

# Factor analysis of the incidence of ARI in Toddlers during the Covid-19 Pandemic

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## ABSTRACT

Acute respiratory infections (ARIs) are one of the leading causes of death among children in developing countries. Acute respiratory infection (ARI) is a disease that affects one or more parts of the airway from the nose to the alveoli, including the appendages (sinus, middle ear cavity, pleura). The high incidence of acute respiratory infections in children under five years of age is a serious problem that needs to be addressed immediately. The aim of this review study was to analyze the causes of acute respiratory infections in children under five years of age. This study is a systematic review using online databases namely Scholar, ScienceDirect, and ProQuest. The keywords used were ARI, infant, and the Covid-19 pandemic. The selection process used the PRISMA protocol, resulting in 15 articles that met the inclusion criteria. The 15 articles included factors such as environmental influences, ventilation, physical environment, mothers' knowledge, population density, indoor air pollution, and children not receiving full immunization. The impact of the COVID-19 pandemic in several parts of Indonesia has the potential to hinder maternal and child access to health services ARI as the government implements policy-based movement restrictions. The impact of the Covid-19 pandemic that has occurred has been a reduction in public access to health facilities in Posyandu and Puskesmas, such as the implementation of primary immunizations, weighing and measuring the height of children under 5 years of age, which have not been controlled.

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## INTRODUCTION

Indonesia, along with India, Nigeria, Pakistan, and China, accounted for more than half of the estimated 138 million cases of pneumonia in young children globally in 2015<sup>1,2,3</sup>. Acute respiratory infections were once a major health problem for children under five in Indonesia. ARI is one of the causes of high morbidity and mortality rates for children under five in the world, including in Indonesia<sup>4</sup>. ARI is an infectious disease that is often found in toddlers because the toddler's body defense system is still very low. ARI is one of the main health problems that occur in infants (0-11 months) and toddlers (1-4 years)<sup>5,6</sup>. The under-five mortality rate

due to ARI in Indonesia ranks first compared to other ASEAN countries. Based on the death survey in Indonesia, shows that ARI is the most common cause of under-five mortality. with a percentage of 22.30% of all under-five deaths<sup>7</sup>. Another study showed that the highest incidence of ARI occurred in children aged 0–4 years, ranging from 82 to 114 per 100,000 population<sup>8,9</sup>.

ARI that occurs in children, if not treated with proper treatment can cause death. The incidence of acute respiratory infection (ARI) that occurs in toddlers is strongly influenced by various factors. Nutritional status, exclusive breastfeeding, immunization status, and low birth weight (LBW) are one of the biological factors that can affect the incidence of ARI<sup>10</sup>. In addition, there are socio-demographic factors including age, gender, education, parental occupation, and family income. Pollution factors in the room, such as the smoking habit of the father or other family members and the presence or absence of a chimney<sup>11</sup>. The occupancy density factors include the presence of air ventilation in the house, the number of occupants of the room, the condition of the walls and floors of the house.

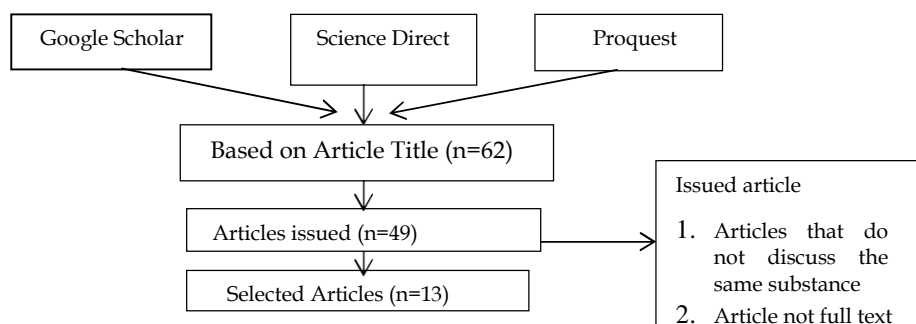
Toddlers with incomplete immunizations will be more susceptible to infectious diseases such as ARI because the mechanisms of their body's defenses (immunity) are not yet complete and perfect<sup>12</sup>. The incidence of ARI is more common in infants with incomplete immunization status as much as 66.7% compared to infants with complete immunization status as much as 58.6%<sup>10</sup>. The severity of ARI is divided into three groups, namely mild ARI (not pneumonia), moderate ARI (pneumonia) and severe ARI (severe pneumonia)<sup>13</sup>. Signs and symptoms of mild ARI are cough, runny nose and with or without fever. Signs and symptoms of moderate ARI include symptoms of mild ARI, headache, discharge from the ears and rapid breathing frequency, rapid respiratory rate for the age group <2 months >60 times/minute, age group 2-11 months i.e. >50 times. /minute and age 12-59 months >40 times/minute. Signs and symptoms of severe ARI include symptoms of mild and moderate ARI, lower chest, pale blue skin, snoring, and decreased consciousness. The aim of this systematic review was to identify the factors behind the incidence of ARI in young children during the Covid-19 pandemic.

## RESEARCH METHOD

occurrence in toddlers. The next stage is to select articles according to the criteria, which are published in 2015-2020 with full text, in the preparation of Preferred Reporting Items for Systematic Reviews and Meta Analysis (PRISMA) the articles that have been found are then synthesized and analyzed according to the inclusion and exclusion criteria. The inclusion criteria in this systematic review are (1) the incidence of ARI in children under five (2), research can provide information about what factors cause the incidence of ARI in children under five, while the exclusion criteria in this systematic review are (1): articles that do not describe the incidence of ARI on Toddler. The search for articles began in August 2022 with keywords that had been determined by the researcher. The articles found by the researchers were selected according to the inclusion and exclusion criteria, with the keywords ARI incidence in toddlers in the midst of covid. The researcher deletes the published articles, examines the articles that meet the criteria and groups them according to the research results to proceed to the discussion.

## RESULTS AND DISCUSSION

Initial literature search found 38 articles (Google Scholar 30 articles, Science Direct 4 articles, Proquest 4 articles) 23 articles that were issued were not in sync with the topic of discussion and did not discuss the incidence of ARI in Toddlers. 15 full text articles meet the criteria as listed in Figure 1



**Figure 1.** Flow diagram and article selection

The results of 15 articles found that the factors for the incidence of ARI in toddlers during the Covid-19 pandemic were obtained by analysis of research articles on the factors of ARI occurrence in toddlers

**Table 1.** Factors for the Incidence of ARI in Toddlers during the Covid-19 Pandemic

No	Title, author, year	Results
1	Analysis of Risk Factors for Acute Respiratory Infections in Children Toddlers <sup>14</sup>  Asriati, M. Zamrud, Dewi Febrianty.2014	The results showed that the density of house occupancy was risk factors for the incidence of ARI in children under five in the working area of the Jati Raya Health Center, Kendari City, with a large risk (OR) = 3,596. Smoke exposure is a risk factor for the incidence of ARI in children under five in the working area of the Jati Raya Health Center, Kendari City in 2012 with a risk magnitude (OR) = 7.8. Exclusive breastfeeding is a protective factor for the incidence of ARI in children under five in the working area of the Jati Raya Health Center, Kendari City.
2	Analysis of Intrinsic Risk Factors for Acute Respiratory Infections in Toddlers in the Work Area of the Panjang Health Center in Bandar Lampung <sup>15</sup>  Amalia, DD Nuryani, N Aryastuti 2019	The results of the study found that there was a relationship between nutritional status and the incidence of ARI in the Long Puskesmas working area, Bandar Lampung city in 2020, with a value (p-value = 0.000, OR 4.261) <sup>3</sup> . There is a relationship between exclusive breastfeeding and the incidence of ARI in the Long Puskesmas working area, Bandar Lampung city in 2020, with a value (p-value = 0.004, OR 2,369) value (p-value = 0.016, OR 1.993) <sup>5</sup> . There is no relationship between the administration of vitamin A with the incidence of ARI in the work area of the Panjang City Health Center in Bandar Lampung in 2020, with a value (p-value = 0.569, OR 1.226). 6. Dominant factor which is related to the incidence of ARI in children under five in the work area of the Panjang City Health Center in Bandar Lampung in 2020 is nutritional status (p-value 0.000 ; OR 4.450)
3	Analysis of Factors Associated with the Incidence of Acute Respiratory Infection (ARI) in Toddlers Age 1-5 Years in the Work Area of Sukaraja Nuban Public Health Center, East Lampung Regency <sup>16</sup>  Dhiny Easter Yanti, Nurhalina Sari, 2021	The results of the chi-square test showed that the factors associated with the incidence of ARI were exposure to cigarette smoke (p=0.002; OR=3.3), nutritional status (p=0.001; OR=10.4), exclusive breastfeeding (p<0.001; OR=4.6) and immunization history (p=0.002; OR=3.3). The results of the multivariate test showed that the most dominant factor associated with the incidence of ARI was nutritional status (OR=9.8) after controlling for other variables. Nutritional status is influenced by various factors, so mothers are advised to be able to provide food with a simple but varied menu that contains balanced nutrition and is supported by exclusive breastfeeding and complete immunization.
4	Analysis of risk factors for the incidence of ARI in terms of house status in the working area of the city health center in the northern region of Kediri City <sup>17</sup>  Mayasari, E. 2017.	From the results of the analysis, the value of $p = 0.000 < \leq 0.05$ , there is an effect of house status on the incidence of ARI. Meanwhile, of the three factors, the most dominant is the ventilation factor where the Exp(B) value is 0.014 more than the Exp(B) value of the other two factors, namely Building Materials 0.012 and floor 0.010 to the incidence of ARI. Most of the respondents suffer from ARI and most of the respondents have ventilation. houses that do not meet the requirements, therefore people should pay more attention to the ventilation of their homes so that the ventilation area of the house is at least 10% of the floor area
5	Analysis of Factors Associated with the Incidence of Acute Respiratory Infection (ARI) in Toddlers at the Panjang Health Center in Bandar Lampung City <sup>18</sup>  Aristatia, N., & Yulyani 2021.	The results showed that the risk factors associated with the incidence of ARI in infants in the work area of the Panjang City Health Center in Bandar Lampung were behavior, occupancy density, ventilation and humidity with a value of ( { p-value 0.000: OR 5.293}, { p-value 0.006 : OR 2.766}, { p-value 0.000 : OR 4.066}, {p-value 0.004 OR 2.918}) and risk factors that are not related to the incidence of ARI in children under five in the work area of the Panjang City Health Center in Bandar Lampung in 2021, namely: lighting, wall types, floor type, roof type, and temperature each with a value (p-value : 0.264 ; 0.722 ; 0.511; 0.429; 1,000). It is known that the most dominant variable that affects the incidence of ARI is ventilation (OR = 1.95 Coef. B = 7.087).

6	Analysis of Family Behavior Factors Against ISPA Incidence in Toddlers <sup>19</sup>  Herawati, P Indrini, I Kristanti 2021	The results of this study showed that there was a significant relationship between the smoking behavior of family members and the incidence of ARI (p=0.001), there was a significant relationship between the use of mosquito coils and the incidence of ARI (p=0.003), and there was a significant relationship between house-cleaning behavior and the incidence of ARI. incidence of ARI (p=0.001)..
7	Aspects of Individual Toddlers with ARI occurrences in Cibabat Cimahi Village 20  Nasution, 2020.	risk analysis of under-five aspects on age, sex, immunization, exclusive breastfeeding and nutritional status had a relationship with the incidence of ARI, while low birth weight had no relationship with the incidence of ARI. From the results of this study, it can be recommended to parents who have toddlers to pay attention to individual factors such as completeness of immunization status that must be met, exclusive breastfeeding for up to 6 months because it is one of the easiest preventions of ARI by parents, even prevention of ARI in toddlers can still be done at home. in the womb for the fulfillment of maternal nutrition in order to avoid LBW in children to be born.
8	Analysis of Risk Factors Affecting the Incidence of ARI in Infants and Toddlers at Basuki Rahmad Health Center Bengkulu City <sup>21</sup>  Indaryani 2018..	The results of bivariate analysis using the Chi-Square statistical test found that there was a significant relationship between LBW and the incidence of ARI (p = 0.000), there was a significant relationship between immunization status and the incidence of ARI (p = 0.000), there was a significant relationship between exposure to cigarette smoke with the incidence of ARI (p=0.000), there was no significant relationship between exclusive breastfeeding and the incidence of ARI (p=0.300).
9	Analysis of Factors Associated with ARI Frequency in Toddlers in the Sand Mine Settlement Environment <sup>22</sup>  Yuni Sufyanti Arief Ilya Krisnana Maria Konsita Pede  Maria,,2015	The results showed that there was a relationship between the host factor and the frequency of ARI with nutritional status (p = 0.024), immunization status (p = 0.000), breastfeeding history (p = 0.030), mother's behavior in caring for children with ARI (p = 0.005 , r = -0.548), maternal actions in preventing ARI (p = 0.014, r = -0.444); environmental factors and house pollution (p = 0.003, r = 0.523), and the physical condition of the house (p = 0.004, r = -0.512) and not related is age (p = 0.524). Based on the results of this study, it is expected that health nurses should be more active in promoting,
10	Factor Analysis " Factors Causing Acute Respiratory Infection in Toddlers in Toili Health Center <sup>23</sup>  Awaited, 2015.	Based on the results of the study, it can be concluded that nutritional status, house ventilation, and residential density are risk factors for the occurrence of Respiratory Tract Infections for children under five at Toili II Health Center. Of the 36 respondents, 18 respondents (50%) experienced malnutrition. Of the 36 respondents, 29 respondents (80.6%) had house ventilation that did not meet the requirements, and of the 36 respondents, there were 16 (44.4%) respondents who fell into the category of occupancy density.
11	Risk Factors for Acute Respiratory Infection in Toddlers in the Work Area of Sukoharjo Health Center <sup>24</sup>  Murti, 2016.	The results of a bivariate study using the relationship between parental knowledge (p = 0.001), there was a relationship between ventilation (p = 0.001), there was a relationship between smoking family members (p = 0.006) and ARI in children under five at the Sukoharjo Health Center. While the multivariate results showed that the knowledge of parents had the highest OR of 8.752 (95% CI = 2.764 to 27.712), meaning that parents who had poor knowledge about the risk of ARI were 8.752 times experiencing ARI in infants.
12	Analysis of Factors Associated with Occurrence of Acute Respiratory Tract Infections in Patients at the Pangkep District General Hospital <sup>25</sup> Jangga, J. 2018.	The results showed that there was a relationship between knowledge, smoking habits, number of occupants of the house and nutritional status with the incidence of ARI in patients at the Pangkep District General Hospital, and the most related variable was smoking habits.
13	Analysis of risk factors for the incidence of acute respiratory infections in Abiansemal, Badung Regency <sup>26</sup>  Marwati, 2022.	Bivariate analysis showed that the risk factors for the incidence of ARI were room occupancy density with a value of 0.05 (p=0.000, OR=28.444), smoking habits of parents (p=0.000, OR=20,000), bedroom ventilation (p=0.003, OR =10,500), bedroom light intensity (p=0,000, OR=67,500), living room light intensity (p=0,001, OR=14,063), bedroom air temperature (p=0,002, OR= 14,571), bedroom air humidity (p=0.000, OR=20,000).

14 The Relationship between the Physical Environment of the House and Occupancy Density on the Incidence of ARI in Toddlers in Cihampelas Village, Cihampelas District, West Bandung Regency <sup>27</sup> Noerlaeli, 2016	The results of the Bivariate analysis showed that there was a relationship between bedroom humidity and the incidence of ARI, p value = 0.048 < value (0.05) and PR = 1.867, there was no relationship between natural lighting in the family room (p value = 1,000), bedroom temperature ( p value = 1,000), bedroom ventilation area ( p value = 0.733) and bedroom occupancy density ( p value = 0.336) with the incidence of ARI in children under five.
15 The Relationship Between Ventilation And Occupancy Density With The Incidence Of Acute Respiratory Infections In Toddlers In Cabean Kunti Village, Cepogo District, Boyolal Regency <sup>28</sup> Sunaryanti, 2019.	the results of the Chi-Square analysis with the results of X2count = 2.879 with a p value = 0.069 > .05 means that there is no relationship between ventilation and the incidence of ARI disease and is less significant, with a value of X2count = 0.896 with a p value = 0.529 > 0.05, there is no relationship between residential density and the incidence of ARI in children under five, and it is less significant that there may be other factors that influence the incidence of ARI disease

## Discussion

Several researchers have found several factors related to the incidence of ARI in children under five including nutritional status <sup>29</sup>, immunization <sup>30,31</sup>, breast milk exclusiveness, caregivers, exposure to cigarette smoke during pregnancy <sup>32</sup>, occupancy density, income, smoking behavior in the family, mother's education <sup>33</sup>, use of cooking fuel and pesticides <sup>34</sup>. Other studies have shown that improving the quality of clean water, sanitation, hygiene and nutrition can reduce the incidence of ARI in children under five <sup>35,36</sup>. Humid and moldy home conditions have been associated with the incidence of ARI in hospitalized children in New Zealand while lack of lighting and ventilation in the home has also been associated with the incidence of this ARI <sup>37,38</sup>. The incidence of acute respiratory infection (ARI) that occurs in toddlers is strongly influenced by various factors. The occupancy density factors include the presence of air ventilation in the house, the number of occupants of the room, the condition of the walls and floors of the house. Toddlers with incomplete immunizations will be more susceptible to infectious diseases such as ARI because the mechanism of their body's defense (immunity) is not yet complete and perfect. Toddler age is vulnerable and at risk for infectious diseases, one of which is ARI. Because at that age the immune system and immune system are still weak. The child's immune system is still weak because the formation of antibodies and respiratory organs is not yet fully and optimally matured. When exposed to germs will be more susceptible to infectious diseases. The immune system is influential in fighting infections from viruses and bacteria that enter the human body <sup>39</sup>. The nutritional status of children under five is related to the incidence of ARI because the nutritional condition of children affects the immune system of children under five. The growth and development of children with good nutritional status makes the immune system and health levels increase. Conversely, if a toddler has poor nutrition, his immune system will decrease so that the toddler will be susceptible to disease <sup>40</sup>. The way to increase the immune system and be susceptible to infectious diseases is to pay attention to the nutritional intake of toddlers to maintain good nutritional status <sup>41</sup>. Immunization is one of the steps to prevent the occurrence of ARI. Immunization such as measles is not to provide direct immunity but can prevent factors that can trigger the occurrence of ARI in toddlers. Toddlers who have complete immunization status can be exposed to ARI because their immune system is low.

## CONCLUSION

The 15 articles included factors such as environmental influences, ventilation, physical environment, mothers' knowledge, population density, indoor air pollution, and children not receiving full immunization. The impact of the COVID-19 pandemic in several parts of Indonesia has the potential to hinder maternal and child access to health services ARI as the government implements policy-based movement restrictions. The impact of the Covid-19 pandemic that has occurred has been a reduction in public access to health facilities in Posyandu and Puskesmas, such as the implementation of primary immunizations, weighing and measuring the height of children under 5 years of age, which have not been controlled.

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