Condition of the house physical environment on the incidence of acute respiratory infections in toddlers in Sumbawa, Indonesia

Condición del entorno físico de la casa sobre la incidencia de infecciones respiratorias agudas en niños pequeños en Sumbawa, Indonesia

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SUMMARY

Objective: *The objective was to examine the relationship between the state of the home's physical environment and the incidence of acute respiratory tract infections (ARI) in toddlers in the working area of the North Moyo Health Center in Sumbawa Regency, Indonesia.*

Methods: *The research design employed is a case-control design with an analytic survey method and a retrospective methodology. This case research focuses on families with a child (age 1- <5 years). ARI victims in the last month at the interview, whereas the control on families with an infant (1- <5 years) who has not suffered from ARI in the past month. Questionnaires and observation sheets are used to collect data. In October 2022, data gathering was conducted. The selection of household samples is determined based on information from medical records. A trained enumerator was responsible for collecting data. The outcomes of data processing were evaluated using the Chi-Square test and multiple linear regression tests in SPSS version 16.0.*

Results: *Results indicated that physical environmental conditions and the application of mosquito coils for >3 hours affected the incidence of acute respiratory infection (ARI). Based on the findings of a statistical test of physical ambient conditions and the use of mosquito coils (count significance < 0.05). While cigarette smoke has no statistically significant influence (significance > 0.05). Thus, physical ambient conditions and the use of mosquito coils are related to the component that determines the occurrence of ARI.*

Conclusion: *Many respondents are unaware that preventing ARI is preferable to treating it. This necessitates a concerted effort from multiple parties to pay prompt attention to preventing ARI sickness in toddlers.*

Keywords: *Physical environment, acute respiratory infections, and toddlers.*

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RESUMEN

Objetivo: *El objetivo de esta investigación fue examinar la relación entre el estado del entorno físico del hogar y la incidencia de infecciones agudas de las vías respiratorias (IRA) en niños pequeños de la zona de trabajo del Centro de Salud de Moyo Norte en la Regencia de Sumbawa, Indonesia.*

Métodos: *El diseño de investigación empleado es un diseño de casos y controles con un método de encuesta analítica y una metodología retrospectiva. Esta investigación de casos se centra en familias con un hijo (edad 1- <5 años). Víctimas de IRA en el último mes en el momento de la entrevista, mientras que el control son familias con un lactante (1- <5 años) que no ha sufrido IRA en el último mes. Para la recogida de datos se utilizan cuestionarios y fichas de observación. En octubre de 2022 se llevó a cabo la recogida de datos. La selección de las muestras de hogares se determina a partir de la información de los historiales médicos. Un encuestador formado se encargó de recopilar los datos. Los resultados del procesamiento de los datos se evaluaron mediante la prueba de Chi-cuadrado y pruebas de regresión lineal múltiple en SPSS versión 16.0.*

Resultados: *Los resultados indicaron que las condiciones ambientales físicas y la aplicación de espirales contra mosquitos durante >3 horas afectaron la incidencia de infección respiratoria aguda (IRA). Según los resultados de una prueba estadística de las condiciones ambientales físicas y el uso de espirales antimosquitos (significación del recuento < 0,05). Mientras que el humo de los cigarrillos no influye de forma estadísticamente significativa (significación > 0,05). Así pues, las condiciones ambientales físicas y el uso de espirales antimosquitos están relacionados con el componente que determina la aparición de IRA.*

Conclusiones: *Muchos encuestados no son conscientes de que es preferible prevenir las IRA que tratarlas. Esto hace necesario un esfuerzo concertado de múltiples partes para prestar pronta atención a la prevención de la enfermedad por IRA en los niños pequeños.*

Palabras clave: *Entorno físico, infecciones respiratorias agudas y niños pequeños.*

INTRODUCTION

The upper and lower respiratory tracts are affected by acute respiratory tract infections (ARI), an acute illness. Fungus, bacteria, and viruses bring on this infection. ARI can be split into three categories: influenza, which is brought on by different types of influenza viruses; respiratory syncytial virus; and the common cold. This illness typically manifests during the transitional season and is brought on by an increase in virus circulating in the air. Additionally, a child's immune system will deteriorate because of air temperature swings from hot to cold. This makes this disease more likely to affect children (1).

Respiratory infections, known as ARI can continue for up to 14 days. Along with the surrounding organs like the sinuses, middle ear area, and lung membranes, the respiratory tract is an organ that extends from the nose to the lung alveoli. Many people are afflicted with ARI, a sickness. Riskesdas reports that the prevalence of ARI was 4,4 % in 2018, with an 8.0 % increase among children ages 1-4. Fever, sneezing, coughing, runny nose, sore throat, body aches, headaches, and weakness are common complaints. Usually, ARI can recover without using medications (self-limited disease). The immune system is the area that needs improvement (2).

Children are susceptible to ARI attack if the body's resistance (immunology) declines. Often target people with low system immunity and children under five still susceptible to numerous infections (1). This illness starts with a high body temperature of about 38°C and one or more symptoms, such as pain in the throat or swallowing, fluid coming from the nose, and a dry cough or phlegm. Otitis media, sinusitis, pharyngitis, pneumonia, and death from shortness of breath are the side effects of ARI.

Each year, ARI affects the life of around four million people. Furthermore, ARI is the primary factor in consultations or hospitalizations in healthcare facilities, particularly in childcare. Similar events took place in Indonesia (3). The World Health Organization (WHO) indicated that toddler death rates above 40 per 1 000 live births, or 15 % to 20 % per year in toddlers, are associated with the occurrence of acute respiratory tract infections (ARI). Indonesia still is the number one for ARI incidence, especially for morbidity causing in infants and toddlers, with a prevalence of 25 %. An additional risk factor for ARI is nutritional status; poor nutrition will weaken the immune system and increase the risk of infectious infections (3).

The greatest baby and toddler mortality rates among Association of Southeast Asian Nations (ASEAN) nations are seen in Indonesia. Currently, pneumonia and diarrhea are still the most common causes of morbidity and child mortality. Pneumonia is the primary factor in children's ARI deaths, particularly in young toddlers. In Indonesia, the prevalence of pneumonia in toddlers is between 10 and 20 percent every year, with a fatality rate of 6 per 1 000 toddlers. ARI sickness is case number 1 (one) in the category of the 10 most common diseases in (NTB) Nusa Tenggara Barat (West Nusa Tenggara), according to the health profile of West Nusa Tenggara (2020), in 2019, with the highest number of visits (174 213) (4).

Intrinsic and extrinsic risk factors are the two categories into which ARI risk factors fall. Age, nutritional state, exclusive breastfeeding, gender, low birth weight, vaccination status, breast-feeding (breast milk), and administering vitamin A are examples of intrinsic factors. Extrinsic factors include the house's physical environment, maternal education, family income, residential density, air pollution, housing type, ventilation, cigarette smoke, fuel consumption, and the use of mosquito coils, in addition to maternal factors such as education, age, and mother's knowledge (5). The physical environment of the house and clean and healthy life behavior that do not meet the requirements remain the risk of the occurrence of ARI in toddlers. Therefore, efforts to prevent ARI need to pay attention to the physical environmental factors of the house and Clean and Healthy Living Behavior (CHLB). According to the World Health Organization Healthy House is a physical structure used by people or humans for shelter, where the environment of the structure provides the necessary amenities and services, equipment that is beneficial for physical and spiritual health, and favorable social situations for individuals and families (4).

According to the results of the preliminary survey, toddlers continue to suffer from ARI the most frequently, followed by episodes of diarrhea, in the North Moyo Health Centre working region. Information indicates that for one month, there are typically 60 visits connected to these conditions. It is believed that one of the determinants of risk for the incidence of ARI in children under the age of five in North Moyo District is the state of the physical environment's sanitation. This research aims to examine the connection between the home's physical environment and the prevalence of acute respiratory tract infections (ARI) in children in the North Moyo Health Center's operating area.

METHODS

A case-control research design with an analytical survey method and a retrospective methodology was adopted. The case in this research are families with a toddler (age 1- <5 years) who has experienced ARI within the previous month at the time the interview was performed. While the control are families with a child (1- <5 years) that has not suffered from ARI in the past month, the case is a household that has. In October 2022, this research was conducted in the North Moyo District Health Center's working region in the Sumbawa Regency, West Nusa Tenggara.

This research's population consists of housewives with children under the age of five who reside in the service area of the North Moyo District Health Center in the Sumbawa Regency. Children under the age of five are the unit of analysis. The sample represents a fraction of the number of households in the North Moyo District Health Center service area with children under the age of five. The minimum sample size (n) is 50 units of analysis, hence the total sample size necessary is 100 units of analysis, with a sample size of 50 units for each case and control.

This research used the approach of purposive sampling for its sampling. This research's data were examined univariately, or by describing the properties of each variable. Variable groups are shown as frequency distribution tables for physical environmental variables, including ventilation of houses, house floors, residential density, smoking behaviors of household members, and the usage of mosquito coils, as well as ARI incidents; it were used the following analysis: (Chi-Square) to determine the picture of the relationship between physical environmental conditions and the dependent variable, the incidence of acute respiratory infection (ARI), and Multivariate Analysis (multiple linear regression) to determine

the dominant factors of a number of sub-physical environmental sub-variables associated with the incidence of ARI in children under the age of five.

Toddlers that being sampling units have to fulfill the criteria:

Toddlers aged 1 year - 5 years, Toddlers who don't have any contagious diseases, Toddlers whose parents agreed to participate in the study as responses, and Toddlers whose parents are willing to be observed by the physical environmental conditions of their homes.

RESULTS

This research was conducted in North Moyo Health Center Working Area on October 2022.

Table 1. Characteristics of Respondents

Mother's Age Category	Frequency (n)	Percentage (%)
<30 years	40	40.0
> 30 years	60	60.0
Total	100	100.0
Toddler Age Categories		
0 - 24 months	32	32.0
25 - 50 months	54	54.0
> 50 months	14	14.0
Total	100	100.0
Work		
Midwife	2	2.0
Houswifes	45	45.0
Employee	12	12.0
Farmer	33	33.0
Civil servants	3	3.0
Total	100	100.0
Last Level of Education		
Elementary	5	5.0
Junior high school	34	34.0
Senior high school	39	39.0
University	22	22.0
Total	100	100.0

(Source: Primary Data, 2022)

Based on the data distribution of respondents 'characteristics, most respondents' mothers are in the age range> 30 years (60 %). Toddlers

with an age range of 25 - 50 months are the most age range in this research (54 %). Most toddler mothers who participated in this survey were housewives with a high school education or less (39 %).

Table 2. ARI Incident

ARI incidence	Frequency (n)	Percentage (%)
ARI	50	50.0
No ARI	50	50.0
Total	100	100.0

(Source: Primary Data, 2022)

In this research, the number of respondents with ARI cases was compared to the number of toddlers without ARI. This is designed to cause toddlers who experience ARI to be assigned to the case group, while toddlers who do not experience ARI will be assigned to the control group.

Table 3. Description of the condition of the physical environment of the house

Categories Home	Frequency (n)	Percentage (%)
Healthy	27	27.0
Unhealthy	73	73.0
Total	100	100.0
The use of insect repellent > 3 hours per day		
Yes	71	71.0
Not	29	29.0
Total	100	100.0
The Presence of Cigarette Smoke		
Yes	61	61
Not	39	39
Total	100	100.0

(Source: Primary Data, 2022)

The results of the Kolmogorov-Smirnov normality test indicated that the data were normally distributed since the normality value was > 0.05, hence multiple linear regression tests could be conducted. The findings of this multiple linear regression test are shown in Table 4.

Table 4. Multiple linear regression test results

Independent Sub variables	Value t	Sig value
Home Conditions	7.793	0.030
Use of Mosquito Repellent	4.542	0.009
The Presence of Cigarette Smoke	4.421	0.074

(Source: Primary Data, 2022)

DISCUSSIONS

There are a number of variables that hinder efforts to reduce the risk of ARI. There must be a policy in place to support children's health in the community and the social support network (6). The findings of the data analysis indicate that the significant value for the variables of the house's physical state and the application of mosquito repellent is <0.05. This indicates that the two variables are a factor related to ARI events in the working area of North Moyo District. ARI disease is affected not only by air pollution but also by home condition that physically impacts indoor air quality and humidity (7). Statistically, the event of ARI in children under 5 years is still the cause of the mortality rate (8), respiratory viruses being the major causative agents. The aim of this work was to determine the respiratory pathogen frequency, the clinical characteristics and the outcome in infants <2 months old hospitalized with ARI. A retrospective study was performed during a five-year period (2008-2011, 2014-2016). The presence of ARI disease is also affected by the cleanliness of the home. This is consistent with the research (9), which indicates that increasing the proportion of households in a community with sanitation facilities that are managed safely can reduce transmission by limiting the likelihood of spreading pathogens from outside the home, thereby contributing to the decline in ARI incidence among toddlers.

Parents serve as social environment role models and household policymakers for their children's homes. In addition, parents can influence the physical environment of the home by providing resources that support their children's food, activities, and sleeping habits (10). A healthy dwelling, as defined by the Indonesian Ministry of Health (2012), satisfies minimal requirements such as access to potable water, access to healthy latrines, flooring, ventilation, and lighting. In this research, 73 % of respondents had homes that did not match the criteria for a healthy home, according to the observation sheet of healthy home criteria. The house is a component of a very influential health-related environment. The home environment has a substantial effect on some ARI variables, including *indoor air pollution*. Multiple elements, including the ceiling, ventilation, residential density, and humidity, influence the indoor air quality of a home (11).

An infection known as an acute respiratory tract infection (ARI) can continue for up to 14 days. Research (12) with the title "*The Relationship between Home Environmental Conditions and the Occurrence of Acute Respiratory Infection (ARI) in Toddlers in Nagan Raya Regency*" claims that there is a significant correlation between the floor factor of a house and the incidence of ARI in toddlers and that this correlation can increase the incidence of ARI in toddlers. It also claims that there is a significant correlation between the occupancy density of a room and the incidence of ARI in toddlers and that this correlation can increase the incidence of ARI in toddlers. One of the significant elements that contribute to the occurrence of ARI is the physical state of the home (ventilation area, humidity, occupants, natural lighting, temperature) (13). The results of a survey of 70 house patients with ARI indicate that 28 % of houses have floors that do not meet the requirements of healthy homes, 78 % of houses have windows that are rarely opened so that no sunlight enters the house, and 57 % of houses have lighting that does not meet the requirements (14).

Inadequate environmental conditions or noncompliance with health standards are risk factors for ARI incidence (15). When the criteria for healthy houses are not met, the house, which is a human physical environment as a place to live, can be a source of sickness (16). ARI is believed to be caused by excessive dust, air ventilation, illumination, and humidity. According to study (17), there is a correlation between dust levels and the incidence of acute respiratory infections (ARI) ($p = 0.0001$), ventilation conditions and the incidence of ARI ($p = 0.0001$), illumination and the incidence of

ARI (p = 0.001), and humidity and the incidence of ARI.

Anti-mosquito drugs are a form of pollution that can be discovered in the home. Similarities between the functions and uses of this anti-mosquito drugs make it effective at killing and repelling mosquitoes. The distinction lies in the percentage of the concentration of poisonous compounds or active ingredients present in anti-mosquito drugs, which are insecticides of insect killer insects classed as an organophosphate. Mothers whose infants are exposed to anti-mosquito drugs are at an elevated risk of developing acute respiratory infection (ARI) (18).

The presence of smoke from mosquito repellants contributes to indoor air pollution. The insect repellents used by respondents negatively impact indoor air quality. The outcome of the research (19), showed the presence of P-Dichlorobenzene chemicals in the smoke of mosquito coils, which considerably impeded human breathing. The usage of mosquito coils influences childhood ARI (19). People believe that using mosquito coils is one way to avoid mosquito bites, even though some individuals are aware that the smoke from mosquito coils is exceptionally hazardous to the health of toddlers, especially in the case of ARI sickness (20). The utilization of mosquito coils is associated with the occurrence of ARI by P value $0,001 < \alpha\ 0.05$ PR = 2.174 (12).

Cigarette smoke is an air pollutant in the form of a complex mixture of substances created by the combustion of tobacco. Children in smoking families are twice as likely to develop acute respiratory infection (ARI) as those in nonsmoking homes (21). The parental smoking habit in the home causes toddlers to become passive smokers who are constantly exposed to cigarette smoke (22). Children between the ages of 1 and 5 who are exposed to cigarette smoke are sensitive to asthma, perished at an early age due to lung infections, are prone to allergies, and are at high risk for contracting pulmonary tuberculosis (23).

The habit of smoking in the home has a significant impact on the respiratory health of toddlers. The frequency with which family members smoke in the home will enhance the amount of cigarette smoke's toxicity.

Consequently, family members who become passive smokers will inhale more noxious smoke (11). Exposure to cigarette smoke is one of the causes of acute respiratory infections in toddlers. Exposure to cigarette smoke creates issues in the respiratory organs of toddlers who may also get ARI (24).

Passive smokers and their surroundings, especially children under the age of five, will be exposed to air pollution due to indoor smoking. Children under the age of five are more susceptible to the effects of environmental tobacco smoke (ETS), which will increase the incidence of ARI in their lungs. More than 4 000 hazardous substances found in ETS, including nitrogen oxides, carbon monoxide, and other particles, impair cilia's ability to function and harm ciliated epithelial cells, which can lead to a reduction in the immune system's capacity on both a local and a systemic level (25). Exposure to passive smokers is classified as high when the number of cigarettes or other smoking tobacco products smoked by daily smokers at home exceeds nine per day and as low when this number falls between one and nine per day. The type of exposure to passive smokers is classified as paternal if the father is a smoker, maternal if the mother is a smoker, and parental if both parents are smokers (26).

Most persons are exposed to more significant health risks from indoor air pollution than from outside air pollution. The link between indoor air quality (IAQ), indoor air pollutants, and chronic non-communicable diseases must be given extensive consideration in light of the increasing severity of indoor air pollution-related health issues (27). This is consistent with the research (28), which indicates that the presence of cigarette smoke in a room will result in ARI issues in children. The results of the research (29) leading to child mortality in Indonesia. This research emphasizes the significance of the family wealth index and the physical quality of the home in enhancing children's health.

CONCLUSION

Conclusively, this study shows that home conditions and using mosquito repellent are significant factors causing ARI. Then this study

also shows a substantial number of respondents are unaware that preventing ARI is preferable to treating it. This necessitates a concerted effort from multiple parties to pay prompt attention to preventing ARI sickness in infants. ARI in children should be prevented from an early age. Prevention efforts require contributions from various parties, including the physical environment, family environment, and health service support. Even the stakeholders' policies are expected to impact the prevention of ARI in toddlers significantly.

Authors' Contributions

All contributors contributed significantly to this study, and all authors agree with the manuscript's content.

Conflict of Interest

The author(s) declared no potential conflicts of interest concerning this article's research authorship and/or publication.

Availability of Data and Materials

All data generated or analyzed during this study are included in this published article.

Ethical Approval

This article received ethical permission from LPPM STIKES Griya Husada Sumbawa No. 023/VII/2021.

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