

Climate Change and Tuberculosis Cases in Islamic Boarding Schools of Indonesia: How to Handle It?

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Dear Editors

World Health Organization (WHO) reported that Tuberculosis (TB) is one of the 10 leading causes of death worldwide. Globally, TB sufferers reached an estimated 10,556,328 cases in 2022, an increase of around 453,199 cases from 2021 (1). This data indicates that TB cases remain a significant global problem. In 2021, Indonesia was in second place with the largest number of TB sufferers in the world, namely 969,000 TB sufferers, after India with 2,950,000 TB cases, followed by China, Philippines, Pakistan, Nigeria, Bangladesh, Democratic Republic of Congo, South Africa, and Myanmar in sequence (1). TB cases in Indonesia increased by 18%, in 2020 there were 819,000 cases. The TB death rate in 2020 reached 93,000 cases, increasing in 2021 with 144,000 cases of TB sufferers in Indonesia. The cause of the increase in TB cases in 2022 was the discovery of cases of pulmonary TB and Drug-Resistant TB, and the Covid-19 pandemic was also a factor causing the increase in TB cases in 2022 (2). According to the theoretical concept of Hendrik L Blum, 45% of environmental factors, 30% of behaviour, 20% of health services, and 5% of hereditary factors can affect a person's health status (3).

This lung disease is commonly found in Indonesia, especially in densely-populated areas such as Islamic boarding schools and correctional institutions, which often lack adequate ventilation and sanitation (4). The increase in TB cases in various population groups, especially in Islamic boarding school environments, requires serious attention from various parties. Unpredictable climate change is a separate obstacle for the

community in dealing with health problems, this occurs globally where the whole world experiences the same thing, namely unpredictable climate change (5). Tuberculosis (TB) is still one of the world's deadliest infectious diseases, with many populations facing high and stagnant case rates of this preventable disease.

One of the impacts of climate change, currently occurring, is the prolonged summer, which contributes to increasing migration rates and, in turn, accelerates the spread of TB cases (4). Mycobacterium tuberculosis tends to spread faster in hot climates compared with cold climates. One factor in the spread of TB is geographic location, especially in densely populated and low-income areas. This also applies to the boarding school environments, including Islamic Boarding schools, which are at high risk of TB transmission (6). Three important components interrelated in the process of disease are humans, disease-causing agents, and the environment. If these three components are in balance, the disease will not appear. However, if this balance is disturbed, the disease can appear. In the case of tuberculosis (TB), the human component is represented by students in Islamic boarding schools (for example, diet, level of knowledge, and others), the disease agent is Mycobacterium tuberculosis, and environmental factors include climate (weather, place of residence, and other geographical factors).

Islamic boarding schools often have high population density, poor sanitation, and suboptimal hygiene practices. These conditions, characterized by poor roof, floor, and wall hygiene, create an ideal environment for TB bacteria

to thrive and increase the risk of transmission among students. Environmental cleanliness is a key factor in preventing the spread of the disease (7). Climate change worsens conditions in Islamic boarding schools that are already vulnerable to TB transmission. Climatic factors such as temperature, humidity, and rainfall affect individual health, including the availability of vitamin D and nutrients, which in turn affect the body's resistance to TB infection. Poor environmental conditions in Islamic boarding schools, such as high population density, inadequate sanitation, and lack of hygiene (especially on the roof, floor, and walls), create an ideal environment for the spread of TB bacteria and further increase the risk of transmission, especially due to the lack of concern for cleanliness among students (8). This makes it very important to analyse the relationship between climate change and the increase in TB cases in Islamic boarding school environments.

Clean and Healthy Living Behavior is one approach to prevent TB transmission in Islamic boarding schools. However, its implementation in Islamic boarding schools is considered less than optimal due to low awareness of students, minimal supervision, and lack of knowledge (7). Another component related to humans is diet patterns, where most students consume foods such as rice, tofu, and tempeh. The diet menu consumed by students is related to economic factors from the family where those who are sent money every month for daily life at the boarding school use the money which is on average middle to lower, so that the nutritional intake consumed does not support health. According to research, it is known that residences with high humidity have a risk of TB up to 6.3 times greater than residences with low humidity (9). The environment of Islamic boarding schools generally consists of bedrooms with 10-20 beds, where mattresses are placed directly on the floor without beds (10). Conditions like this create an ideal environment for the development of TB germs, so that the number of TB cases in Islamic boarding schools increases.

One way to deal with this problem is through IEC or Health Education conducted in Islamic boarding schools, both attended by students, ustads, boarding school caretakers and others who are closely related to the spread of TB in Islamic boarding schools. Education can be done using interpersonal communication and counseling

methods. Interpersonal communication is the provision of two-way information in the form of verbal and non-verbal or a combination of both and there is an emotional element (10). Counseling aims to help patients to recognize themselves, know their problems and develop alternative solutions to problems, explain alternative solutions to problems that ultimately the patient can determine the solution to the problem themselves based on their own needs, not based on coercion. Therefore, education related to clean and healthy living behavior in the Islamic boarding school environment is very important to be carried out in an effort to reduce the risk of TB.

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Authors' Contribution

All authors have contributed equally to the conceptualization of the work and writing and reviewing of the manuscript. All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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