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Factors Associated with Acute Respiratory Disease (ARD) among Children under Five Years of Age in District Headquarter Hospital (DHQ) Sheikhupura

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ABSTRACT:

Background: Acute respiratory disease (ARD) remains a major cause of morbidity among children younger than five years, particularly in low-resource settings. This study assessed the frequency of ARD and its sociodemographic, clinical, and environmental correlates among under-five children in Sheikhupura, Pakistan.

Methods: A cross-sectional analytical study included 382 children presenting to the pediatric outpatient and emergency departments of District Headquarter Hospital Sheikhupura. Participants were recruited through convenience sampling. Data were collected using a structured questionnaire covering sociodemographic, clinical, and household environmental characteristics. Associations with current ARD were examined using the chi-square test, with $p<0.05$ considered statistically significant.

Results: Current ARD was reported in 312 children (81.7%), while 304 (79.6%) had experienced ARD during the preceding two weeks and 280 (73.3%) had recurrent episodes in the previous month. Paternal education was significantly associated with current ARD ($p<0.001$). Significant associations were also observed with the number of under-five children with ARD in the household ($p<0.001$), child comorbidity ($p=0.047$), and household surface-cleaning solution ($p<0.001$). Sex, residence, maternal education, parental occupation, immunization status, birth weight, household crowding, indoor pollution, traffic smoke, factory smoke, bird exposure, and housing material were not significantly associated with current ARD.

Conclusion: ARD was highly frequent among under-five children attending DHQ Hospital Sheikhupura. Household clustering, paternal education, comorbidity, and cleaning practices were associated with current ARD. Prospective multicenter studies with multivariable analysis are needed to identify independent predictors.

INTRODUCTION

Acute respiratory diseases (ARDs) are a major cause of morbidity among children younger than five years, particularly in low- and middle-income countries. They involve the upper or lower respiratory tract and include conditions such as pharyngitis,

bronchitis, bronchiolitis, and pneumonia. Most childhood respiratory infections are caused by viral or bacterial pathogens, with rhinovirus, influenza virus, respiratory syncytial virus, and adenovirus among the commonly implicated viral agents [1,2]. Young children are particularly susceptible because of their developing respiratory and immune systems, which increase vulnerability to infection and its complications [3].

Biological, sociodemographic and environmental factors all play a role in the occurrence of ARD in children. Low birth weight, prematurity, poor breastfeeding, poor nutritional status, poor immunization status and underlying co morbidities have all been linked to increased respiratory morbidity [3-5]. Parental factors can also play a large role. Less maternal education, socioeconomic disadvantage, large family sizes and low levels of education of families about preventive practices can lead to higher exposure of children to infections and delay seeking of appropriate care [3,6]. So evidence from a number of low-resource settings therefore points to the fact that childhood ARD is not simply an infectious disease and needs to be considered in the broader social and household context.

In environments where household air pollution and overcrowding is prevalent, exposures are especially significant. Young children are more likely to suffer from respiratory illness from exposure to biomass fuel, wood smoke, cigarette smoke, poor housing, and inadequate ventilation [3,7]. Poor housing quality and household air pollution was also found to be an important contributor to acute respiratory symptoms in children in a study conducted in Punjab, Pakistan [7]. Other potentially harmful environmental factors, crowding and close contacts may also contribute to transmission or exacerbation of respiratory symptoms.

Childhood respiratory health is also related to immunization and nutrition. There is evidence that incomplete vaccination is linked to a higher incidence of ARD and that pneumococcal vaccination can have a marked impact on reducing pneumonia and other respiratory diseases in children under five years of age [4,8]. Breastfeeding gives further protection from childhood infectious diseases while inappropriate feeding practices and malnutrition can make children more vulnerable to respiratory infections [5,9]. These findings highlight the need for vaccination, nutrition, parental education, and reduction of environmental risk to be combined in preventive measures.

In Pakistan ARD remains a significant public health problem in children under 5 years. National data have been analysed to show associations between childhood respiratory illness and a number of factors such as age, socioeconomic status, maternal education, breast feeding practices, housing characteristics and vaccination status [6]. Household environmental exposures and nutritional factors have also been reported as potentially important determinants based on Pakistani studies [7,10]. However, district and hospital level evidence detailing the influence of both sociodemographic and environmental factors is still limited, especially for Sheikhupura.

Therefore, this study aimed to determine the frequency of acute respiratory disease and assess the sociodemographic and environmental factors associated with ARD among children younger than five years presenting to District Headquarter Hospital, Sheikhupura, Pakistan.

METHODS

Study Design and Setting

A cross-sectional analytical study was conducted over six months at District Headquarter (DHQ) Hospital Sheikhupura, Punjab, Pakistan, in collaboration with the Institute of Nursing, University of Health Sciences, Lahore.

Study Population and Sampling

Children under the age of 5 years attending the paediatric out-patient or emergency department were convenience sampled. The sample size was determined with 27.3% prevalence of ARD, 95% confidence level, 5% margin of error, and 10% drop-out, giving the number of participants as 382 [1]. Children were excluded if they had been recently hospitalized or had a significant chronic condition.

Data Collection

Structured questionnaires were used to collect data which was modified from a previous study [1]. It evaluated sociodemographic factors, clinical features of ARD and environmental exposure factors such as household crowding, indoor pollution, smoke exposure, animals, birds, cleaning practices, and housing factors. An Urdu translated questionnaire was used for the interviews of parents/guardians, which took around 10-15 minutes.

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Pilot Testing

A questionnaire was pilot tested in 38 children in the same context. The Cronbach's alpha scores were 0.75 for ARD related items and 0.76 for symptom related items, which are considered to be acceptable values.

Ethical Considerations

The ethical clearance from the relevant committees of University of Health Sciences, Lahore and permission from DHQ Hospital Sheikhupura was obtained. Parental/guardians written informed consent was obtained and thumb print if necessary. There was adherence to confidentiality and voluntary participation.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 23. Categorical variables were expressed in frequencies and percentages, and numerical variables were expressed in mean ± standard deviation as appropriate. Chi-square test was used for associations with ARD. A two-sided p-value <0.05 was considered statistically significant.

RESULTS

A total of 382 children were included in the analysis. Of these, 199 (52.1%) were male and 183 (47.9%) were female. Most participants were from rural areas (66.5%). Regarding maternal education, 31.7% of mothers had no formal education, while 48.0% had completed at least secondary education. Housewives accounted for 28.5% of respondents, whereas 41.0% were classified under other occupations (Table 1).

Table 1. Sociodemographic characteristics of the study participants (N=382)

Characteristic	Category	n (%)
Sex of child	Male	199 (52.1)
	Female	183 (47.9)
Place of residence	Rural	254 (66.5)
	Urban	128 (33.5)
Maternal education	No formal education	121 (31.7)
	Primary school	77 (20.2)
	Secondary school	92 (24.0)
	Above secondary school	92 (24.0)
Maternal/respondent occupation	Merchant	60 (15.7)
	Government employee	56 (14.7)
	Housewife	109 (28.5)
	Other	157 (41.0)

Clinical Characteristics

Current ARD was reported in 312 children (81.7%), while 304 (79.6%) had experienced an ARD episode during the preceding two weeks. Recurrent ARD, defined as at least two episodes during the previous month, was reported in 280 children (73.3%), and 263 (68.8%) had a history of persistent ARD lasting at least 14 days during the preceding three months. Only 49 children (12.8%) had known comorbidities and 19 (5.0%) had a household history of COVID-19. Most children were born at term (86.6%) and were fully immunized according to the National Immunization Program (86.6%). Nearly half had normal birth weight (48.7%), whereas 45.3% were reported as underweight at birth (Table 2).

Table 2. Clinical characteristics of children (N=382)

Clinical characteristic	Category	n (%)
Current ARD	No	70 (18.3)
	Yes	312 (81.7)
ARD during previous 2 weeks	No	78 (20.4)
	Yes	304 (79.6)
Previous contact with an ARD patient	No	341 (89.3)
	Yes	41 (10.7)
Recurrent ARD (≥2 episodes in previous month)	No	102 (26.7)
	Yes	280 (73.3)
Persistent ARD (≥14 days in previous 3 months)	No	119 (31.2)
	Yes	263 (68.8)
Known comorbidity	No	333 (87.2)
	Yes	49 (12.8)
Household history of COVID-19	No	363 (95.0)
	Yes	19 (5.0)
Gestational status at birth	Preterm	51 (13.4)
	Full term	331 (86.6)
Birth weight	Normal	186 (48.7)
	Underweight	173 (45.3)
	Overweight	23 (6.0)
Immunization status	Not vaccinated	24 (6.3)
	Partially vaccinated	27 (7.1)
	Fully vaccinated	331 (86.6)

Environmental Characteristics

Environmental exposures were common. Most households had between one and three rooms, with two-room households accounting for 42.9% of the sample. Burning logs was the most frequently reported source of indoor pollution (42.9%), followed by cigarette smoke (26.2%) and chimney smoke (22.0%). A factory emitting smoke was reported near 63.9% of residences, while 34.6% reported traffic-related smoke near the home.

Animals were present in 81.2% of households and birds in 72.8%; 57.3% of children reportedly had close contact with animals or birds. Regular cleaning and disinfection of frequently touched surfaces was reported by only 28.0% of respondents. Water alone was the most frequently reported surface-cleaning method (65.4%). Approximately half of the houses were constructed from bricks and cement (52.6%) (Table 3).

Table 3. Environmental characteristics of participating households (N=382)

Environmental characteristic	Category	n (%)
Number of rooms	1	63 (16.5)
	2	164 (42.9)
	3	95 (24.9)
	4	60 (15.7)
Indoor pollution source	Burning logs	164 (42.9)
	Chimney smoke	84 (22.0)
	Cigarette smoke	100 (26.2)
	Other	34 (8.9)
Carpets in house	No	298 (78.0)
	Yes	84 (22.0)
Factory emitting smoke nearby	No	138 (36.1)
	Yes	244 (63.9)
Traffic-related smoke nearby	No	250 (65.4)
	Yes	132 (34.6)
Animals in house	No	72 (18.8)
	Yes	310 (81.2)
Birds in house	No	104 (27.2)
	Yes	278 (72.8)
Close contact with animals/birds	No	163 (42.7)
	Yes	219 (57.3)
Regular surface cleaning/disinfection	No	275 (72.0)
	Yes	107 (28.0)
Surface-cleaning solution	Soap and water	44 (11.5)
	Diluted household bleach	44 (11.5)
	70% alcohol	44 (11.5)
	Water only	250 (65.4)
Major construction material	Bricks and cement	201 (52.6)
	Bricks	181 (47.4)

Factors Associated With Current ARD

Bivariate analysis identified significant associations between current ARD and paternal educational status (χ^2=27.156, p<0.001), the reported number of children younger than five years with ARD in the household (χ^2=51.201, p<0.001), presence of child

comorbidity (χ^2=3.943, p=0.047), and the type of solution used for cleaning household surfaces (χ^2=33.642, p<0.001) (Table 4).

The association with paternal education was not monotonic; current ARD occurred in 76.8% of children whose fathers had no formal education, 81.9% whose fathers had primary education, 70.1% whose fathers had secondary education, and 98.9% whose fathers had education above the secondary level. Among children with known comorbidity, 35/49 (71.4%) had current ARD compared with 277/333 (83.2%) among those without reported comorbidity.

Current ARD also varied substantially according to surface-cleaning practice: 28/44 (63.6%) among households using soap and water, 44/44 (100%) among those reporting diluted household bleach, 27/44 (61.4%) among those using 70% alcohol, and 213/250 (85.2%) among those using water alone. These findings represent unadjusted associations and should not be interpreted as evidence of causation.

No statistically significant associations were observed for sex, residence, maternal education, maternal occupation, paternal occupation, household COVID-19 history, gestational status at birth, immunization status, birth weight, number of rooms, household size, crowding, indoor pollution source, carpets, nearby factory smoke, traffic smoke, perception of smog, presence of birds, location of birds at night, close animal/bird contact, or house construction material (all p>0.05) (Table 4).

Table 4. Bivariate associations between participant characteristics and current ARD

Variable	χ^2	df	p-value
Sex of child	2.094	1	0.148
Residence	0.508	1	0.476
Maternal education	1.845	3	0.605
Paternal education	27.156	3	**<0.001**
Maternal occupation	2.258	5	0.812
Paternal occupation	0.628	5	0.987
Number of children <5 years with ARD	51.201	2	**<0.001**
Child comorbidity	3.943	1	**0.047**
Household COVID-19 history	0.812	1	0.367
Gestational status at birth	0.018	1	0.893
Immunization status	2.429	2	0.297
Birth weight	4.410	2	0.110
Number of rooms	0.635	3	0.888
Number of household members	5.625	7	0.584
Number sleeping in one room	11.598	6	0.072
Indoor pollution source	1.384	3	0.709
Carpets in house	0.693	1	0.405
Factory smoke near home	0.038	1	0.845
Traffic smoke near home	0.003	1	0.958
Perception of smog as an ARD factor	0.017	1	0.897
Birds in house	0.078	1	0.779

Location of birds at night	0.421	1	0.516
Close contact with animals/birds	2.463	1	0.117
Surface-cleaning solution	33.642	3	**<0.001**
Major construction material	0.002	1	0.965

Values are Pearson chi-square statistics calculated from the cell counts reported in the thesis. A p-value <0.05 was considered statistically significant.

DISCUSSION

The present study found a high frequency of acute respiratory disease (ARD) among children younger than five years presenting to DHQ Hospital Sheikhupura, with 81.7% having current ARD and 73.3% reporting recurrent episodes during the previous month. Childhood respiratory illness remains an important cause of morbidity in low- and middle-income countries, where socioeconomic disadvantage, nutritional factors, household crowding, and environmental exposures may increase susceptibility to respiratory infections [1-3]. Previous Pakistani data have similarly demonstrated an important burden of respiratory illness among young children and highlighted the contribution of household and socioeconomic characteristics [4,5].

Sex and place of residence were not significantly associated with current ARD in this study. Likewise, maternal education was not significantly associated after recalculation of the reported contingency data. In contrast, paternal educational status showed a significant association with ARD ($p<0.001$) [6]. However, the relationship was not linear across educational categories, as a particularly high frequency of ARD was observed among children whose fathers had education above the secondary level. Therefore, this finding should not be interpreted simply as evidence that lower parental education increases ARD risk [7]. Previous studies have nevertheless suggested that parental education may influence childhood respiratory health through health literacy, preventive practices, healthcare-seeking behavior, and household living conditions [4,8].

The number of children younger than five years with ARD within the household was strongly associated with current ARD ($p<0.001$). This finding may reflect shared environmental exposures and increased opportunities for transmission among young children living in the same household. Household crowding, close interpersonal contact, and shared caregiving environments have previously been associated with childhood respiratory infections [2,9]. However, the cross-sectional nature of the present study prevents determination of the temporal direction of this association [10].

Comorbidity was also associated with current ARD ($p=0.047$), although the proportion with ARD was lower among children with reported comorbidity than among those without comorbidity. Consequently, this association should be interpreted cautiously and does not demonstrate that comorbidity increased the risk of ARD [11]. Most children were fully immunized, and immunization status was not significantly associated with current ARD after recalculation of the reported data. Vaccination nevertheless remains an established preventive strategy against several important causes of childhood respiratory disease, including pneumococcal infections [12].

Environmental exposures were common: many households reported burning logs, cigarette smoke exposure, nearby factory emissions, animals, birds, and limited routine surface disinfection. Nevertheless, most individual environmental factors, including indoor pollution source, factory smoke, traffic smoke, household carpeting, birds, animal/bird contact, and housing construction material, were not significantly associated with current ARD. This differs from previous studies reporting associations between household air pollution, biomass-fuel exposure, tobacco smoke, and childhood respiratory illness [2,5]. Differences in exposure measurement, study population, sample size, and the hospital-based setting may partly explain these findings [13].

The type of solution used for household surface cleaning was significantly associated with current ARD ($p<0.001$). The pattern was not consistently protective, however, such as all children in homes reporting use of diluted bleach having ARD. This outcome could be due to changes in behaviour following illness, variations in household hygiene or, unknown or unmeasured confounding. As a result of this association, causal conclusions should not be drawn [14].

There are several limitations to these findings. The study was done in one hospital and the sampling was convenience which makes it not generalizable to the larger community. Recall and reporting bias may also influence data obtained from caregivers. Also, cross-sectional design can only draw associations and the analysis was largely conducted with only two variables without

adjusting for other possible variables. Further multicenter prospective studies with uniform clinical definitions and modified regression analyses are needed [15].

CONCLUSION

ARD was very common in children less than 5 years of age who came to the DHQ Hospital Sheikhupura. Most of the sociodemographic and environmental factors were not associated with current ARD, except for paternal education, number of young children with ARD living in the household, child comorbidity, and household surface-cleaning method. This is a reminder of the need for preventive measures at the household level, educating carers, early recognition of respiratory illness and the need for more prospective studies in order to determine independent risk factors for childhood ARD.

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