



## Coastal Environmental Factors Related to the Increase in ISPA Cases at the Belawan Branch Health Center

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### ABSTRACT

Acute Respiratory Infection (ARI) is still a public health problem that is often found in coastal areas, including in the work area of the Belawan Branch Health Center, Medan City. Characteristics of the coastal environment such as air quality influenced by port activities, settlement density, housing conditions, high air humidity, and environmental sanitation are suspected to play a role in the increase in ISPA incidents. This study aims to describe the distribution of ISPA incidence based on coastal environmental factors in the work area of the Belawan Branch Health Center. This study uses a quantitative approach with a descriptive analysis method. The research sample amounted to 100 respondents who were selected using accidental sampling techniques. Data collection was carried out through interviews using structured questionnaires and observation of the environmental conditions of the respondents' residences. The variables studied include environmental air quality, settlement density, house ventilation, environmental humidity, and environmental sanitation. The data is analyzed descriptively and presented in the form of frequency and percentage distributions. The results showed that the proportion of ISPA incidence was higher in respondents living in environments with poor air quality, dense settlements, unqualified home ventilation, high environmental humidity levels, and poor environmental sanitation. This condition reflects the important role of coastal environmental factors in the incidence of ISPA in the research area. The conclusion of this study shows that coastal environmental factors contribute to the high incidence of ISPA in the work area of the Belawan Branch Health Center. Therefore, efforts to prevent ISPA need to be focused on improving environmental conditions and strengthening promotive and preventive activities at the primary health service level.

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## INTRODUCTION

Acute Respiratory Infection (ARI) is still one of the public health problems with a high prevalence in Indonesia, especially in coastal areas. Typical coastal environmental characteristics, such as settlement density, inadequate sanitation conditions, and exposure to risky environmental factors, have the potential to increase the incidence of respiratory diseases including ISPA (1). This disease not only has an impact on people's quality of life, but also contributes to the increasing burden of health services in first-level health facilities. Nearly 4 million people die each year from acute respiratory tract infections, 98% of which are caused by upper respiratory tract infections. Mortality among infants, children and the elderly is particularly high, especially in low- and middle-income countries (2).

The physical environment is an important determinant in the occurrence of ISPA. Studies have shown that residential sanitation conditions, poor ventilation, occupancy density, and indoor and outdoor air pollution exposure are significantly associated with the incidence of ISPA in various age groups (3). Such as inadequate housing density and ventilation can worsen indoor air quality and facilitate the transmission of respiratory pathogens, while smoking habits and the use of traditional fuels indoors also contribute to domestic air pollution which increases the risk of ISPA (4).

Coastal areas have environmental characteristics that specifically increase susceptibility to respiratory diseases. Port activities, marine transportation, coastal industries, and heavy vehicle traffic have the potential to produce exhaust gas emissions, dust, and air pollutant particles. In addition, high levels of air humidity, residential density, and limited sanitation facilities and decent housing are often found in coastal areas. The combination of these factors creates an environment that is not conducive to respiratory health and increases the risk of ISPA in coastal communities.

This condition is reflected in data on the incidence of ISPA at the regional and city levels. Although specific data on ISPA cases at the Belawan Medan Branch Health Center for 2025 is not yet publicly available, a report by the Medan City Health Office shows a significant increase in ISPA cases throughout 2025. In August 2025, there were 25,715 cases of ISPA, which then increased to 30,952 cases in September 2025, and experienced a sharp spike in October 2025 with a total of 42,643 cases (5). This increasing trend shows that ISPA is still a serious health problem and requires special attention from various parties.

More broadly, the North Sumatra Provincial Health Office reported as many as 669 thousand cases of ISPA during the period from January to September 2025, with the city of Medan as the region with the highest number of cases. The high incidence of ISPA in Medan City indicates that environmental and social risk factors have not been optimally handled, especially in areas with complex environmental characteristics such as coastal areas. The Belawan Branch Health Center as a first-level health service facility in coastal areas has a strategic role in handling ISPA problems. The characteristics of the coastal environment of Belawan, which include population density, air quality influenced by port and industrial activities, and diverse housing and sanitation conditions, are strongly suspected to contribute to the high number of ISPA case visits. However, the relationship between coastal environmental factors and the increase in ISPA cases in the work area of the Belawan Branch Health Center still requires a more in-depth and data-based scientific study.

Based on these conditions, research on coastal environmental factors related to the increase in ISPA cases at the Belawan Branch Health Center is important to be carried out. Therefore, this study seeks to examine in detail the coastal environmental factors related to the increase in ISPA cases in the work area of the Belawan Branch Health Center, so as to provide a scientific basis for more targeted public health interventions as well as the formulation of effective sanitation and disease control policies in coastal communities.

## RESEARCH METHODS

This study uses a quantitative approach with a descriptive analysis method that aims to describe the distribution of the incidence of Acute Respiratory Infection (ARI) based on environmental factors in the coastal area of the Belawan Branch Health Center, Medan City. A quantitative approach was chosen to obtain a numerical picture of the occurrence of ISPA and the characteristics of the accompanying environmental factors, while descriptive analysis was used to present the data in the form of frequency and percentage. This research will be carried out in the work area of the Belawan Branch Health Center in 2025. The research population is all communities in the coastal area, with a sample of 100 respondents obtained through *accidental sampling techniques*.

Data were collected through interviews using structured questionnaires and direct observation of the environmental conditions of the respondents' residences. The variables studied included environmental air quality, settlement density, house ventilation, environmental humidity, and environmental sanitation, while the incidence of ISPA was determined as the main variable observed. The data obtained were analyzed descriptively to describe the distribution of ISPA incidence based on each environmental factor. The results of the analysis are presented in the form of a frequency and percentage distribution table to provide a clear

picture of the proportion of ISPA occurrences in each category of environmental factors in the coastal area of the Belawan Branch Health Center.

## RESULTS

Based on the results of the Health Office's report, it is known that cases of Acute Respiratory Infection (ARI) are still showing a significant increasing trend in urban areas, especially Medan City. Although specific data on ISPA cases at the Belawan Medan Branch Health Center in 2025 is not yet publicly available, aggregate data at the city and provincial levels can be used as a strong indicator to describe the public health situation in the region, given that Belawan is part of the City of Medan with typical coastal environmental characteristics. Data from the Medan City Health Office shows a sharp spike in ISPA cases in 2025. This increase can be seen from the number of ISPA cases recorded from month to month, as presented in Table 1.

**Table 1.** Number of ISPA Cases in Medan City in 2025

Month (2025)	Number of ISPA Cases
August	25,715 cases
September	30,952 cases
October	42,643 cases

Source: Medan City Health Office, 2025

Based on Table 1, it can be seen that there has been an increase in ISPA cases by 5,237 cases from August to September 2025. A more significant spike occurred in the period from September to October 2025, which was an increase of 11,691 cases with Medan City as the region with the highest number of cases. Although specific data on the number of ISPA cases at the Belawan Branch Health Center is not yet publicly available, the high number of ISPA cases in Medan City provides a strong indication that the work area of the Belawan Branch Health Center, which is located in the coastal area, has a high potential risk of ISPA incidents. This is in line with the characteristics of the coastal environment of Belawan which is influenced by port activities, sea transportation, population density, and diverse residential and sanitation conditions.

## DISCUSSION

### The Relationship of Environmental Factors with the incidence of ISPA at the Belawan Branch Health Center

Based on the results of a study on 100 respondents in the work area of the Belawan Branch Health Center, it was obtained that the incidence of ISPA is still relatively high and is related to several factors of the coastal environment. There are several environmental factors associated with the occurrence of ISPA:

#### a. The Relationship of Environmental Air Quality with ISPA Occurrences

Environmental air quality is the most dominant factor in influencing the incidence of Acute Respiratory Infections (ARI). Air polluted by various pollutants, such as motor vehicle fumes, industrial emissions, dust, and small fine particles (PM<sub>2.5</sub> and PM<sub>10</sub>), can have a direct impact on respiratory health (6). Continuous exposure to these pollutants can cause irritation of the mucosa of the respiratory tract, decrease the function of cilia, and weaken the body's natural defense mechanisms against infection-causing microorganisms (7). As a result, individuals who are exposed to polluted air for long periods of time become more susceptible to acute respiratory infections.

**Table 2.** The Relationship of Environmental Air Quality with ISPA Occurrences

Air Quality	ISPA n (%)	No ISPA n (%)	Total n (%)
Bad	42 (80,8)	10 (19,2)	52 (100)
Good	20 (41,7)	28 (58,3)	48 (100)
Total	62 (62,0)	38 (38,0)	100 (100)

Based on Table 2, most of the respondents who live in environments with poor air quality experience ARI, which is as many as 42 respondents (80.8%). Meanwhile, in respondents who lived in environments with good air quality, the incidence of ISPA was found in 20 respondents (41.7%). These findings suggest that the proportion of ISPA incidence is higher in respondents who are exposed to poor environmental air quality. This condition can be attributed to the characteristics of the coastal area of Belawan which are influenced by port activities, sea transportation, and motor vehicles that have the potential to reduce ambient air quality. In the coastal area of Belawan, ambient air quality is affected by port activities, sea transportation, and heavy vehicle traffic that is quite dense. Exhaust emissions from marine ships and motor vehicles, coupled with dust from loading and unloading activities, contribute to the increase in the concentration of pollutants in the air. This condition worsens the air quality of the

environment and increases the risk of respiratory distress in the people living around the area. Thus, environmental air quality in the coastal area of Belawan has a close relationship with the increase in the incidence of ISPA in the work area of the Belawan Branch Health Center.

#### b. The Relationship between Settlement Density and the Incidence of ISPA

Settlement density is an environmental factor that plays an important role in increasing the risk of STI transmission. Settlements with high density levels cause the distance between houses to be very narrow, so that air circulation between buildings becomes less than optimal (8). This condition facilitates the spread of pathogens that cause ISPA through the air, especially in environments with low air quality and inadequate ventilation.

**Table 3.** Distribution of ISPA Incidence Based on Settlement Density

Settlement Density	ISPA n (%)	No ISPA n (%)	Total n (%)
Solid	45 (75,0)	15 (25,0)	60 (100)
Not Solid	17 (42,5)	23 (57,5)	40 (100)
Total	62 (62,0)	38 (38,0)	100 (100)

Table 3 shows that respondents living in densely populated settlements have a higher proportion of ISPA incidence, which is 75.0%. On the other hand, in respondents who lived in non-densely populated settlements, the proportion of ISPA was lower, at 42.5%. Dense residential conditions cause the distance between houses to narrow and increase the intensity of contact between individuals, thus potentially accelerating the transmission of respiratory infections. In addition, the large number of residents in one house increases the intensity of contact between individuals, so that the chance of transmission of respiratory infections becomes greater (9). This situation is often found in coastal areas with limited land and high population growth, such as the Belawan area. High settlement density, if not balanced with good environmental and housing quality, can be the main risk factor for an increase in ISPA cases.

#### c. The Relationship of Home Ventilation to the Incidence of ISPA

Home ventilation is an important aspect in maintaining indoor air quality. Ventilation that does not meet health standards causes air exchange between indoor and outdoor to be suboptimal (1). As a result, the air in the house tends to be trapped and contains various pollutants, such as cigarette smoke, dust, and disease-causing microorganisms. This condition increases the risk of developing ISPA, especially in family members who spend more time indoors (10).

**Table 4.** Distribution of ISPA Incidence Based on Home Ventilation Conditions

Home Ventilation	ISPA n (%)	No ISPA n (%)	Total n (%)
Not Eligible	40 (76,9)	12 (23,1)	52 (100)
Eligible	22 (45,8)	26 (54,2)	48 (100)
Total	62 (62,0)	38 (38,0)	100 (100)

Based on Table 4, most of the respondents who lived in houses with ventilation were not eligible to experience ISPA, which was 76.9%. Meanwhile, in homes with qualified ventilation, the proportion of ISPA incidence is lower, which is 45.8%. Inadequate ventilation can cause poor air circulation in the house so that pollutants and microorganisms that cause disease easily accumulate. In coastal areas, poorly ventilated homes are often associated with tight building designs and space limitations. The lack of ventilation also causes the humidity level inside the house to increase, thus worsening indoor air quality. Children and the elderly are the most vulnerable group to the adverse effects of unhealthy home ventilation, because their respiratory systems and immune systems are relatively weaker (11).

#### d. The Relationship of Environmental Humidity to the Incidence of ISPA

Coastal areas generally have climatic characteristics with high levels of air humidity. High humidity can affect air quality and respiratory health. A humid environment supports the growth and development of viruses and bacteria that cause ARI. Additionally, humid air can slow evaporation and worsen indoor air quality, especially in homes that have inadequate ventilation and natural lighting.

**Table 5.** Distribution of ISPA Occurrence Based on Environmental Humidity

Environmental Humidity	ISPA n (%)	No ISPA n (%)	Total n (%)
Height	47 (72,3)	18 (27,7)	65 (100)
Normal	15 (42,9)	20 (57,1)	35 (100)
Total	62 (62,0)	38 (38,0)	100 (100)

Table 4 shows that the incidence of ISPA is more common in respondents who live in environments with high humidity levels, which is 72.3%. In an environment with normal humidity, the proportion of ISPA is lower, which is 42.9%. High air humidity in coastal areas can create conditions that favor the growth of microorganisms that cause respiratory tract infections. Humid coastal climate conditions can also cause homes to become moldy and dusty, increasing the risk of respiratory irritation (12). Exposure to a humid environment for a long period of time can reduce the comfort and health of home residents, and contribute to the increase in the incidence of ISPA in the coastal area of Belawan.

#### e. The Relationship of Environmental Sanitation to the Incidence of ISPA

Environmental sanitation is an important factor related to the general public health status, including the incidence of ARI. Poor sanitation, such as suboptimal household waste management, limited waste disposal facilities, and the existence of standing water around settlements, can reduce the quality of the environment (13). An unhealthy environment can worsen public health conditions and lower immunity, thereby increasing susceptibility to infectious diseases.

**Table 6.** Distribution of ISPA Occurrence Based on Environmental Sanitation

Environmental Sanitation	ISPA n (%)	No ISPA n (%)	Total n (%)
Bad	44 (75,9)	14 (24,1)	58 (100)
Good	18 (42,9)	24 (57,1)	42 (100)
Total	62 (62,0)	38 (38,0)	100 (100)

Based on Table 5, respondents who live in environments with poor sanitation have a higher proportion of ISPA incidence, which is 75.9%. In contrast, in respondents with good environmental sanitation, the proportion of ISPA was lower. Poor environmental sanitation can reduce the overall quality of environmental health and increase people's susceptibility to infectious diseases, including ISPA. In coastal areas, sanitation problems are often exacerbated by limited infrastructure and dense environmental conditions (14). Household waste that is not properly managed can pollute the environment and create conditions that are not conducive to health. Poor sanitation conditions indirectly contribute to the increase in the incidence of ISPA through a decrease in the quality of life and health of coastal communities.

#### Efforts to Prevent ISPA in Coastal Areas

Efforts to prevent Acute Respiratory Infections (ARIs) in coastal areas require a comprehensive and sustainable approach, given the characteristics of coastal environments that have a higher risk of respiratory health disorders. Environmental conditions influenced by port activities, residential density, high air humidity, and sanitary limitations are important factors that need to be considered in efforts to prevent ISPA.

- a) Improving environmental air quality  
Control of air pollution sources, both from land and sea transportation activities, needs to be carried out through monitoring vehicle and ship emissions, managing industrial activities around coastal areas, and arranging residential environments to have adequate open space. In addition, the public needs to be educated to reduce the habit of burning garbage around the house which can worsen air quality and increase the risk of ISPA (15).
- b) Improvement of the quality of the residential environment  
Healthier settlement arrangements, including reducing occupancy density and improving home ventilation, can help improve air circulation within the home. A home that has good ventilation and lighting can reduce air humidity and prevent the accumulation of pollutants and microorganisms that cause respiratory tract infections (9).
- c) Environmental sanitation improvements  
An important component in the prevention of ISPA in coastal areas. Good household waste management, provision of proper waste disposal facilities, and control of standing water around settlements can improve the overall health quality of the environment (11). A clean and healthy environment can lower the risk of exposure to infectious agents that contribute to the occurrence of ARI.
- d) Clean and healthy living behavior (PHBS) of coastal communities needs to be improved  
Health education about the importance of maintaining house cleanliness, coughing and sneezing etiquette, using masks under certain conditions, and avoiding exposure to cigarette smoke in the house are effective preventive measures. Changes in people's behavior play an important role in breaking the chain of transmission of ISPA, especially in vulnerable groups such as toddlers and the elderly.

## e) The role of primary health services

Especially the Belawan Branch Health Center, which is very important in efforts to prevent ISPA. Puskesmas can play a role through promotive and preventive activities, such as environmental health counseling, monitoring of public health conditions, and early detection of ISPA cases. Collaboration between health workers, local governments, and communities is needed to create a healthier coastal environment and reduce the incidence of ISPA in a sustainable manner.

Overall, the prevention of ISPA in coastal areas requires synergy between improving the physical environment, changing community behavior, and strengthening the role of health services. This integrated approach is expected to be able to reduce the risk of ISPA incidents and improve the health status of coastal communities, especially in the work area of the Belawan Branch Health Center.

## CONCLUSION

It can be concluded that the incidence of Acute Respiratory Infections (ARI) in the work area of the Belawan Branch Health Center is still relatively high and related to the condition of the coastal environment. Environmental air quality factors, settlement density, house ventilation conditions, environmental humidity levels, and environmental sanitation play a role in the high proportion of ISPA incidents in the community. The characteristics of the coastal area of Belawan influenced by port activities, population density, and diverse settlement conditions reinforce the role of environmental factors as an important determinant of respiratory health. These findings show that efforts to control ISPA in coastal areas need to be directed at improving environmental conditions and strengthening promotive and preventive activities at the Puskesmas level.

## SUGGESTION

Based on the results of the study, it is recommended that the Belawan Branch Health Center increase promotive and preventive efforts through environmental health counseling and periodic monitoring of the environmental conditions of coastal communities. Local governments and related agencies are expected to support the improvement of the quality of the coastal environment, especially in air pollution control, settlement planning, and improving environmental sanitation. The community is also expected to play an active role in implementing clean and healthy living behaviors, especially in maintaining environmental cleanliness and air quality in the house. In addition, further research is recommended to use an analytical design with a larger sample count and consider other variables related to the occurrence of ISPA, so as to provide a more comprehensive picture.

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