

# ANALYSIS FACTORS OF THE PHYSICAL ENVIRONMENT ON THE RISK OF STUNTING IN PREGNANT WOMEN

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## Abstract

**Background:** Stunting can occur before delivery due to inadequate nutrition during pregnancy, the causes of stunting also include social, physical, and biological environmental factors. Based on the results of the study, it was found that 52 pregnant women in the second and third trimesters with high-risk pregnancies had the potential to give birth to children at risk of stunting.

**Purpose:** This study aims to determine the relationship between physical environmental factors such as sanitation, clean water, family latrines, residential settings, and cigarette smoke pollutants with the risk of stunting in the working area of the Batu City Health Center, Bogor Regency.

**Methods:** This type of research is an analytic survey with a cross sectional approach. The research sample was 100 pregnant women. The research was conducted in September 2022 using a questionnaire. Data analysis was performed univariately and bivariately using the Chi Square statistical test. The frequency distribution of high-risk pregnant women is 52.0%, physical environmental factors are not good sanitation is 68.0%, water is not clean 61.0%, does not have a toilet 55.0%, residential settings are at risk 55.0%, and cigarette smoke pollutants are 67.0%.

**Result:** The results of statistical tests showed that there was a significant relationship between physical environmental factors and the risk of stunting with a p-value below 0.05.

**Conclusion:** There is a significant relationship between sanitation, clean water, family latrines, residential settings, cigarette smoke pollutants with a high risk of pregnancy which has the potential for mothers to give birth to children at risk of stunting. It is expected to improve health education for pregnant women even before conception to create a superior generation free from stunting.

**Keywords:** Clean water, Family latrines, Pregnancy, Sanitation, Stunting

## Introduction

Stunting is a chronic nutritional problem caused by low dietary intake for a long time due to the provision of food that does not match dietary needs. So that toddlers are declared to have a short length or height compared to age <sup>1</sup>. According to the World Health Organization (2021), the occurrence of stunting in the world will reach 22% or 149.2 million in 2020. Apart from stunting, another problem that many toddlers experience is

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malnutrition. WHO states that 49% of the 10.4 million under-five deaths in developing countries are related to malnutrition <sup>2</sup>.

Indonesia is the third country with the highest prevalence of stunting in the Southeast Asia/Southeast Asia Regional (SEAR) region. Until now, the prevalence of stunting nationally is better in terms of several ASEAN countries, such as Myanmar (35%), but it is still higher than Vietnam (23%), Malaysia (17%), Thailand (16%), and Singapore (4%)<sup>3</sup>. Based on the results of the Indonesian Nutrition Status Study (SSGI) and the Ministry of Health (Kemenkes), the national stunting rate shows improvement, decreasing by 3.3%, from 27.7% in 2019 to 24.4% in 2021. One of the global nutrition targets for 2025 is to reduce the prevalence of stunting, as well as a good step towards achieving the RPJMN target (2020-2024) to reduce stunting rates <sup>4</sup>.

Indonesia's Health Profile in the results of a study on Indonesia's nutritional status by the BKKP Ministry of Health of the Republic of Indonesia in 2021, it is known that the proportion of stunting in West Java shows a decrease of 24.5% so that the average decrease in stunting in the last three years in West Java is around 1.35%. West Java Province is one of the provinces with an accelerated reduction in stunting. Based on data released by SSGI, out of 27 regencies/cities in West Java, four regencies/cities have a high prevalence of stunting (30-39.9%), namely Garut Regency, Cianjur Regency, Bandung Regency, and Cirebon City <sup>5</sup>.

Bogor Regency is one of the priority districts for stunting intervention in West Java. Based on published data on the nutritional status of toddlers in 2022, the prevalence of stunting in Bogor Regency in 2021 will drop to 9.89%, and then in 2022, it will drop to 4.78% <sup>6</sup>. Stunting can occur before birth and is caused by low nutritional intake during pregnancy. There are two factors that cause stunting namely direct and indirect causes.

The direct causes are health-related, such as lack of nutrition and infectious diseases. In contrast, the indirect causes include access to nutritious food, health services, proper sanitation and clean water, and education. According to the Ministry of Health (2018), factors for stunting in children occur before conception and during pregnancy, and after birth. This is consistent with the results of Nirmalasari's research (2020), which revealed that the risk factors for stunting consistently in Indonesia are mother, child, and environmental factors <sup>7</sup>.

The causes of stunting are also very complex, including social, physical, and biological environmental factors. Social factors include macro-level political and social policies. In contrast, physical environmental factors include clean water, sanitation, family latrines, residential arrangements, and exposure to domestic pollutants (cigarette smoke and cooking fuel). Meanwhile, for biological factors, there are gender and age of children under five, as well as consumption of micronutrients <sup>8</sup>.

Based on data from the Technical Implementation Unit (UPT) of the Kota Batu Public Health Center in 2022, there are three villages in their working area: Mekarjaya Village, Parakan Village, and Kota Batu Village. Of the villages with 2,885 children, 1.07% or 31 were stunted. Based on the survey above, the researcher is interested in conducting an "Analysis of Physical Environmental Factors on the Risk of Stunting in Pregnant Women

in the Working Area of the Kota Batu Public Health Center, Bogor Regency.”

## **Method**

### *1. Research design*

This type of quantitative research uses an analytic survey method with a cross-sectional approach, where the researcher studies the dynamics of the correlation between the independent and dependent variables through an observation approach or data collection is carried out all at once.

### *2. Setting and samples*

Conducting research from December 2022 to January 2023 in the working area of the Kota Batu Public Health Center, Bogor Regency. The population in the study were all pregnant women in the second and third trimesters who had their pregnancies checked at Kota Batu Health Center, totaling 134 peoples. Sampling technique with Accidental sampling. The number of samples was calculated based on the Slovin formula because the number must be representative so that the research results can be generalized, namely  $N = N / (1 + (N \times e^2))$  so that a sample of 100 pregnant women was obtained.

### *3. Measurement and data collection*

Data collection techniques are questionnaires or questionnaires that have been tested for validity and reliability to obtain valid questionnaire items. SPSS software is used to test the validity of the Pearson product-moment test, it is known that the results of the r-table calculation are 0.361, and the reliability test uses Cronbach's alpha below 0.7 with 30 respondents. In this type of closed questionnaire, the respondent only must give a choice of one of the answers that are considered correct with the Guttman scale measurement scale, namely "Yes" and "No," which consists of 25 questions with five variables, namely factors of sanitation, clean water, family latrines, residential settings, and cigarette smoke pollutants. Data collection by distributing questionnaires in the work area of the Kota Batu Public Health Center

### *4. Data analysis*

The data was processed by tabulating data using the Chi-Square statistical test with the SPSS Windows 25 application. The conclusion of the statistical test is the decision to accept or reject  $H_0$ . If the p-value is lower than the value  $\alpha$  (0.05), then  $H_0$  is rejected. It is interpreted that the dependent and independent variables have a significant correlation. In the health sector, the risk ratio odds ratio (OR) is used to assess the strength of the correlation.

## **Results**

Based on the characteristics of the respondents, it is known that the majority of pregnant women (52.0%) are at high risk of stunting, 68.0% have poor sanitation, 61.0% have an unclean water environment, 55.0% do not have latrines, 56.0% have risky residences, and 67.0% have smoking families. The results showed that sanitation, water hygiene, family latrines, residential settings, and cigarette smoke significantly correlated with pregnant women's risk of stunting their babies (p-value <0.05).

**Table 1.**  
**Characteristics of Respondents**

Variable	Sum (n)	Percentage (%)
<b>Stunting Risk</b>		
High Risk	52	52.0
Low Risk	48	48.0
Total	100	100.0
<b>Sanitation</b>		
Not good	68	68.0
good	32	32.0
Total	100	100.0
<b>Water</b>		
Not clean	61	61.0
clean	39	39.0
Total	100	100.0
<b>family latrines</b>		
Do not have	55	55.0
have	45	45.0
Total	100	100.0
<b>Residential arrangements</b>		
risky	56	56.0
No risk	44	44.0
Total	100	100.0
<b>Cigarette smoke pollution</b>		
smoke	67	67.0
Do not smoke	33	33.0
Total	100	100.0

**Table 2.**  
**Relationship between Respondent Characteristics and Stunting Risk**

Characteristic	Stunting Risk				P-Value		
	High Risk		Low Risk		Total		
	f	%	f	%	N	%	
<b>Sanitation</b>							
Not good	30	44.1	38	55.9	68	100.0	0,037
good	22	68.1	10	31.2	32	100.0	
<b>Water</b>							
Not clean	26	42.6	35	57.4	61	100.0	0,032
Clean	26	66.7	13	33.3	39	100.0	
<b>Family Latrines</b>							
Do not have	34	61.8	21	38.2	55	100.0	0,049
have	18	40.0	27	60.0	45	100.0	
<b>Residential arrangements</b>							
Risky	35	62.5	21	37.5	56	100.0	0,030
No risk	17	38.6	27	61.4	44	100.0	
<b>Cigarette smoke pollution</b>							
Smoke	40	59.7	27	40.3	67	100.0	0,047
Do not smoke	12	36.4	21	63.6	33	100.0	

Information: P Value = Chi Square Test

## **Discussion**

### ***Sanitation***

The results showed that most of the pregnant women lived in an environment with poor sanitation. The results of the Chi Square test obtained a value of  $P = 0.037 (<0.05)$  which means that there is a significant relationship between poor sanitation and pregnant women at risk of stunting in their children.

The results of this study are in line with Olo (2021) which says that children who live in environments with inadequate sanitation have a 40% risk of experiencing stunting. For example, in an environment where garbage is disposed of, it will become a nest for cockroaches, mosquitoes, rats, and others, which is indirectly related to the high incidence of common diseases, especially diarrhea, which will have an impact on the nutritional status of pregnant women<sup>9</sup>. This research is also in line with the results of Zalukhu's research (2022) which shows that there is a significant relationship between sanitation and the risk of stunting<sup>10</sup>. However, the results of Lestari's research (2018) show that KEK is very influential on the incidence of stunting because a poor diet causes susceptibility to infection, thereby inhibiting growth and the risk of stunting in pregnant women and toddler<sup>18</sup>.

Researchers assume that most pregnant women with poor sanitation have a high chance of experiencing a high risk of pregnancy which results in babies being born will experience stunting due to behavior that does not maintain environmental cleanliness resulting in poor sanitation, such as there are no landfills which result in environmental pollution so that it disturbs health. There are a small number of pregnant women who have good sanitation but are at low risk of stunting. According to researchers, even though sanitation is good, risk factors can occur due to other factors; for example, diet during pregnancy and non-adherence to taking Fe tablets will experience anemia, thus putting pregnant women at high risk of stunting in their childbirth

### ***Water hygiene***

The results showed that there were some pregnant women who did not have clean water for their daily needs. The results of the Chi-Square test obtained a value of  $P = 0.032 (<0.05)$ , meaning that there is a significant relationship between unclean water and the risk of stunting in pregnant women for their children.

Mustika's research (2021) in Torlesse (2016) states that in Indonesia, there is a relationship between poor sanitation and clean water quality as risk factors for stunting. Sources of drinking water are said to be good, namely tap water, springs, and protected wells. The minimum distance between the well and the septic tank or cattle shed, waste disposal, and landfill is about 10 meters<sup>11</sup>.

Based on the theory put forward by Nisa (2020) states that the lack of cleanliness of water sources used for daily needs can cause infection with various diseases such as diarrhea and intestinal worms, which will result in digestive disorders, which can reduce weight. If this goes on for a long time and often, it will cause stunting<sup>12</sup>.

According to the researchers' assumptions, pregnant women who have poor-quality

water sources will be susceptible to various diseases that affect their pregnancy, causing various complications that put pregnant women included in the high-risk category for stunting in their children. Clean water that is not contaminated will improve public health status, but of course, it is not easy to find sources of clean water or water treatment that is not according to standards causes water to be easily contaminated with bacteria.

### ***Family latrines***

The results showed that some pregnant women did not have their latrines, so they used shared latrines. The Chi-Square test results showed a value of  $P = 0.049$  ( $<0.05$ ), meaning there is a significant relationship between latrine ownership and the risk of stunting in the children they give birth. The OR value is 2.429, which means that mothers who do not have a latrine have 2.429 times the risk of experiencing stunting compared to mothers who have a latrine.

A latrine is one thing that every family must have. A latrine used together allows for contamination of the water source from the latrine, which impacts pollution disorders such as diarrhea. The use of healthy latrines is also influenced by knowledge, attitudes, and ownership of latrines<sup>13</sup>.

Using a shared latrine or not having a latrine is at risk for diseases such as intestinal worms. Latrines are closely related to worms because they are associated with feces, the transmission medium for worms. Worm or worm infection can cause anemia because people infected with worms can then experience decreased food intake and malabsorption of nutrients. The incidence of anemia significantly occurs in pregnant women who have worm infections<sup>14</sup>.

Olo's research (2021) states that if a family does not have latrine facilities, they will defecate in the open. This is related to the incidence of stunting because this behavior causes environmental pollution due to the spread of germs. If these germs are touched by a child who is still growing, such as by putting a finger in his mouth, hands that have been contaminated with germs will infect the intestines. Intestinal infection conditions can be in the form of diarrhea, which can affect nutritional status by reducing appetite and disrupting nutrient absorption, which causes children to experience malnutrition and interfere with growth<sup>9</sup>.

The researcher assumes that most pregnant women do not have family latrines and only have shared ones. This happened because the density of settlements meant that there was no land for making a septic tank, so many families used shared latrines. In addition, there is also a need for more awareness about the importance of owning a latrine.

### ***Residential settings***

The study results show that some pregnant women have a risky residence. The Chi-Square test results showed a value of  $P = 0.030$  ( $<0.05$ ), meaning a significant relationship exists between residential settings and the risk of stunting. The OR value is 2.647, meaning pregnant women whose homes are at risk have 2.647 times the risk of experiencing stunting in their children compared to mothers whose homes are not at risk.

Based on the theory put forward by Agustina (2021), the quality of the living environment can reflect environmental health, which can be seen from indicators of

environmental quality, including residential density, quality of drinking water, conditions of garbage disposal, distance to stables, and environmental cleanliness. Environments with high residential densities, close to trash cans and animal pens, will have lower health than environments with good residential densities<sup>[15]</sup>. Poor housing construction, such as houses that are too open, houses that are close to livestock pens, and neighborhoods with lots of stagnant water, all of which make the living environment a risk for disease breeding which increases<sup>16</sup>.

The researcher assumes that why do most respondents have residential settings that are at high risk of stunting due to the demographics of areas close to rivers, the density of people making settlements close together, and the distance to health facilities difficult to reach, which makes most pregnant women at high risk because pregnant women do not get facilities continuous health. Neighborhoods with high residential density, poor sanitation, and poor garbage disposal will also have poor health compared to areas that are not too densely populated.

### ***Cigarette smoke pollution***

The results showed that there were some pregnant women who had families who smoked. The results of the Chi-Square test showed a P value = 0.030 (<0.05), which means that there is a significant relationship between cigarette smoke pollutants and the risk of stunting, where pregnant women who are exposed to cigarette smoke for a long time will experience health problems, thereby putting their pregnancy at risk. The OR value is 2.593, meaning that pregnant women who are exposed to cigarette smoke have 2.593 times the risk of experiencing stunting at birth compared to those who are not exposed to cigarette smoke.

Cigarette smoke is the biggest cause of indoor pollution, and cigarette pollution can cause fetal growth disorders. Nicotine can be absorbed quickly from the respiratory tract into the mother's bloodstream, breast milk, and baby's breath. This pollution accumulates so that the baby suffers from respiratory problems, lung and ear infections, vomiting, diarrhea, increased heart rate, and colic growth disorders. The nicotine and carbon monoxide in cigarettes also cause new blood vessels to narrow. As a result, the transport of oxygen and nutrients to the fetus is hampered, so the fetus will experience growth disturbances and the development of nerves and other organs<sup>8</sup>.

Research conducted by Ayu et al. (2020) stated that smoking behavior is a person's activity which is the person's response to external stimuli, namely the factors that influence a person to smoke and can be observed directly. Human behavior can be divided into three domains, namely, knowledge, attitudes, and skills (psychomotor practice). One of the factors that affect children's growth is exposure to pollution from cigarette smoke. The ingredients in the form of carbon monoxide and benzene can reduce the number of red blood cells and damage the spinal cord, which will have an impact on the risk of anemia. One of the effects of anemia is a decrease in the number of nutrients in cells, tissues, and glands, especially the glands that produce the hormone thyroxine and growth hormone. These two hormones greatly influence the incidence of stunting<sup>17</sup>.

Researchers assume that smoking behavior or families exposed to cigarette smoke are



the most dominant factors for a high risk of stunting because exposure to cigarette smoke during pregnancy will cause babies to be born with low birth weight (LBW), which will disrupt the child's growth so that they are at risk experiencing stunting.

### **Limitations**

Limitations in this study are due to the distance and the place that is far from the research location, as well as dense settlements so that access roads that are far from the main road make it difficult for data collection.

### **Conclusion**

There is a significant relationship between the physical environmental factors of sanitation, clean water, family latrines, residential settings, and cigarette smoke pollutants with the risk of stunting in pregnant women for the birth of their children. This research is recommended for families or health workers to further improve health education for pregnant women even before conception to create a superior generation free from stunting.

It is recommended that village midwives and posyandu cadres can play an active role in preventing stunting in children since pregnancy, starting from the process of approaching and assisting families until the baby is born in good condition and improving eating patterns, parenting patterns, and improving the environment to increase health status. In future research, research will be carried out on the relationship between genetic factors and parenting styles for stunting in children.

### **Ethical Considerations**

His research has earned an ethically worthy statement from Komisi Etik Penelitian Kesehatan (KEPK) Prima Indonesia University, Number through a review from the ethical commission, Number 022/KEPK/UNRI/I/2023

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### **Conflict of interest**

There is no conflict of interest.

### **Author's contribution**

RPP performs research preparation and design and analyzes and interprets data. AHP, SP, and JAS were involved in analyzing and interpreting the data. SP and JAS assisted critically and reviewed the manuscript. All authors read and approved the final manuscript.

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