Original Article

Impact of Status of Residence on Infant with Respiratory Tract Infections

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Abstract

Background: Respiratory tract infections (RTIs) are a leading cause of morbidity in infants, influenced by socio-demographic and environmental factors.

Objective: This study aimed to evaluate the impact of residence status with RTIs during the first year of life in Bangladesh, with insights applicable to similar settings globally.

Materials and Methods: This longitudinal, community-based observational study was conducted at the Institute of Child and Maternal Health (ICMH), Dhaka, from January 2015 to December 2016. A cohort of 308 newborns was enrolled, with 212 completing the 12-month follow-up. Data were collected through structured questionnaires, interviews, and clinical examinations. Socio-demographic variables, including housing status and residence level, were analyzed using chi-square and logistic regression tests. The study compared RTI prevalence between infants residing in ground-level homes, including tin-shed structures, and those in upper-floor residences.

Results: RTI prevalence was significantly higher among infants living in ground-level homes (71%), especially in tin-shed structures, compared to those in upper-floor residences 148 (28.5%) (χ^2=3.13, df=1, p<0.043). Male infants 115 (55.5%) showed a higher susceptibility to RTIs than females 92 (44.5%). The cohort predominantly consisted of nuclear families 171 (83%), with most infants having up to two siblings. Socio-demographic factors, including mode of delivery, parental consanguinity, and housing type, were associated with varying RTI patterns, highlighting the critical role of environmental exposures.

Conclusion: Residence level significantly influences infant RTI prevalence, with ground-level living posing higher risks in resource-limited settings. Addressing housing quality, pollution control, and equitable healthcare access is essential to mitigate RTI burdens in infants, Bangladesh.

Keywords: Status of Residence; Infants; Respiratory Tract Infection.

Introduction

There are approximately 3.4 million infants in Bangladesh, representing about 33% of the nation's total child population.[1] Respiratory tract infections (RTIs) remain a significant contributor to infant morbidity and mortality worldwide, with disparities influenced by socio-environmental factors, one of them is the level of residence.[2] Rural and urban living conditions distinctly affect exposure to environmental pollutants, healthcare accessibility, and socioeconomic variables, shaping the epidemiology of infantile RTIs.[3]

This longitudinal follow-up study addresses the limited understanding of how residence level influences infant RTIs, particularly in low-resource settings like Bangladesh. By focusing on environmental and socio-demographic factors, it fills a research gap in identifying preventable risks, guiding targeted interventions to reduce infant morbidity and mortality.

Globally, RTIs are among the leading causes of mortality in children under five, accounting for approximately 15%

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of all deaths annually, with infants being the most vulnerable group due to their underdeveloped immune systems.[4] Variations in residence significantly affect RTI incidence and prevalence. Rural areas, often characterized by biomass fuel use, overcrowding, and limited healthcare access, demonstrate higher RTI prevalence than urban regions.[5] Conversely, urban environments pose risks of pollution-induced respiratory diseases due to industrial emissions, vehicular exhaust, and poor ventilation.[6,7]

In South Asia, including Bangladesh and India, RTI prevalence in infants is compounded by high population density, inadequate sanitation, malnutrition, and poor-quality healthcare access.[8,9] Bangladesh reports RTI incidence rates ranging from 28% to 40% among infants, particularly in rural and slum areas where poverty, indoor air pollution, and lack of maternal education heighten vulnerability.[10,11] Similar trends are observed in India, where biomass fuel exposure and outdoor air pollution contribute to a heightened RTI burden among children under five.[12,13]

In contrast, European countries and the USA show comparatively lower RTI prevalence due to improved healthcare infrastructure, immunization coverage, and cleaner environments; however, urban centers in these regions still report substantial RTI cases linked to traffic-related air pollution, allergens, and social inequalities.[14]

Understanding the interplay between residence characteristics and RTI burden is crucial for pediatric specialists, public health professionals, and policymakers to develop targeted prevention strategies and optimize healthcare delivery. By analyzing epidemiological trends, this study underscores how residence-level disparities influence infant respiratory health across diverse global contexts.The aim and objective was to evaluate the impact of residence status with RTIs during the first year of life in Bangladesh, with insights applicable to similar settings globally.

Materials and Methods

This was an observational study conducted to evaluate the impact of residence status on infant respiratory tract infections (RTIs). The study was carried out at the Institute of Child and Maternal Health (ICMH) in Matuail, Dhaka, Bangladesh, over two years from January 2015 to December 2016.

A total of 384 healthy infants born in the Gynecology and Obstetrics Department of ICMH were initially enrolled, with 212 completing the first year of life with adequate follow-up. Purposive sampling was employed to ensure the inclusion of diverse socio-demographic groups. Data were collected using semi-structured questionnaires, face-to-face interviews, detailed history-taking, physical examinations, & appropriate diagnostic investigations.

Infants were monitored through a structured surveillance system, including monthly scheduled visits and additional visits as required. A total of 3,696 infant-months of observation were achieved, with 212 infants completing the 12-month follow-up, yielding 2,544 infant-months of data.

During the surveillance period, 3,846 communication points were recorded, including 478 physical visits and 3,368 telephone follow-ups. The dataset excluded instances where multiple phone calls or physical visits occurred for the same illness episode, which were estimated to be threefold higher than the recorded counts.

This methodology ensured a comprehensive evaluation of the relationship between levels of residence and infant RTIs, providing insights into the epidemiological factors affecting respiratory health in infants in the region.

Statistical Analysis- Baseline socio-demographic characteristics were descriptively analyzed for the 212 infants. Statistical analysis was conducted to compare categorical variables using chi-square or Fisher's exact tests, while discrete and continuous variables were analyzed through logistic regression. Data management and analysis were performed using SPSS software, version 22.

Result

This longitudinal study aimed to assess the Impact of status of Residence on Infant RTI among a birth cohort while analyzing variations based on socio-demographic factors. Conducted at the Institute of Child and Maternal Health (ICMH), Dhaka, Bangladesh, from January 2015 to December 2016, the study enrolled 308 newborns and successfully followed up with 212 infants for the first 365 days of life.

Of the analyzed cohort, 115 (55.5%) were male, and 92 (44.5%) were female. Mode of delivery showed that 159 (75%) infants were born via cesarean section (CS), and 53 (25%) via vaginal delivery (VD). The mean birth weight was 2903 ± 400 grams, mean birth length was 48 ± 2.5 cm, and mean occipitofrontal circumference (OFC) was 33 ± 2 cm.

This comprehensive dataset highlights the critical role of socio-demographic and environmental factors in shaping the respiratory health of infants, providing

valuable insights for targeted interventions to reduce respiratory disease burden in similar settings.

Table-1: Demographic characteristics of the study participants

Demographic scenario	Number (%)
Gender	
Male	115 (55.50)
Female	92 (44.50)
Residents	
Live in Tin shed house	106 (51)
Ground floor of building	42 (20)
Live in1st floor	32 (15.5)
Live in 2nd floor and above	27 (15.5)

The study included 212 participants, demographic scenario of which 115 (55.5) were male and 92 (44.5) were female. Regarding housing conditions, 106 participants (51) lived in tin-shed houses, while 42 (20) resided on the ground floor of a building. Additionally, 32 participants (15.5) lived on the first floor, and 27 (13) resided on the second floor or above.

Table-2: Sibling number in families

Sibling number	Number (%)
Upto 02	171(83)
Upto 04	31(15)
Upto 06	05(02)

The majority of families, 171 (83), had up to 2 siblings, indicating smaller family sizes were most common. A smaller proportion, 31 (15), had up to 4 siblings, showing moderately sized families were less frequent. Only 5 (2) families reported having up to 6 siblings, indicating that large families were rare in this sample.

Table-3: Family members

Family member	Median	Maximum	Minimum	Mode
Member	09	21	03	04

The table shows the distribution of family members among the study participants. The median family size was 9 members, with a minimum of 3 and a maximum of 21 members per family. The mode was 4, indicating that families with 4 members were most common.

Table-4: Inferential statistics on Respiratory tract infection and residence

	Respiratory tract infection		P value
	Up to 6 episodes	> 6 episodes	
Residence at ground level	46 (22%)	102 (49%)	0.043
Residence above ground level	26 (12.5%)	33 (16%)	

The table presents the relationship between respiratory tract infection (RTI) episodes and type of residence. Among the 207 participants, 72 (35) experienced up to 6 episodes of RTI, while 135 (65) had more than 6 episodes. Out of those living at ground level (tin-shed or ground floor), 46 (22) reported up to 6 episodes and 102 (49) reported more than 6 episodes, totaling 148 (71.5). In contrast, among participants living above ground level, 26 (12.5) had up to 6 episodes and 33 (16) had more than 6 episodes, totaling 59 (28.5).

The analysis indicates a higher prevalence of RTI among those residing at ground level. The association was statistically significant ($\chi^2 = 3.13$, df = 1, $P < 0.043$).

Discussion

This study evaluated the impact of residence status on infant respiratory tract infections (RTIs) in Bangladesh, revealing a higher prevalence of RTIs among infants residing in ground-level homes, particularly in tin-shed structures (Table 1). Our results showed that nearly two-thirds (64%) of infants from ground-floor and tin-shed dwellings experienced more than six RTI episodes during the first year of life (Table 1). This finding is consistent with regional studies demonstrating that infant RTI prevalence ranges between 55% and 70% in low-income South Asian communities, where overcrowding, poor ventilation, and biomass fuel exposure are prevalent risk factors.[15,18]

A large-scale study from rural India reported that 58% of infants living in ground-level or poorly ventilated houses experienced at least one RTI episode within the first year, compared to 32% in upper-floor or well-ventilated homes.[20] Similarly, a Bangladeshi cohort study found that 61% of infants from tin-shed dwellings experienced recurrent RTIs, compared to 38% from concrete houses, supporting our findings that lower-level, poorly ventilated residences increase infant susceptibility (Table 4). Other studies in Dhaka and Chattogram also reported that children from low-income, tin-roofed, and

congested homes had 1.8 to 2.5 times higher odds of developing respiratory infections compared to those from brick-built or multi-storey houses.[23] These results indicate that structural and environmental conditions at the household level significantly contribute to early-life respiratory morbidity in developing countries.

In contrast, findings from high-income countries such as those in Europe and the USA demonstrate different trends. In urban settings of London and New York, studies have shown that apartment-dwelling infants have a 25–30% higher risk of respiratory infections compared to those in suburban homes, primarily due to exposure to traffic-related air pollution, indoor particulate matter, and allergens.[24] For example, a UK birth cohort study found that infants exposed to PM (Perticuler Matter measred im micro meter) levels exceeding 25 μg/m^3 had a 1.4-fold increased risk of recurrent lower RTIs, while a US-based study reported that high-rise urban dwellings were associated with nearly double the odds of wheezing illnesses before age one.[22] These global data reinforce the principle that while the source of environmental exposure may differ—biomass combustion in developing countries versus industrial and vehicular emissions in developed nations—the impact on infant respiratory health remains universally significant.

The predominance of nuclear families (Table 3) and lower sibling counts in our cohort (Table 2) may have mitigated household transmission of infections. This observation aligns with global research showing that each additional child in a household can increase the odds of RTI transmission by 20–30%, particularly in shared sleeping environments.[17,19] The male predominance (55.5%) in RTI cases (Table 1) is also notable and parallels findings from South Asian studies reporting male-to-female ratios of 1.2–1.4:1, attributed to both biological vulnerability and gender-based disparities in care-seeking behavior.[21] Although our study did not perform inferential statistical analysis on gender variation, this remains an important consideration for future research.

A total of 212 infants were followed over the study period, out of 308 originally enrolled. The dropout rate of 31% represents a limitation and may have introduced attrition bias. Additionally, factors such as urban–rural disparities, seasonal fluctuations, and air quality were not quantitatively assessed. Therefore, while our findings highlight key environmental and socio-demographic determinants of infant RTIs (Table 4), their generalizability may be limited to comparable low-income urban and peri-urban populations.

Future studies should incorporate air quality indices, household ventilation metrics, and quantitative exposure assessments to strengthen causal inference. Nevertheless, our findings emphasize that residence type and housing elevation are critical determinants of early-life respiratory health. Improving housing standards, promoting upstairs or well-ventilated living environments, controlling indoor and outdoor air pollution, and ensuring equitable healthcare access remain essential strategies to reduce the global burden of RTIs among infants.

Weaknesses of the study were only 212 of the 308 enrolled infants completed the study, potentially introducing bias, because of small sample size. These outcomes are not universally relevant to varied economic and social conditions. Air quality and seasonal variations were not quantitatively assessed.

Upstairs living, improving housing conditions, controlling air pollution, and ensuring equitable healthcare access remain essential strategies to reduce the RTI burden among infants globally.

Conclusion

This study demonstrates that residence status significantly affects the risk of respiratory tract infections in infants during their first year of life in Bangladesh. Infants living in ground-level homes faced a higher prevalence of RTIs, emphasizing the influence of socio-demographic and environmental factors like housing conditions. These findings highlight the importance of improving living environments, reducing air pollution, and ensuring equitable access to healthcare to lessen the burden of RTIs.

Recommendations

Improve ventilation and housing in ground-level and tin-shed homes, control air pollution, and educate families on reducing environmental risks to protect infant respiratory health. Where possible, encourage living above ground level to lower exposure to pollutants. Further large-scale cohort studies with greater sample sizes are needed to deepen our understanding of these associations and guide effective interventions.

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