

# 29. Physical environment of houses as determinants of pneumonia

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## Physical Environment of Houses as Determinants of Pneumonia among Children in Country Sides

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### ABSTRACT

**Background:** Pneumonia is an acute infection of the lung tissue (*alveoli*) most prevalent in infants. Home physical environment that does not meet the health requirements is to trigger the occurrence of the disease. This study aims to determine the relationship between the home physical environment with pneumonia in infants.

**Method:** The method used is a case-control with an analytical approach. 60 respondents are selected where 30 respondents serve as a treatment group, and the rest is as a control one. The research was conducted in Baturaden, Banyumas Regency, Central Java, Indonesia. The variables studied are living room ventilation width, window width, wall type, floor types, and room occupation density. The research employs Chi-Square test to find the relationship between variables.

**Results:** The results showed the physical environment of the house that has a significant relationship with the incidence of pneumonia among children.

**Conclusion:** Since the physical environment of the house still risk factors for pneumonia ignored by the community, the community health center must play more active roles in disseminating the information to the society about the importance of proper physical environment condition.

**Keywords:** Physical environment, house, pneumonia, children, window

### INTRODUCTION

Factors affecting the health of both the individual and the public are an environment, behavior, services, and descent <sup>(1)</sup>. Environmental factors are the most prominent factor to do with the transmission of diseases, especially infectious diseases. The closest environment to the human being is housing as people spend time sitting at home making the house as a residence must always consider the aspects of health.

Pneumonia kills more children than any other disease, covering nearly 1 in 5 deaths of children and infants, killing more than 2 million children under five each year and the majority occur in developing countries <sup>(2)</sup>. World Health Organization (WHO) estimates that the incidence rates of pneumonia in countries with infant mortality rates above 40 per 1,000 live births are 15%-20% per year in the toddler age group. The incidence of

pneumonia in Indonesia in infants is estimated between 10% - 20% per year.

Central Java Province ranks the fifth in the number of pneumonia of children under five around 18, 477 cases, and when seen from the case fatality rate (CFR)'s infants, the province is ranked the 16<sup>th</sup> with numbers of CFR approximately 10% <sup>(3)</sup>.

Banyumas District as one of the regencies in Central Java displays the of cases of pneumonia with were 860 where the highest position was found in the area of Baturaden with the prevalence of 87 cases. Previous research <sup>(4)</sup> showed that the physical environment of the house that has a relationship with the incidence of acute respiratory infections are the humidity, ventilation, types of floor, and occupant density but the temperature and lighting of the house that does not have a significant relationship but risky. As such, this research would like to expand the previous study by identifying factors

related to pneumonia in children by observing the physical condition of the houses.

### METHODOLOGY

This research is an analytic observational study using a design of case-control comparing the physical environment of respondents homes or patients with non-cases ones. The research was conducted with the physical condition of houses regarding the total area of ventilation, spacious windows, type of wall, floor types and density of occupants with children under five years of age. The population in this study were all toddlers in Health Community Service or *Pusat Kesehatan Masyarakat* Baturaden II with the sample size of 30 infants diagnosed suffering from pneumonia and the control as many as 30 healthy infants. Data collected then tabulated and analyzed descriptively with a frequency distribution table as well as Chi-Square to see the relationship between the dependent and independent variables.

### RESULTS

Ventilation of family room in case group showed 27 respondents (90%) include the category of not eligible (<10% of floor area) and three respondents (10%) include the suitable ( floor area  $\geq$  10%). Further, 30 measurements in the control group showed 16 respondents (53.3%) including ineligible categories (<10% of floor area) and nine respondents (15%) including in the category of meeting the requirements ( $\geq$  10% of floor area). Further, the results of chi-square test showed p-value 0.004 less than  $\alpha = 0.05$ , revealed the significant association between the family room ventilation with the incidence of pneumonia in young children. Besides, the calculation of odds ratios indicates the value of 7.875 meaning toddlers in the family room ventilation conditions that do not meet the requirement will have 7.875 times (rounded to 8) higher risk for pneumonia than the family room ventilation conditions complying to the health requirement.

Window size in the case group showed 29 respondents' (96.7%) property were in ineligible (<20% of floor area) and only one respondent (3.3%) meeting the requirement of health standard ( $\geq$  20% of floor area). In the other hand, in the control group, there were 25 respondents (83.3%) included into ineligible categories (<20% of the floor area) and five respondents (16.7%) included in the group of eligible ( $\geq$  20% of floor area).

The results of chi-square test showed p-value 0.001 smaller than  $\alpha = 0.05$  indicating there is a significant relationship between the window size with pneumonia in young children. The calculation of odds ratios report the value of 5.800 meaning toddlers with an odd volume of windows are risky 5.800 (rounded to 6) times higher to be infected with pneumonia.

The wall condition in a case group indicated four respondents' (13.3%) walls are not eligible and 26 respondents (86.7%) had suitable family room walls (waterproof). Besides, in control group there were three respondents (10%) had ineligible family room walls and 27 respondents (90%) had waterproof wall room. The results of chi-square test showed p-value 0.001 smaller than  $\alpha = 0.05$  indicating there is the significant relationship between the condition of living room wall with the incidence of pneumonia in young children. The calculation of odds ratios indicate the value of 1.385 meaning toddler with improper living room wall will be at risk 1.385 (rounded to 1) time greater than those in the waterproof living room.

The conditions of the floor in case group revealed two respondents (6.7%) had a property floor that is not waterproof and 28 respondents (93.3%) had the waterproof floor. In control group only one respondent (3.3%) with the non-waterproof floor. The results indicates that both control and case groups have been in compliant with the requirement. Chi-square test showed p-value= 0.001 smaller than  $\alpha = 0.05$  suggesting there is a significant relationship between the type of living room floor with the incidence of pneumonia in young children. The calculation of odds ratios indicate the value of 2.071 meaning toddlers with the non-waterproof floor will be at risk 2.071 (rounded to 2) times greater to be affected by pneumonia.

The room occupation density refers to the number of people sleeping in the bedroom (maximum 3). In case of the group, there are 28 respondents (93.3%) whose bedroom was crowded and only two respondents (6.7%) included in the category of eligible occupant density. In the control group, there were 27 respondents (90%) fall into not qualified occupant density, and three respondents (10%) fall into the category of eligible occupant density. Results categorization generally indicate that bedroom in both control and case groups are occupied by many people which is typically in rural areas due to big family members. Chi-square test shows the p-value 0.000 less

than  $\alpha = 0.05$ , revealing the significant relationship between the density of occupancy with the incidence of pneumonia in young children. The calculation of odds ratios indicate the value of 1.556 meaning the toddlers sleeping with many family members are at risk 1.556 (rounded to 2) times greater to be affected by pneumonia.

## DISCUSSION

Spacious living room ventilation has a significant relationship with the incidence of pneumonia in infants. The result of the study is in line <sup>(5)</sup> which shows that large family room ventilation associated with acute respiratory infection in infants.

Spacious house ventilation function for setting the air, because the condition of the walls of the house can contribute to the creation of humidity and temperature that allows germs will die or multiply. Spacious house ventilation air circulation is beneficial for the entry of ultraviolet light to reduce evaporation in the room. High humidity can be caused by moisture from human sweat and breathing which is dangerous to health if there is a cause of pneumonia <sup>(6)</sup>.

Size of living room window has a significant relationship with the incidence of pneumonia in infants. The results are consistent <sup>(7)</sup> that the window size has an association with the occurrence of pneumonia in infants. Lack / insufficient ventilation (<10% of the floor area of the room) would make the pollutants in the room are longer and will add to the risk of exposure to contaminants in the place <sup>(8)</sup>. The window would not function properly if kept closed or are permanently made of glass that can not be opened. The window that cannot be opened would make the bedroom becomes stuffy and humid enabling the development of pathogenic microorganisms, one of the organisms that cause pneumonia. Therefore, the windows should also be impermanent to be open every day so that air can flow out smoothly <sup>(9)</sup>.

Wall function is a supporting the roof to protect the house again rain, heat, and wind from outside. Type of wall has a significant association with the incidence of pneumonia in infants. The magnitude of the risk of suffering from pneumonia could be seen from OR = 2.9 means children under five living in the house with the condition of the wall, did not qualify with a risk of pneumonia was three times greater than toddlers who stay at home with the state of the house walls meet requirements. The results of this study differ <sup>(10)</sup> which

showed that no significant relationship between the type of wall with acute respiratory infection in infants.

The house with an earthen floor will cause home space hot, dusty, and more humid. Warm temperatures can increase evaporation in the room, so it's not just the humidity increased, but also the content of pollutants coming from home building materials. High humidity (> 80%) is a good condition for the growth and survival of bacteria cells (pneumococcus) <sup>(15)</sup> that the bacteria can multiply. State of the floor has a significant relationship with the occurrence of pneumonia. The magnitude of the risk of suffering from pneumonia could be seen from OR = 3.9, which means children under five living in the house with this type of flooring is not eligible with a risk of pneumonia was four times greater than toddlers who stay at home with this type of flooring qualifies. The risk of pneumonia would be higher if the toddlers often play on the floor that is not eligible <sup>(16)</sup>.

House floor construction must be watertight and always dry so it can be easily cleaned of dirt and dust, but it can avoid the rising groundwater that can increase the humidity in the room. To prevent the ingress of water into the house, the floor should be raised approximately 20 cm from the ground. The floor made of the soil should not be used anymore because during the rainy season, this floor will be moist and can cause diseases to occupants. Therefore it is necessary to install tiles or waterproof coating <sup>(11)</sup>.

There is a significant correlation between the density of occupant with the incidence of pneumonia in infants. More and more residents are gathered in one room is a potential risk for the transmission of a disease, especially for children who are relatively vulnerable to disease transmission <sup>(12)</sup>. The solution that can be given if the family really can not afford the room economically is to arrange the items in the room and not too much stuff in the places. Crowded house occupants allow transmission of bacteria, viruses that cause respiratory illnesses from pneumonia through which the occupants of the house to the other occupants of the house easily and quickly.

## CONCLUSION

The results of house physical condition relationship with the incidence of hepatitis A in children under five in Community Health Center or Puskesmas I Baturraden in Central Java, Indonesia are summed up as follows:

There is a connection between family room ventilation with the incidence of pneumonia in young children. The odd ratios indicate that toddlers in the family room ventilation conditions that do not meet the requirement will have eight times greater risk for pneumonia than the family room ventilation conditions complying with the health requirement.

There is a significant relationship between the window size with the pneumonia in young children. The odds ratio indicate that toddlers with an odd size of windows are risky six times greater to be infected with pneumonia.

Type of wall has a significant association with the incidence of pneumonia in infants. The odds ratio indicate children under five living in the house with the condition of the wall did not meet the health requirement will have a risk of pneumonia three times greater.

There is a significant relationship between the type of living room floor with the incidence of pneumonia in young children. The odds ratios indicate that toddlers with the non-waterproof floor will be at risk two times greater to be affected by pneumonia.

There is the significant relationship between the density of occupancy with the incidence of pneumonia in young children. The odds ratios indicate that the toddler sleeping with many family members are at risk two times greater to be affected by pneumonia

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