year. On an average, <5 year old children suffer about 5 episodes of ARI<sup>2</sup> and 3 episodes of diarrhea<sup>14</sup> per child per year. Walke *et al.*,<sup>15</sup> Awasthi and Pande<sup>16</sup> report 4.1 episodes, 1.67 episodes of ARI per child per year, respectively. Sutariya *et al.*<sup>17</sup> states children suffer from 3.42 episodes of diarrhea per child per year. These differences in the incidence rates may be due to the fact that some studies have been done only in a part of the year, regional differences, and different questions used to estimate ARI and diarrhea in the studies.

Prevalence of diarrhea was significantly increased in those children belonging to a lower socioeconomic status, those in overcrowded houses and whose care giver had unsatisfactory personal hygiene. About 88% of diarrheal deaths worldwide are attributable to unsafe water, inadequate sanitation, and poor hygiene (WHO/UNICEF 2004). Our study also confirms the same. A study by Yavatmal Khadse *et al.*<sup>18</sup> had also stated that hand washing with soap and water after defecation and before feeding had a protective value against diarrhea. There was significant association between lack of personal hygiene and occurrence of diarrhea in the study by Stanly *et al.*<sup>12</sup>

Prevalence of ARI was significantly increased in children who had not received vitamin A supplements, children with congenital anomaly, those in overcrowded houses, whose care givers had unsatisfactory personal hygiene and those children who were found to be 'at risk'. Vitamin A deficiency is known to be associated with an increase in mortality and morbidity due to respiratory and intestinal infections.<sup>19</sup> In a randomized trial in India,<sup>20</sup> vitamin A supplements had no significant effect on the percentage of time ill or number of respiratory infection episodes. Children who received vitamin A had a significantly increased mean duration of diarrheal episodes. In our study, though there is a significant association of reduction of ARI prevalence with vitamin A, there is no significant association in the reduction of diarrheal prevalence. Hence, there is a clear need to undertake a comprehensive trial with adequate sample size and a standardized methodology that could give clear, unbiased, and convincing evidence on the role of routine vitamin A supplementation. Overcrowding has a direct relationship with the prevalence of ARI. The present study found a significant association between ARI and overcrowding. Various studies such as by Bipin *et al.*,<sup>21</sup> Rahman and Rahman<sup>22</sup> Gupta *et al.*,<sup>23</sup> and Berman *et al.*<sup>24</sup> found a similar association.

## CONCLUSION

The two major killers of children ARI and diarrhea are preventable by simple interventions like maintaining good personal hygiene and sanitation.

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