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Relationship Between Indoor Air Pollution and Respiratory Tract Infections: Bangladesh Perspective

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Respiratory tract infections, afflicting any part of the respiratory system, pose significant global health concerns, responsible for substantial morbidity and mortality rates worldwide. These infections can be attributed to a myriad of pathogens, including viruses, bacteria, and fungi, with the specific causative agent often dictating the severity and course of the disease[1]. Exemplifying the ubiquity and variety of these pathogens is the commonality of upper respiratory tract infections, like the common cold and sinusitis, and the criticality of lower respiratory tract infections, such as bronchitis and pneumonia. The recent SARS-CoV-2 pandemic underscores the global impact of respiratory infections, illustrating their potential to rapidly transition from localized disease to widespread public health crises[1].

However, the manifestation of these infections is contingent upon a complex interplay of individual and environmental risk factors. Indoor air pollution, a pervasive problem in low-income nations relying on biomass fuels for domestic needs, is a significant contributor to respiratory tract infections[2]. Combustion-derived pollutants infiltrate the respiratory system, triggering pathological reactions leading to various infections[3]. Other factors, including age, smoking, immunodeficiency, and the presence of chronic lung diseases, also play vital roles in an individual's susceptibility to these infections. Preventative strategies include hygiene practices, vaccinations, and minimizing exposure to air pollution and tobacco smoke, with management typically entailing symptom control and, in bacterial infections, antibiotic therapy[4]. However, the global rise of antimicrobial resistance necessitates judicious antibiotic use, highlighting the need for innovative research methodologies and comprehensive analytical models considering the multifaceted nature of these risk factors[5].

An investigation into the relationship between indoor air pollution and respiratory tract infections was conducted by Azad[6] and the research team in 2014 on 145 children aged 0 to 18 years as part of a systematic, randomised control trial at Shalchura, Nalitabari, Sherpur in Bangladesh between February 2011 and August 2011. The researchers collected data via a questionnaire from participants who lived in homes where biomass fuel, LP gas, and electricity were used for cooking, and their responses were documented[6]. According to the study, the prevalence of ARTI like fever, fast breathing, wheeze, chest in drawing, sore throat was higher in children aged 0 to 5 years old, most of whom were female, lived in a roof or pucca house with a poor ventilation system, accompanied their mother while cooking, and resided in the house most of the time, use of mosquito coils and insecticides[6].

According to Singh[7], a well-conducted study cannot show any association or identify any effect due to the small sample size. However, a large sample is also more cost-effective and requires a large amount of manpower[8]. The sample size in this study was insufficient to draw any conclusions. The study found no link between residents' smoking habits and respiratory tract infection in children, even though most studies found a link[9-10]. Moreover, in 2011, a study[11] in Ethiopia found that parental education, immunisation, malnutrition, the mother's occupation, and the location of residence were all important risk factors for respiratory infection; hence, the income of parents, and family members, the distance between the kitchen area, and living space, and time spent on cooking are also important factors related to the conclusion which was not included in the study. The children's mother was not well educated enough to distinguish between bronchitis and bronchiolitis. Moreover, the child’s immunization history was not evaluated which is also a key factor for respiratory tract infection[12].

Murray et al[12] initiated a longitudinal study from October 2004 to September 2005 to look for air pollution, specifically cooking fuel type and ventilation, as a risk factor for acute lower respiratory tract infections like bronchitis and bronchiolitis. As per the study by Murray et al[12] participants were 4300 under 59 months old children who lived in an urban area, Kamalapur, Dhaka, Bangladesh, caregivers completed a questionnaire that

was used to collect data and a medical officer who was part of the research team observed physical examinations, such as respiratory rate, temperature, and major and minor signs of respiratory illness, and in severe cases sent patients to the hospital for treatment. Children under the age of one year have a high incidence of bronchitis, bronchiolitis, and other respiratory infections; this incidence is not gender-related but is linked to air pollution (Biomass fuel), moreover, the occurrence of respiratory tract infections is decreased by appropriate and sufficient ventilation systems[12].

However, Kamalapur, Dhaka has a high level of outdoor air pollution which was not assessed, as a result, biomass fuel is not the sole cause of respiratory tract infection; other risk factors include outdoor air pollution, family members' smoking habits, and particulate matter[13]. Particulate matter, an important indicator of indoor air pollution[14], was not measured in this study. Children's nutritional status and living conditions are also influenced by their economic situation[15]. Furthermore, the house's construction materials, the number of windows, and the stove used for cooking were linked to respiratory infection[16], which were not excluded. When children visited the hospital for treatment, their immunisation and nutritional status were monitored which is also an important factor for a respiratory disease that was not collected for every child. The social, economic, and environmental conditions of urban areas differ from those of rural areas and affect the prevalence of respiratory infection[17-18].

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