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Factors associated with acute respiratory infection among under-five children at Muara Enim community health center: A cross-sectional study

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Abstract

Background: Acute Respiratory Infection (ARI) remains a major public health problem among under-five children and contributes significantly to morbidity and primary health care utilization. Household environmental and behavioral factors are known to increase the risk of ARI, particularly in areas with substandard housing conditions.
Objective: This study aimed to analyze factors associated with Acute Respiratory Infection among under-five children in the working area of Muara Enim community Health Center.
Methods: This study employed a quantitative cross-sectional design. The study population consisted of all mothers with under-five children aged 0–59 months in Kelurahan Tungkal, Muara Enim District, totaling 444 individuals. A total of 82 respondents were selected using random sampling. Data were collected through face-to-face interviews using a structured questionnaire assessing cigarette smoke exposure, mosquito coil use, housing density, and household ventilation. Data were analyzed using the Chi-square test with a significance level of 0.05.
Results: The findings showed significant associations between cigarette smoke exposure (p = 0.000), mosquito coil use (p = 0.000), housing density (p = 0.000), household ventilation (p = 0.002), and the occurrence of Acute Respiratory Infection among under-five children. Children exposed to these risk factors had a higher proportion of ARI compared to those who were not exposed.
Conclusion: Acute Respiratory Infection among under-five children is significantly associated with household environmental and behavioral factors. Strengthening community-based health education focusing on ARI prevention is recommended, particularly regarding smoking cessation inside the home, reduction of mosquito coil use, and improvement of healthy housing conditions. Intersectoral collaboration is essential to support sustainable household environmental improvements.

Background

Acute Respiratory Infection among under-five children represents a persistent global public health problem that continues to contribute substantially to childhood morbidity and mortality worldwide (Bender et al., 2024). Acute Respiratory Infection affects vulnerable pediatric populations by causing recurrent respiratory symptoms and functional impairment in early childhood across diverse geographic settings (Bhurtel et al., 2022). Acute Respiratory Infection increases the risk of severe complications such as pneumonia that often require intensive medical treatment and hospitalization among under-five children (Correia et al., 2021). The immature immune system of under-five children predisposes them to respiratory infections under adverse environmental and social conditions globally (Ekholuenetale et al., 2023). Social and environmental inequalities exacerbate the distribution of Acute Respiratory Infection by disproportionately affecting children living in disadvantaged households (Chelak & Chakole, 2023). Health systems in low- and middle-income countries face significant challenges in preventing and managing Acute Respiratory Infection due to limited preventive resources and delayed care-seeking behaviors (Fidah et al., 2024). Therefore, identifying modifiable factors associated with Acute Respiratory Infection remains a critical priority for child health research worldwide (Apanga & Kumbeni, 2021).

The epidemiological burden of Acute Respiratory Infection in Indonesia remains high and reflects broader global trends affecting developing countries (Kementerian Kesehatan RI, 2023). National health surveillance data reported more than 877,000 cases of Acute Respiratory Infection in Indonesia, with a prevalence of 4.8% among under-five children at the national level (Kementerian Kesehatan RI, 2023). Provincial health reports indicated that

South Sumatra recorded a substantial number of Acute Respiratory Infection cases among children, demonstrating persistent regional disparities (Profil Kesehatan Provinsi Sumatera Selatan, 2023). Local health authorities documented that Muara Enim District contributed significantly to the provincial burden of Acute Respiratory Infection cases among under-five children (Dinas Kesehatan Muara Enim, 2021). Primary health care facilities serve as the main reporting and treatment centers for Acute Respiratory Infection cases in district-level health systems (Puskesmas Muara Enim, 2025). Temporal fluctuations in Acute Respiratory Infection incidence reflect ongoing exposure to environmental and behavioral risk factors in community settings (Dinas Kesehatan Muara Enim, 2021). Consequently, localized epidemiological investigations are essential to understand the contextual determinants of Acute Respiratory Infection at the primary health care level (Agrarina et al., 2025).

Environmental risk factors within household settings play a central role in the transmission and recurrence of Acute Respiratory Infection among under-five children (Haryani et al., 2021). Poor housing conditions such as inadequate ventilation, overcrowding, and insufficient living space increase indoor air pollution exposure among young children (Junilantivo et al., 2022). Physical environmental deficiencies facilitate the accumulation of respiratory irritants that compromise respiratory health in early childhood (Waliyyuddin et al., 2024). Unsanitary household conditions create favorable environments for infectious agents that cause respiratory illnesses in children (Budianto, 2022). Studies conducted in various Indonesian regions have consistently demonstrated a significant association between poor housing conditions and Acute Respiratory Infection incidence among under-five children (Pasaribu et al., 2021). Similar findings across international contexts reinforce the importance of environmental determinants in shaping respiratory health outcomes (Dagne et al., 2020). Therefore, household environmental quality represents a critical intervention target for reducing Acute Respiratory Infection among under-five children (Chelak & Chakole, 2023).

Behavioral risk factors within households significantly contribute to Acute Respiratory Infection exposure among under-five children (Kurniawan et al., 2021). Passive smoking exposes children to toxic substances that impair respiratory function and increase infection susceptibility (Firda Wahyuni et al., 2021). Caregivers' smoking behavior inside the house places under-five children at continuous risk of inhaling harmful cigarette smoke (Luselya & Roberth, 2023). The use of mosquito coils produces particulate matter and toxic fumes that irritate the respiratory tract of young children (Luselya & Roberth, 2023). Repeated inhalation of combustion byproducts exacerbates respiratory inflammation and weakens pulmonary defense mechanisms in children (Correia et al., 2021). Behavioral risk factors often coexist with poor environmental conditions, amplifying the cumulative risk of Acute Respiratory Infection (Pasaribu et al., 2021). Consequently, behavioral modification strategies are essential components of comprehensive Acute Respiratory Infection prevention programs (Alamer, 2024).

Nutritional status also plays a significant role in determining susceptibility to Acute Respiratory Infection among under-five children (Agrarina et al., 2025). Malnutrition compromises immune function and increases vulnerability to infectious diseases in early childhood (Apanga & Kumbeni, 2021). Children with poor nutritional status experience delayed recovery and higher recurrence rates of Acute Respiratory Infection episodes (Dagne et al., 2020). The interaction between nutritional deficiencies and environmental exposures intensifies the risk of respiratory infections in under-five populations (Ekholuenetale et al., 2023). Primary caregivers' health-seeking behavior further influences the severity and outcomes of Acute Respiratory Infection episodes (Fidah et al., 2024). Timely access to health services improves clinical outcomes and reduces complications associated with Acute Respiratory Infection (Rianita Citra Tri Sartika & Anggriawan, 2022). Therefore, multifactorial approaches are necessary to address the interconnected determinants of Acute Respiratory Infection among under-five children (Chelak & Chakole, 2023).

Despite extensive global and national evidence, limited studies have comprehensively examined the combined influence of environmental, behavioral, and nutritional factors at the primary health care level in Muara Enim District (Dinas Kesehatan Muara Enim, 2021). Existing

surveillance data primarily focus on case counts without detailed analysis of underlying risk factors (Puskesmas Muara Enim, 2025). Local epidemiological patterns suggest persistent and fluctuating Acute Respiratory Infection incidence among under-five children in Kelurahan Tungkal (Profil Kesehatan Provinsi Sumatera Selatan, 2023). Context-specific research is required to generate evidence-based recommendations tailored to local health system needs (Agrarina et al., 2025). Cross-sectional study designs provide an effective approach for identifying associated factors in community-based health research (Abdul Rahman et al., 2025). Robust methodological approaches enhance the validity and applicability of findings for public health interventions (Abdul Rahman et al., 2025). Therefore, this study aims to analyze factors associated with Acute Respiratory Infection among under-five children at Muara Enim Primary Health Center using a cross-sectional study design.

Methods

Study Design

This study employed a quantitative observational design with a cross-sectional approach to examine factors associated with Acute Respiratory Infection among under-five children. The cross-sectional design was selected because it allows the simultaneous assessment of exposure variables and health outcomes within a defined population at a single point in time. This design is appropriate for identifying associations between environmental, behavioral, and housing-related factors and the occurrence of Acute Respiratory Infection in community settings. The study was conducted in Kelurahan Tungkal, which is part of the service area of Muara Enim Primary Health Center, Muara Enim District, South Sumatra Province. The study period was carried out from May to July 2025 to ensure adequate participant recruitment and data completeness. The selection of the study location was based on consistently high and fluctuating Acute Respiratory Infection case reports among under-five children over the past three years. Although this design does not establish causal relationships, it provides valuable epidemiological evidence to inform preventive strategies at the primary health care level.

Sampling

The study population consisted of all mothers who had under-five children aged 0–59 months residing in Kelurahan Tungkal within the working area of Muara Enim Primary Health Center in 2025. Based on local demographic records, the total population comprised 444 eligible mothers. A probability sampling method using simple random sampling was applied to ensure that each eligible participant had an equal chance of being selected. This sampling technique was chosen to minimize selection bias and improve the representativeness of the sample. Inclusion criteria included mothers who had under-five children living permanently in the study area and who were willing to participate in the study. Mothers who were unable to communicate effectively or declined participation were excluded. Using appropriate sample size considerations, a total of 82 under-five children were included in the final analysis. This sample size was considered sufficient to detect statistically meaningful associations between the studied variables.

Instruments

Data were collected using a structured questionnaire developed based on the study objectives and relevant public health indicators. The questionnaire consisted of closed-ended questions covering key independent variables, including exposure to cigarette smoke, use of mosquito coils, housing density, and household ventilation conditions. The dependent variable was the occurrence of Acute Respiratory Infection among under-five children, as reported by mothers based on recent symptoms and health center diagnoses. Each variable was operationally defined to ensure consistency and clarity during data collection. Housing density and ventilation were assessed according to nationally accepted standards for healthy housing conditions. The use of a structured questionnaire was justified to facilitate uniform data collection and reduce interviewer variability. Prior to data collection, the questionnaire was reviewed to ensure clarity and appropriateness for the local context.

Data Collection

Primary data were collected directly from respondents through face-to-face interviews conducted by trained data collectors. Before the interview process, respondents received a detailed explanation regarding the purpose, procedures, and benefits of the study. Interviews were conducted in a private and comfortable setting to encourage honest responses and maintain confidentiality. Each respondent was asked to complete the questionnaire under the guidance of the interviewer to minimize misunderstanding of questions. Responses were recorded systematically on standardized data collection forms. Data collection procedures were carried out consistently throughout the study period to maintain data quality. All completed questionnaires were checked daily for completeness and accuracy before data entry.

Data Analysis

Data were entered, cleaned, and analyzed using Statistical Package for the Social Sciences software. Univariate analysis was conducted to describe the frequency and percentage distribution of each study variable. This analysis provided an overview of respondent characteristics and the prevalence of Acute Respiratory Infection and related risk factors. Bivariate analysis was performed to examine the association between independent variables and the dependent variable. The Chi-square test was used to assess statistical relationships between categorical variables. A significance level of 0.05 was applied to determine statistical significance. This analytical approach was selected to identify factors significantly associated with Acute Respiratory Infection among under-five children in the study area.

Ethical Consideration

Ethical principles were strictly applied throughout the research process to protect participants' rights and well-being. The study was conducted after obtaining formal permission from relevant institutional authorities and local health offices. All participants were informed about the study objectives, procedures, potential risks, and benefits prior to participation. Written informed consent was obtained from each respondent to confirm voluntary participation without coercion. Participants were assured that all personal information would be kept confidential and used solely for research purposes. Data were anonymized to prevent identification of individual respondents. Participants were also informed of their right to withdraw from the study at any time without any consequences.

Results

This section presents the empirical findings of the study on factors associated with Acute Respiratory Infection among under-five children at Muara Enim Primary Health Center. The results are organized to describe respondent characteristics and to examine the relationships between selected environmental and behavioral factors and the occurrence of Acute Respiratory Infection. Descriptive analysis is used to illustrate the distribution of key variables, followed by bivariate analysis to assess statistical associations. The findings are presented systematically in tabular form to enhance clarity and facilitate interpretation. All results are reported based on statistical testing conducted at a 95% confidence level. The presentation of results focuses solely on observed data without causal inference.

Table 1 shows that 40.2% of under-five children experienced Acute Respiratory Infection, while the majority did not experience the condition. A considerable proportion of children were exposed to cigarette smoke and lived in households with inadequate ventilation. The use of mosquito coils and substandard housing density were also observed among a notable number of respondents. These findings indicate that exposure to potential environmental and behavioral risk factors remains prevalent in the study area

Table 1. Distribution of Respondent Characteristics and Study Variables among Under-Five Children at Muara Enim Primary Health Center

Variables	Frequency (n)	Percentage (%)
Acute Respiratory Infection (ARI) Status		40,2
ARI	33	59,8
No ARI	49	
Cigarette Smoke Exposure		
Exposed	35	42,7
Not Exposed	47	57,3
Mosquito Coil Use		
Yes	24	29,3
No	58	70,7
Housing Density		
Does Not Meet Standards	25	30,5
Meets Standards	57	69,5
Ventilation		
Does Not Meet Standards	39	47,6
Meet Standards	43	52,4

Table 2 demonstrates statistically significant associations between all examined independent variables and the occurrence of Acute Respiratory Infection among under-five children. Children exposed to cigarette smoke, mosquito coil use, inadequate housing density, and poor ventilation showed higher proportions of Acute Respiratory Infection compared to their counterparts. All variables tested yielded p-values below 0.05, indicating meaningful relationships. These results suggest that household environmental and behavioral factors are significantly associated with Acute Respiratory Infection in the study population.

Table 2. Association Between Independent Variables and ODF Status

Variables	ARI Status				Total	*p Value*
	ARI		No ARI			
	f	%	f	%	f	
Cigarette Smoke Exposure						
Exposed	28	80	7	20	35	0,000
Not Exposed	5	10,6	42	89,4	47	
Mosquito Coil Use						
Yes	18	75	6	25	24	0,000
No	15	25,9	43	74,1	28	
Housing Density						
Does Not Meet Standards	20	80	5	20	25	0,000
Meets Standards	13	22,8	44	77,2	57	
Ventilation						
Does Not Meet Standards	23	59	16	41	39	0,000
Meet Standards	10	23,3	33	76,7	43	

Discussion

This study demonstrated that cigarette smoke exposure, mosquito coil use, housing density, and ventilation were significantly associated with Acute Respiratory Infection among under-five children in the Muara Enim Primary Health Center area (Apanga & Kumbeni, 2021). The findings indicate that environmental and behavioral household factors play a crucial role in shaping respiratory health outcomes among young children (Chelak & Chakole, 2023). The proportion of under-five children experiencing Acute Respiratory Infection in this study reflects the persistent burden of respiratory diseases reported in both national and global contexts (Bender et al., 2024). The cross-sectional findings align with epidemiological patterns observed in low- and middle-income countries where household exposures remain dominant

determinants of child health (Ekholuenetale et al., 2023). The observed associations emphasize the importance of preventive strategies that target modifiable risk factors at the household level (Agrarina et al., 2025). These results support the growing body of evidence that Acute Respiratory Infection among under-five children is a multifactorial condition influenced by environmental, behavioral, and structural determinants (Dagne et al., 2020). Therefore, the discussion of each associated factor provides important insights for contextualizing the study findings within existing literature (Bhurtel et al., 2022).

The analysis revealed a strong association between household cigarette smoke exposure and the occurrence of Acute Respiratory Infection among under-five children (Kurniawan et al., 2021). Passive smoking exposes children to toxic substances that impair respiratory tract defenses and increase susceptibility to infection (Firda Wahyuni et al., 2021). Caregiver smoking behavior inside the home creates continuous indoor air pollution that disproportionately affects young children with immature respiratory systems (Luselya & Roberth, 2023). Similar associations have been reported in multiple Indonesian and international studies examining respiratory outcomes in early childhood (Pasaribu et al., 2021). The consistency of findings across settings strengthens the plausibility of cigarette smoke exposure as a critical risk factor for Acute Respiratory Infection (Apanga & Kumbeni, 2021). Behavioral patterns related to smoking are often deeply embedded within household practices and require targeted interventions to achieve sustainable change (Alamer, 2024). Consequently, reducing children's exposure to cigarette smoke remains a key public health priority in preventing Acute Respiratory Infection (Chelak & Chakole, 2023).

This study also identified a significant relationship between mosquito coil use and Acute Respiratory Infection among under-five children (Luselya & Roberth, 2023). Mosquito coil combustion releases particulate matter and chemical compounds that irritate the respiratory tract when inhaled by young children (Firda Wahyuni et al., 2021). Prolonged exposure to these pollutants may weaken pulmonary defense mechanisms and facilitate respiratory infections (Correia et al., 2021). Previous studies conducted in various Indonesian regions have reported similar associations between mosquito coil use and respiratory morbidity in children (Budianto, 2022). The persistence of mosquito coil use reflects limited access to safer vector control alternatives in many communities (Chelak & Chakole, 2023). Household practices related to mosquito control therefore represent an important modifiable risk factor for respiratory health (Agrarina et al., 2025). Addressing this issue requires community education and promotion of safer mosquito prevention methods (Alamer, 2024).

Housing density was found to be significantly associated with Acute Respiratory Infection among under-five children in this study (Pasaribu et al., 2021). Overcrowded living conditions increase close contact among household members and facilitate the transmission of respiratory pathogens (Dagne et al., 2020). High occupancy density contributes to elevated indoor humidity and reduced air quality that adversely affect respiratory health (Junilantivo et al., 2022). Similar findings have been documented in both urban and rural settings across Indonesia (Haryani et al., 2021). International evidence also supports the role of housing density as a determinant of childhood respiratory infections (Apanga & Kumbeni, 2021). Structural housing conditions often reflect broader socioeconomic constraints that limit families' ability to improve living environments (Chelak & Chakole, 2023). Therefore, housing improvement strategies should be integrated into public health interventions targeting Acute Respiratory Infection prevention (Waliyyuddin et al., 2024).

Ventilation was another household environmental factor significantly associated with Acute Respiratory Infection among under-five children (Junilantivo et al., 2022). Inadequate ventilation restricts air circulation and allows the accumulation of indoor pollutants and infectious agents (Waliyyuddin et al., 2024). Poor ventilation exacerbates the effects of other environmental exposures such

as cigarette smoke and mosquito coil emissions (Budianto, 2022). Studies conducted in various Indonesian provinces have consistently reported similar associations between ventilation and respiratory morbidity in children (Pasaribu et al., 2021). International studies also highlight ventilation as a key protective factor for respiratory health in early childhood (Dagne et al., 2020). Improving household ventilation represents a feasible and cost-effective intervention for reducing Acute Respiratory Infection risk (Chelak & Chakole, 2023). These findings underscore the importance of healthy housing standards in promoting child respiratory health (Haryani et al., 2021).

The combined influence of behavioral and environmental factors observed in this study illustrates the complex nature of Acute Respiratory Infection among under-five children (Agrarina et al., 2025). Exposure to multiple household risk factors simultaneously may amplify children's vulnerability to respiratory infections (Ekholuenetale et al., 2023). This interaction reflects the interconnectedness of social determinants of health within household environments (Chelak & Chakole, 2023). Similar multifactorial patterns have been observed in studies conducted across diverse geographic regions (Apanga & Kumbeni, 2021). The findings reinforce the need for integrated intervention approaches rather than single-factor strategies (Alamer, 2024). Health promotion efforts should therefore address behavioral change, environmental improvement, and caregiver awareness simultaneously (Fidah et al., 2024). Such comprehensive strategies are essential for achieving sustained reductions in Acute Respiratory Infection incidence among under-five children (Bender et al., 2024).

The cross-sectional design of this study allowed for efficient identification of associations between risk factors and Acute Respiratory Infection (Abdul Rahman et al., 2025). This methodological approach is widely used in public health research to assess population-level relationships at a specific point in time (Bhurtel et al., 2022). Although causal inference cannot be established, the findings provide valuable epidemiological insights relevant to primary health care settings (Agrarina et al., 2025). The use of random sampling strengthened the representativeness of the study population (Abdul Rahman et al., 2025). Reliance on caregiver-reported data may introduce recall bias, which is a common limitation in community-based studies (Fidah et al., 2024). However, the consistency of findings with existing literature supports the credibility of the results (Pasaribu et al., 2021). Therefore, the study contributes meaningful evidence to the understanding of Acute Respiratory Infection determinants at the local level (Dinas Kesehatan Muara Enim, 2021).

In conclusion, the discussion highlights that Acute Respiratory Infection among under-five children is strongly associated with modifiable household environmental and behavioral factors (Apanga & Kumbeni, 2021). The findings are consistent with national and international studies addressing childhood respiratory health (Bender et al., 2024). Local health systems play a critical role in translating these findings into preventive actions at the community level (Puskesmas Muara Enim, 2025). Strengthening caregiver education and improving household environments may substantially reduce Acute Respiratory Infection incidence (Alamer, 2024). Intersectoral collaboration is necessary to address structural determinants such as housing quality and ventilation (Chelak & Chakole, 2023). Primary health care-based interventions should prioritize vulnerable populations in high-risk areas (Profil Kesehatan Provinsi Sumatera Selatan, 2023). Ultimately, evidence generated from this study supports targeted public health strategies to improve respiratory health among under-five children in Muara Enim District (Agrarina et al., 2025).

Conclusion and Recommendation

This study concludes that Acute Respiratory Infection among under-five children at Muara Enim Primary Health Center is significantly associated with household environmental and behavioral factors. Exposure to cigarette smoke, use of mosquito coils, inadequate housing density, and poor household ventilation were all found to have statistically significant relationships with the occurrence of Acute

Respiratory Infection. These findings indicate that children living in unhealthy household environments are at higher risk of developing respiratory infections. The results highlight the importance of addressing modifiable risk factors within the home setting to reduce the burden of Acute Respiratory Infection among under-five children. The study also confirms that primary health care settings play a crucial role in identifying and managing environmental risk factors at the community level. Although causal relationships cannot be established due to the cross-sectional design, the findings provide valuable epidemiological evidence to inform preventive strategies. Overall, this study contributes to the growing body of evidence emphasizing the role of household conditions in childhood respiratory health.

Based on the study findings, health care providers at Muara Enim Primary Health Center are encouraged to strengthen health education programs focusing on the prevention of Acute Respiratory Infection among under-five children. Educational interventions should emphasize the importance of avoiding smoking inside the house and reducing children's exposure to cigarette smoke. Community outreach activities should promote safer alternatives to mosquito coils to minimize indoor air pollution. Health promotion programs should also address healthy housing standards, including adequate ventilation and appropriate housing density. Collaboration between the health sector and local government authorities is recommended to support housing improvement initiatives that meet healthy living standards. Environmental health officers should be actively involved in household assessments and community education to reinforce preventive practices. Future research is recommended to employ longitudinal or interventional designs to further explore causal relationships and evaluate the effectiveness of household-based interventions in reducing Acute Respiratory Infection among under-five children.

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Declaration on the Use of AI
No AI tools were used in the preparation of this manuscript.

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