

Study of Physical Environment Factors on Pneumonia in Indonesia

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Abstract Pneumonia is a pulmonary disease with a high mortality rate caused by viruses, bacteria, and fungi. Pneumonia as the most significant disease causing the death of children and elderly in the world. The World Health Organization (WHO) in 2005 estimated that toddler mortality due to pneumonia in worldwide was around 19% or ranged from 1.6 to 2.2 million, and approximately 70% occurred in developing countries, especially Africa and Southeast Asia. This study aims to examine physical environmental factors using the incidence of toddlers' pneumonia in Indonesia. This study uses the literature review method. Data sources analyze from the literature. Physical environmental factors that influence the rate of pneumonia in Indonesia are temperature, humidity, ventilation, lighting, floor type and type of wall.

1 INTRODUCTION

Pneumonia is one of pulmonary disease that is caused by viruses, bacteria and fungi. Pneumonia can affect all age groups, but the highest mortality rate is in the age group of toddlers. Pneumonia in toddlers often coincides with an acute infection process in the bronchus with symptoms of shortness of breath and rapid breathing due to sudden pulmonary inflammation (Dep Kes RI, 1996).

The bacteria that causes pneumonia is *Streptococcus pneumoniae* is actually a normal flora in a healthy human esophagus. But when the immune system has decreased, that can be caused by old age, nutritional problems, and health problems, the bacteria will immediately multiply after infecting. Infection can quickly spread throughout the body through the bloodstream. Infections that occur in individuals generally cause symptoms, namely high fever, shortness of breath, sweating, and a rapid heartbeat. As a result, lips and nails can turn blue because the body lacks oxygen intake. Even in severe cases, the patient will show symptoms of shivering, removing green mucus when coughing, and chest pain (Misnadiarly, 2008)

Pneumonia is one of main disease that killed toddlers in the world, which estimated about 2 million children under five (toddler) die of pneumonia from 9 million in total toddler's deaths. Every five deaths among children under five are caused by

pneumonia (Wardlaw, Johansson, Hodge, & UNICEF, 2006). Most cases of pneumonia are found in developing countries, 70% are in Africa and Southeast Asia (Unicef & WHO, 2009). Acute Respiratory Disease which is one of the caused is by pneumonia, also takes 28% as the main cause of under-five mortality in Indonesia.

In Indonesia, under five years's pneumonia is the second leading cause of death after diarrhea with a proportion of 15.5%. Pneumonia always falls into the 10 highest death diseases in Indonesia. Pneumonia is the cause of 16% of under-five's deaths, namely an estimated 920,136 toddlers in 2015. The mortality rate due to toddler's pneumonia in 2016 was 0.11% while in 2015 it was 0.16%. In 2016 the mortality rate due to pneumonia in the age 1-4 group was slightly higher at 0.13% compared to the toddler group at 0.06%.

There are many pneumonia risk factors according to the results of previous studies, such as young age, lack of immunization status, poor nutritional status, lack of breastfeeding, floors of houses that is made from soil, pollution from the kitchen due to the use of firewood, cigarette smoke pollution, pollution from mosquito repellent, home lighting that does not meet the requirements, house temperature, house humidity that is too low, poor home ventilation, occupancy density and also influenced by the habits of healthy living behavior in the family.

Unhealthy living conditions are one of the triggers of pneumonia. Houses that are said to meet health requirements must fulfill three aspects, such as lighting, air conditioning and air temperature, as well as humidity in the house (Kementerian Pemukiman dan Prasarana Wilayah, 2013). Ventilation is mainly related to air quality in houses's space. The air quality is influenced by various factors, such as building materials (asbestos), building structures (room ventilation), chemicals in the interior and furniture, air quality outside the house, density of house occupancy, excessive humidity, as well as dust that is contained in the house. In addition, the air quality in the house is also influenced by the activities of the occupants. Various activities can cause pollution in the house because it can produce dust and gas. The activities, such as smoking, the use of cosmetic ingredients, or the use of pesticides in the house. Low air quality in the house can cause various health problems for the occupants.

WHO estimates that every year there are three million cases due to indoor air pollution and 0.2 million cases caused by outdoor pollution. In developing countries, the problem of indoor air pollution generally occurs because human's indoor activities without adequate ventilation. The purpose of this study was to examine physical environmental factors using the incidence of toddler's pneumonia in Indonesia.

2 METHOD

This study uses the literature review method. Data sources using some journals and books literature.

3 RESULT AND DISCUSSION

Physical environmental factors that influence the incidence of pneumonia include: temperature, humidity, ventilation, lighting, floor conditions and wall conditions.

Temperature

Temperature and humidity are closely related to the growth and proliferation of aetiological factors in pneumonia in the form of viruses, bacteria and fungi. Viruses, bacteria and fungi that cause pneumonia for growth and breeding require optimal temperature and humidity. (Sinaga, Suhartono, & Hanani, n.d.2009).

A study showed a relationship between temperature and the incidence of pneumonia (Darmawati, 2016). Statistical test results from the research show that $p = 0,000$ and $OR = 5,9$. The p value <0.05 can be interpreted statistically that there

is a relationship between the extent of ventilation and the incidence of pneumonia in children under five (Darmawati, Sunarsi, & Trisnaini, n.d.2016)

The results of the Padmonobo et al study conducted in the Jatibarang Community Health Center area of Brebes Regency also showed that the temperature factor was related to the incidence of pneumonia. (Padmonobo, Setiani, & Joko, 2012)

Humidity Relative

Indonesia is a tropical country with high air humidity. High humidity in the house can accelerate the growth of microorganisms such as bacteria and fungi. Conversely, moisture that is too low can cause irritation to the respiratory tract. According to the Minister of Health Regulation No. 1077 of 2011 concerning guidelines for air health in the environment of the home room the humidity standard is 40% -60%.

Biological Research et al in 2017 conducted in the working area of Semin I Community Health Center in Gunung Kidul Regency showed that there was a significant relationship between humidity that did not meet the requirements with the incidence of pneumonia in children under five. While the value of $OR = 5.474$ with 95% CI which is worth > 1 which can be concluded that toddlers who live at home with humidity that does not meet the requirements have a 5 times greater risk of pneumonia compared to toddlers who live in conditions of humidity that meet the requirements. (Hayati & Winarni, 2017)

Podmono's 2012 study also showed humidity associated with the incidence of pneumonia in infants. Air humidity is also affected by ventilation in the house, because good air circulation will regulate the level of humidity in the house. This is in accordance with the statement (Kovesi et al., 2007)

Ventilation

Ventilation serves to exchange air in the house. Lack of ventilation will increase the amount of CO_2 and reduce the amount of O_2 in the house and increase the humidity of the room. The required ventilation area is 10% of the floor area. The area of ventilation determines whether the ventilation rate is smooth or not.

Research results from Suryani et al (Suryani, Hadisaputro, & Zain, 2018) there is a relationship between the extent of ventilation and the incidence of pneumonia with the incidence of adjusted $OR 5.99$ perforation pneumonia, meaning that children living in homes with a ventilation area of less than 10% of the floor area are at 5.99 times more likely to suffer

pneumonia compared to children living in house with extensive ventilation. Research result from Zairinayati et al (Zairinayati, Udiyono, & Hanani, 2013) also showed the same results, namely the extent of ventilation associated with the incidence of pneumonia with the results of statistical tests. The results of statistical tests turned out to have a relationship between the extent of home ventilation with the incidence of pneumonia ($p = 0.002$; OR = 3.889; CI 95% 1.724 - 8.774). With an OR value of 3.889, it means that children who live in a house with a wide area of ventilation that does not meet the requirements have a risk of pneumonia 3.9 times greater than toddlers who live in homes with extensive ventilation that meets the requirements.

Lighting

The lighting standard inside the house is 60 lux. Research from Zairinayati 2013 in the work area of the Social Health Center in Sukarame Sub-district Palembang showed that there was a relationship between the quality of lighting in the room and the incidence of pneumonia ($p = 0.001$; OR = 4.824; CI 95% 1.880-9.764).

Lighting quality is also one of the conditions of the house that has a relationship with the incidence of pneumonia in infants in the Sentosa Baru Health Center in 2008 with an OR value of 2.9, which means that a toddler living in a house with poor quality lighting has a risk of pneumonia. 9 times compared to children who live in homes whose lighting quality meets the requirements, especially for toddlers who do not receive exclusive breastfeeding, their parents' income level is low. This result is acceptable because light is very influential on the bacterial growth process. (Sinaga et al., 2009) Generally light damages cells that do not chlorophyll. Ultraviolet light can cause ionization of cell components which results in inhibiting growth or causing death. Streptococcus bacteria are sensitive to lighting so they cannot grow and develop in a room that has lighting quality that meets the requirements.

Floor Type

The relationship between the type of floor and the incidence of pneumonia in toddlers that are indirect, the floor that is not watertight (the type of ground floor) can affect the humidity in the house and moisture can affect the proliferation of germs that cause pneumonia. Direct relationships can occur because floors of houses made of soil will cause conditions in the house to become dusty. This dusty state is one of the forms of indoor air pollution. Dust

in the air when inhaled will stick to the lower airway. Accumulation of the sticking of dust will cause lung elasticity to decrease, causing toddlers to have difficulty breathing or shortness of breath. (Padmonobo et al., 2012)

Based on the bivariate analysis, the relationship between the type of floor and the incidence of pneumonia was $p = 0.000$, so it can be said that there was a relationship between the type of floor and the incidence of pneumonia. the floor of his house met the requirements. (Sartika & Setiani, n.d.2012)

Wall Type

The wall of the house serves to support the roof as well as protecting the house from interference by rain, angina and heat. Construction of a wall that is not permanent and made of woven bamboo can affect pneumonia. Non-permanent home walls will affect temperature.

Non-permanent wall types are made of woven bamboo (gedek) or painted boards using chalk. Material or chalk paint on the wall causes easy fall out, causing dust. In relation to the type of wall that is not permanent, which is made of materials that fall easily causes dust / dirt / particles. This dusty state is one form of indoor air pollution which can be a trigger that causes irritation to the airways when inhaled. The airways that experience irritation become a medium for the growth of various bacteria and viruses that cause pneumonia.

The results of the study from Juni et al in the work area of Banjar Mangu Health Center 1 Banjarnegara District (Juni, Nurjazuli, & Suhartono, 2016) showed a correlation between the type of wall type of wall and the incidence of pneumonia in infants with $p = 0.004$ and OR = 6.62 with 95% CI = 1.79 - 24.57. So that the type of non-permanent house wall becomes a risk factor for the incidence of pneumonia in infants.

4 CONCLUSIONS

Physical environmental factors that influence the incidence of pneumonia in Indonesia are temperature, humidity, ventilation, lighting, floor type and type of wall

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