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ORIGINAL ARTICLE

Effect of Overcrowding on Childhood Hospital Admissions for Acute Respiratory Infection: A Matched Case–Control Study

FAZAL BADSHAH[1], SAAD FARID[2], MAZHAR ALI[3], SUMBAL AFZAL KHAN[4]
[1]Consultant child Specialist, Shifa foundation, Shifa international hospital Islamabad.
[2]Medical officer Peads ward Saidu Teaching Hospital/ Saidu Medical College Swat.
[3]Consultant child Specialist, Shifa foundation, Shifa international hospital Islamabad.
[4]Postgraduate resident Obs & Gynae ward Saidu Teaching Hospital Swat.
Correspondence to: Saad Farid, Email: saadsmc@yahoo.com, Cell: 0333-6412426

ABSTRACT

Objective: To determine the association between in-house overcrowding and acute respiratory infections (ARIs) in children.
Methods: This case-control hospital-based study wad conducted in Saidu Teaching hospital from March-2022 to December-2022. For cases we included 80 patients of age 6 to 59 months, who presented with newly diagnosed or relapsed cases of ARI. Controls were age and gender matched individuals who presented to outdoor hospital department for non-ARI evaluation and had no history of ARI since past 2 months. The in-house crowding was defined as >3 persons living in one bedroom in a home.
Results: Mean age in this study was 18.3±8.9 months in ARI group and 19.7±7.8 months in control group (p-value 0.41). There were higher number of patients belonging to poor class in ARI group; 36 (45%) versus 21 (26.2%) in controls, 26 (32.5%) patients in ARI and 31 (38.7%) patients in controls were belonging to middle class, 18 (22.5%) patients in ARI and 28 (35.0%) patients in control group were belonging to upper class (p-value 0.03). Majority of patients in ARI group were from rural areas; 53 (66.3%) in ARI and 37 (46.3%) in control group (p-value 0.01). In-house overcrowding was found in 19 (20%) patients in ARI group and in only 9 (11.3%) patients in control group (p-value 0.03).
Conclusion: In-house crowding is significantly associated with increased risk of ARI. The issue of overcrowding in rural regions is more serious than in cities. For Pakistani populations, the problem of overcrowded housing needs to be addressed.
Keywords: In-house overcrowding, Acute respiratory infections, Rural living, socio-economic status.

INTRODUCTION

Respiratory tract infections (RTIs) represent a prevalent and significant public health concern.[1] Children and individuals of lower socioeconomic status are particularly susceptible to a higher occurrence of lower RTIs.[2] Severe acute respiratory tract infections (RTIs), specifically pneumonia in children under the age of five, result in hospitalisations and mortality in approximately 15% of instances.[3] According to the findings of the Global Burden of Disease research conducted in 2019, lower respiratory tract infections have been identified as the second leading source of burden among children.[4] According to recent data from 2015, pneumonia is accountable for the mortality of around 0.9 million children under the age of five annually, constituting 15% of all deaths in the under-five age group in South Asia.[5]

Pakistan has a childhood mortality rate of 67 fatalities per 1,000 live births.[6] The nation experiences a significant burden of worldwide pneumonia-related mortality in children under the age of five, with an estimated annual death toll of 640,000.[6] The prevalence of acute respiratory infections (ARI) among children under the age of five has exhibited a decrease from 16% in the period of 2012-2013 to 14% in the period of 2017-2018. Notably, the age group of 6 to 23 months has displayed the highest occurrence of ARI symptoms.[7]

Several risk factors have been found to be linked to the morbidity and mortality of acute respiratory infections (ARI). These risk factors include malnutrition, poverty, low birth weight, insufficient breastfeeding, substandard housing conditions, overcrowding, outdoor and indoor pollution, as well as limited access to preventative and curative healthcare services.[8, 9] The association between overcrowding in homes and its detrimental effects on health has been widely acknowledged. However, there is a limited body of research that has specifically examined the transmission mechanisms of respiratory infections in children residing in overcrowded households.[6, 10] The presence of households crowding has the potential to lead to elevated prevalence rates of acute respiratory infections (ARI) among children. In the current study, we investigated the association between in-house overcrowding and acute respiratory infections (ARIs) in children.

METHODS

This case-control hospital-based study wad conducted in Saidu Teaching hospital from March-2022 to December-2022. Informed consent from patient's parents was obtained. For cases we included 80 patients of age 6 to 59 months, who presented with newly diagnosed or relapsed cases of ARI. Children presenting with cough, difficult breathing or fast breathing, unable to eat or drink properly, fever and convulsions were labelled as having ARI. The standard algorithm protocol was followed to determine the severity of ARI. Controls were age and gender matched individuals who presented to outdoor hospital department for non-ARI evaluation and had no history of ARI since past 2 months. While immune-compromised patients such as those with HIV, or tuberculosis patients were excluded.

A questionnaire was developed for data collection, that included information regarding age, gender, socio-economic status and number of family members and bedrooms in the home. The in-house crowding was defined as >3 persons living in one bedroom in a home. To get this we divided the total number of individuals including children in home with total number of bedrooms.

Association of in-house crowding with occurrence and severity of ARI was the primary study outcome.

RESULTS

Mean age in this study was 18.3±8.9 months in ARI group and 19.7±7.8 months in control group (p-value 0.41). There were 48 (60%) male patients in ARI and 46 (57.5%) in control group (p-value 0.78). There were higher number of patients belonging to poor class in ARI group; 36 (45%) versus 21 (26.2%) in controls, 26 (32.5%) patients in ARI and 31 (38.7%) patients in controls were belonging to middle class, 18 (22.5%) patients in ARI and 28 (35.0%) patients in control group were belonging to upper class (p-value 0.03). Majority of patients in ARI group were from rural areas; 53 (66.3%) in ARI and 37 (46.3%) in control group (p-value 0.01). In-house overcrowding was found in 19 (20%) patients in ARI group and in only 9 (11.3%) patients in control group (p-value 0.03) (Table 1).

Table 1: Comparison of Study Characteristics.

	ARI (N=80)	Controls (n=80)	p-value
Mean Age	18.3±8.9	19.7±7.8	0.41
Child's Gender			
Male	48 (60%)	46 (57.5%)	0.78
Female	32 (40%)	34 (42.5%)	
Socio-economic Status			

Poor	36 (45%)	21 (26.2%)	0.03
Middle Class	26 (32.5%)	31 (38.7%)	
Upper Class	18 (22.5%)	28 (35.0%)	
Residence			
Rural	53 (66.3%)	37 (46.3%)	0.01
urban	27 (33.7%)	43 (53.7%)	
In-house Crowding			
Yes	19 (20.0%)	09 (11.3%)	0.03
No	61 (80.0%)	71 (88.7%)	

DISCUSSION

According to Baker et al. overcrowding increases the risk of exposure and the transmission of respiratory diseases, such as secondary bacteria with viral infections.[11] If airflow within an enclosed location is restricted, the danger of exposure is also raised. Overcrowding in living conditions that aren't appropriate could encourage ARIs. Children under the age of three who reside in homes with more than five people or fewer than four rooms have a significantly higher risk of hospitalisation for respiratory infections, according to a study conducted in rural Alaska.[12] A meta-analysis revealed that crowding in the household is associated with an increased risk of developing respiratory infections (OR 1.69, 95% CI 1.34-2.13), influenza (OR 1.74, 95% CI 1.27-2.37), and bronchiolitis.[11]

A study from Swat Pakistan, also reported house overcrowding as a risk of ARI, the authors reported overcrowding in 55% children with ARIs.[13] Moreover the authors reported that being poor and living in rural areas are also risk factors of ARIs.[13] Similar findings were reported by Islam et al. from Bangladesh who reported poorty, in-house overcrowding and rural area living as risk factors of ARIs.[14]

A study conducted in Canada demonstrated a significant correlation between elevated levels of indoor carbon dioxide (CO_2) and the susceptibility to respiratory infections in young infants.[15] In addition, it is important to note that indoor humidity levels might be impacted by overcrowding, hence potentially elevating the susceptibility of household members to acute respiratory infections.[16] The findings of the current study align with previous research conducted in countries such as India and Nigeria, which have also identified home overcrowding as a significant risk factor for respiratory illness.[17, 18]

In a study by El-Koofy et al. conducted in Egypt, the authors did not find in-house overcrowding as a risk factor of ARIs, also the study also did not reported significance association of residential area with ARIs.[2]

In this study we found that being rick considerably reduces the probability of ARI hospitalisation. However, it is believed that having too many people living in one place is a sign of social marginalisation and poverty.[19] Families in poverty frequently have to make due with little to no electricity, undersized bedrooms, and inadequate hygienic conditions. Homes in rural or underdeveloped areas commonly use wood-burning stoves or other air-polluting cooking methods. A meta-analysis that included research on rural houses found a significantly increased risk of ARI in children who are exposed to cooking with filthy fuel.[20]

CONCLUSION

In-house crowding is significantly associated with increased risk of ARI. The issue of overcrowding in rural regions is more serious than in cities. For Pakistani populations, the problem of overcrowded housing needs to be addressed.

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