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Biosecurity Challenges: How Defense Strategies Against Tuberculosis In Asean Countries

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Abstract

This comprehensive research provides a thorough analysis of tuberculosis (TB) incidence trends and sanitation challenges within the ASEAN region spanning from 2005 to 2021. It underscores the critical need for robust defense strategies against TB, particularly in light of setbacks exacerbated by the COVID-19 pandemic. The research, conducted in Jakarta, Indonesia, from June to July 2023, delved into biosecurity challenges of tuberculosis in ASEAN countries, using a quantitative approach and cross-sectional design. Data from 2005 to 2021, sourced from the ASEAN database, underwent descriptive statistics and trend analysis to explore TB incidence rates, ensuring a comprehensive investigation scope. The study places emphasis on the imperative of implementing comprehensive measures encompassing prevention, screening, swift diagnosis, utilization of advanced treatment regimens, and ensuring robust patient support systems. Moreover, it highlights the pivotal role of addressing sanitation challenges, as substandard conditions significantly heighten the risks of TB transmission. The study's scope encompasses an array of critical subjects, with a central focus on TB incidence rates, as well as the crucial aspects of access to improved sanitation facilities and sanitation services. The conclusion is the ASEAN region, especially the Philippines, faces a notable tuberculosis burden, coupled with uneven access to sanitation. Effective interventions and collaboration are vital for improving public health and sanitation standards in ASEAN countries.

Keywords**: **Tuberculosis, ASEAN, TB incidence, sanitation challenges, public health, defense strategy, COVID-19

INTRODUCTION

The ASEAN (Association of Southeast Asian Nations) region is one of the areas where Tuberculosis (TB) remains a significant public health concern. The World Health Organization's (WHO) South-East Asia Region, which includes ASEAN member states, has been working towards achieving Sustainable Development Goals and elimination targets for TB by the 2030 deadline. At the UN High-Level Meeting on Tuberculosis in September 2018, Member States committed to intensified efforts and investments to address the TB burden in the region (WHO, 2022a).

The apportioned coverage targets for TB in the South-East Asia Region between 2018 to 2022 include diagnosing and treating around 18 million TB patients, including approximately 1.5 million children with TB, successfully treating over half a million drug-resistant TB patients, and providing nearly 11 million people with TB preventive treatment. The region has been making steady, albeit slow, progress towards achieving these targets (WHO, 2022a). However, the COVID-19 pandemic posed significant challenges, causing setbacks in TB control efforts. Reduced case notifications and exacerbated social determinants, such as poverty and inequity, contributed to the regression in TB control progress (Ellwanger et al., 2021).

The impact of the COVID-19 pandemic necessitates urgent planning in the ASEAN region to catch up on the ground lost in TB control efforts (Davies & Wenham, 2020). This includes comprehensive packages involving prevention, screening, rapid diagnosis, newer and shorter treatment regimens, and patient support, including rehabilitative and palliative care. Despite the setbacks, there is still hope for substantial gains in the quest to end TB through multipronged action, multistakeholder engagement, and a whole-of-society approach.

Tuberculosis has a significant impact on health and economy in Asia (Wu & Dalal, 2012). The disease spreads through the air when people with TB cough, sneeze, or talk, and others inhale the TB bacteria. The main risk factors for TB include close contact with TB patients, smoking, alcohol consumption, poor nutritional status, and diabetes (Silva et al., 2018). Prevention and control of TB require a comprehensive and coordinated strategy. This includes early detection and effective treatment of TB, as well as interventions to reduce risk factors. Besides health impacts, TB also causes large economic and social losses (Chakaya et al., 2021). TB can reduce the productivity and income of the sick and their families. TB can also increase poverty, stigma, and discrimination (Datiko et al., 2020). According to WHO, nearly one in two households affected by TB bear costs of more than 20% of their household income, according to the latest national TB patient cost survey data. The world did not achieve the target of 0% TB patients and households facing catastrophic costs due to TB by 2020 (WHO, 2022b).

It's worth noting that areas and countries along the China-proposed Belt and Road Initiative, which includes several ASEAN countries, have a high burden of tuberculosis. In 2018, among the 65 countries along the route, the incidence rate of tuberculosis was 181.5 per 100,000, and the mortality rate was 23.1 per 100,000. The highest incidence and mortality rates were observed in South Asia, East Asia, and ASEAN countries. While TB incidence in most countries along the Belt and Road Initiative was declining, the rate of decrease was not yet sufficient, indicating the need for enhanced cross-border collaboration and notification systems (Chen et al., 2021).

Studying tuberculosis (TB) incidence trends and sanitation challenges is crucial for public health surveillance and disease control. Monitoring TB incidence helps identify outbreaks, assess the burden of the disease, and track drug resistance patterns. It also enables the evaluation of TB control programs' effectiveness and aids in identifying vulnerable populations, such as those with weakened immune systems. Addressing sanitation challenges is essential, as poor conditions can contribute to TB transmission. By understanding the trends and challenges, policymakers can develop evidence-based prevention strategies and allocate resources effectively, contributing to global efforts in combating TB and improving overall public health outcomes.

RESEARCH METHODS

Study Location and Duration

The study was conducted in Jakarta, Indonesia, which represents a part of the ASEAN region. The research spanned from June 2023 to July 2023.

Data Source

The data utilized in this study was derived from secondary sources, specifically the ASEAN database. This database covers a period from 2005 to 2021, providing historical information on tuberculosis (TB) incidence rates across ASEAN countries.

Study Design

This research employed a quantitative approach to examine the biosecurity challenges posed by tuberculosis in ASEAN countries. The study adopted a cross-sectional design, enabling the researchers to examine various subjects across multiple years, ranging from 2005 to 2021. The cross-sectional design allowed for the investigation of the concurrent relationship between observed variables during the designated duration.

Data Collection

The data used for analysis in this study was acquired from the Statistics Division of the ASEAN Secretariat (ASEANstats) and the National Statistical Offices of the ASEAN Member

States. These data were collected under the framework of the ASEAN Community Statistical System (ACSS), ensuring the data's reliability and uniformity.

Data Analysis Techniques:

a. Descriptive Statistics: Descriptive statistics were employed to provide a summary and description of TB incidence rates in the ASEAN countries. Measures such as mean, median, standard deviation, and range were used to describe the central tendency and variability of TB incidence rates across different countries and over the years covered in the dataset.
b. Trend Analysis: Trend analysis was conducted to identify patterns and alterations in TB incidence rates over the 17-year study period (2005-2021). Time-series graphs were plotted to visualize the trends in TB incidence rates across different countries and years. Statistical techniques like linear regression may have been applied to assess the significance and direction of any observed trends.

Scope of Investigation

The study's scope included a diverse range of subjects, focusing on the incidence rates of tuberculosis in the ASEAN countries. Researchers examined alterations and patterns in the observed variables (TB incidence rates) throughout the designated duration (2005-2021).

RESULT AND DISCUSSION

Figure 1. Incidence of Tuberculosis in ASEAN

The research results presented in Figure 1 shed light on the incidence of tuberculosis (TB) within the ASEAN region, providing crucial insights into the current public health scenario. The data reveal that, on average, the ASEAN countries are experiencing a moderate to high burden of tuberculosis. This finding is concerning as tuberculosis remains a major global health issue, and its prevalence in the ASEAN region highlights the urgent need for effective control measures.

Among the ASEAN countries, the Philippines stands out with the highest incidence of tuberculosis. This particular observation is significant and warrants immediate attention from policymakers and healthcare authorities in the Philippines. Strategies must be formulated and implemented to address the underlying factors contributing to the high incidence rate and to ensure that comprehensive prevention, diagnosis, and treatment measures are in place.

Additionally, the research findings indicate that Indonesia and Myanmar fall within the moderate to high tuberculosis incidence category. This indicates that both countries are grappling with a substantial burden of the disease, and concerted efforts must be undertaken to curb its spread. Governments, healthcare systems, and international organizations should collaborate to develop tailored interventions that take into account the unique challenges faced by each country.

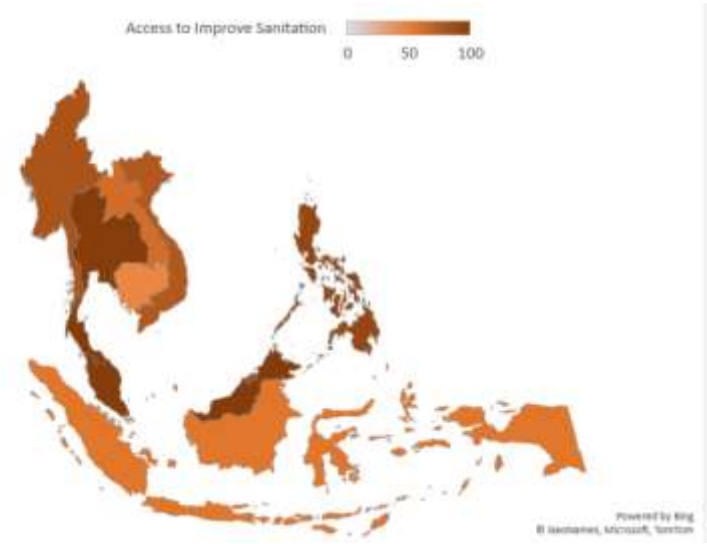

Figure 2. Access to Improve Sanitation

The research findings presented in Figure 2, which focuses on "Access to Improve Sanitation" within the ASEAN region, offer critical insights into the state of sanitation facilities and services. Upon analyzing the data, two significant interpretations emerge. Firstly, the average access to improved sanitation facilities in the ASEAN countries is relatively good. This positive observation indicates that many member nations have made commendable progress in providing their populations with access to better sanitation infrastructure. Access to improved sanitation is a fundamental aspect of public health and has wide-ranging benefits, including reducing the risk of waterborne diseases and improving overall well-being. The region's collective efforts to invest in sanitation infrastructure and promote better hygiene practices have evidently yielded positive results, underscoring a commitment to improving living conditions and safeguarding public health.

However, the second interpretation highlights that certain ASEAN countries are still facing challenges in ensuring adequate access to improved sanitation. Specifically, Indonesia, Cambodia, and Vietnam are identified as countries with less than 80% access to improved sanitation. This

reveals that a significant portion of the population in these countries continues to lack access to proper sanitation facilities, which can have adverse effects on health and quality of life. Addressing this disparity is crucial to achieving equitable development and protecting the well-being of all citizens.

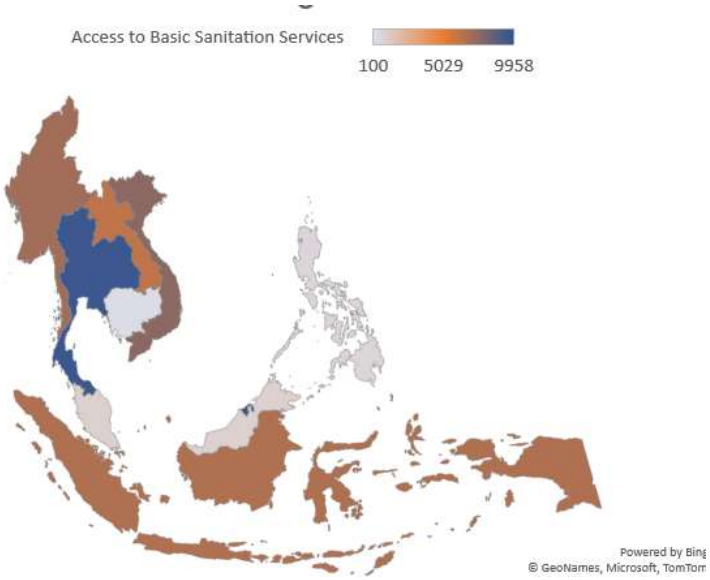

Figure 3. Access to Basic Sanitation Services

The insights presented in Figure 3, which examines "Access to Basic Sanitation Services" across the ASEAN region, offer critical observations about the state of basic sanitation facilities and services. A comprehensive analysis of the data leads to two significant interpretations that underscore the current situation and the need for further improvements. Firstly, the data reveal that among the ASEAN countries, only Thailand stands out as having relatively good access to basic sanitation services. This finding highlights the commendable efforts made by Thailand in advancing sanitation infrastructure and providing its population with essential sanitation facilities. The country's success in this aspect is a testament to the effectiveness of targeted policies, investments, and public awareness campaigns that promote the importance of sanitation for public health and well-being. Thailand's achievements in this area serve as a valuable benchmark and demonstrate the positive impact that focused efforts can have on improving access to basic sanitation.

However, the second interpretation points to an area of concern, as the average access to basic sanitation services in the ASEAN region still requires significant improvement. This observation indicates that many member countries are grappling with challenges in providing their populations

with adequate and reliable basic sanitation facilities. The lack of access to such services can have far-reaching consequences, including the heightened risk of waterborne diseases and compromised living conditions. Addressing this issue is crucial for fostering public health, sustainable development, and improving the overall quality of life for ASEAN citizens.

To address the existing disparities in access to basic sanitation services, it is vital for all ASEAN countries to prioritize and invest in comprehensive sanitation improvement initiatives. Governments and relevant stakeholders should develop and implement robust policies, action plans, and funding mechanisms to accelerate progress in this area. This includes investing in the development of sanitation infrastructure, particularly in underserved and marginalized communities, and ensuring that sanitation services are affordable and accessible to all.

Figure 4. Access to Limited Sanitation Service

The insights derived from Figure 4, which explores "Access to Limited Sanitation Service" within the ASEAN region, provide valuable information about the state of sanitation facilities and services. A comprehensive analysis of the data yields two significant interpretations that shed light on the progress made and the challenges that persist.

Firstly, the data indicate that the Philippines stands out as a country with relatively good access to limited sanitation services. This finding is a testament to the efforts made by the Philippine government and stakeholders in addressing sanitation challenges and improving public health outcomes. While the access may be categorized as limited, the progress achieved by the Philippines demonstrates a commitment to expanding sanitation services and reaching underserved communities. This positive indicator suggests that the country has taken significant steps towards promoting better sanitation practices and protecting the well-being of its citizens.

However, the second interpretation underscores a broader concern, as the average access to limited sanitation services across the ASEAN region still requires improvement. This observation suggests that many member nations are facing obstacles in providing even basic sanitation services to their populations. The notion of limited sanitation service access may encompass a lack of adequate facilities or infrastructure, which can contribute to health risks and hinder sustainable development efforts.

Discussion

Sanitation Challenges in ASEAN Countries

Improved sanitation facilities are defined as facilities that likely hygienically separate human excreta from human contact. These facilities ensure better hygiene and sanitation, reducing the risk of waterborne diseases and improving public health. The indicators used to measure access to improved sanitation facilities are the percentage of the population with access to improved sanitation facilities and the percentage of the population using safely managed sanitation services (Kabange & Nkansah, 2015).

The percentage of the population with access to improved sanitation facilities is a measure of the proportion of people using improved sanitation facilities compared to the total population. Improved sanitation facilities include various types such as flush/pour flush toilets connected to a piped sewer system, septic tank, or pit latrine with a slab, ventilated improved pit (VIP) latrines, and composting toilets (WHO, 2006).

On the other hand, the percentage of the population using safely managed sanitation services is a more ambitious indicator that goes beyond the traditional definition of improved sanitation. Safely managed sanitation services effectively separate excreta from human contact and ensure that excreta do not re-enter the immediate environment. Facilities that meet the criteria for safely managed sanitation include pit latrines with a superstructure and durable material, toilets connected to a septic tank, or toilets connected to a sewer network.

Access to Basic Sanitation Services

Basic sanitation services refer to the provision of facilities and services for the safe disposal of human urine and feces. Access to basic sanitation services is fundamental to human development, and it is considered a human right for every man, woman, and child. Inadequate sanitation is a major cause of disease worldwide, and improving sanitation has a significant beneficial impact on people's health (WHO, 2017).

Basic sanitation services include improved sanitation facilities that are not shared with other households. Improved sanitation facilities include flush/pour flush to piped sewer systems, septic tanks or pit latrines; ventilated improved pit latrines, compositing toilets or pit latrines with slabs (WHO, 2006). The percentage of the population using at least basic sanitation services is an indicator used to measure access to basic sanitation services.

Evaluation of Basic Sanitation Coverage in ASEAN Countries

Countries in Asia and the Pacific need to prioritize investments in water supply and sanitation services to support vibrant and livable cities. Currently, around 1.7 billion people in Asia and the Pacific have no access to modern sanitation, a problem that is becoming increasingly acute in urban areas, with tens of millions of people moving every year into slums and other infrastructure-poor areas (ASIAN Development Bank, 2014). In the WHO South-East Asia Region, access to safe sanitation services remains a problem, with 900 million people lacking basic sanitation, and more than 500 million practicing open defecation (WHO, 2018).

However, in recent years, Member States have made significant progress. Region-wide, urban coverage of basic sanitation is now close to 70%, and in a majority of countries, rural coverage exceeds 50%. The share of the Region’s population practicing open defecation has

meanwhile been reduced from more than 50% to less than 30%, while several Member States have achieved more than 90% coverage of basic sanitation services (WHO, 2018).
In ASEAN countries, the percentage of the population using at least basic sanitation services varies widely. According to the World Bank, in 2019, the percentage of the urban population using at least basic sanitation services was 98.6% in Brunei Darussalam, 97.5% in Singapore, 96.2% in Malaysia, 92.3% in Thailand, 87.2% in Indonesia, 84.6% in the Philippines, 81.5% in Vietnam, 78.6% in Cambodia, and 75.2% in Lao PDR (The World Bank, 2023).

Access to Limited Sanitation Services

Sanitation services refer to the management of excreta from the facilities used by individuals, including the emptying and transport of excreta for treatment and eventual discharge or reuse. Limited sanitation services can be understood as conditions where adequate and hygienic sanitation facilities are not available or accessible to a significant portion of the population (Peal et al., 2020). Improved sanitation facilities are essential for maintaining hygienic conditions and preventing the spread of diseases caused by contact with human excreta. These facilities are categorized based on various criteria, such as whether they are shared with other households, the method of excreta treatment and disposal, and the connection to sewer systems (Islam et al., 2021).

The first category of improved sanitation facilities includes those that are not shared with other households, ensuring a more private and hygienic environment. The second category involves facilities where excreta are treated and disposed of on-site, reducing the risk of contamination. The third category encompasses facilities where excreta are stored temporarily and later emptied and treated off-site, ensuring safe disposal. The fourth category involves facilities connected to a sewer system, with excreta transported through wastewater and treated off-site, contributing to effective sanitation management (Rah et al., 2020).

On the other hand, unimproved sanitation facilities do not meet the criteria for improved sanitation. Examples of such facilities may include pit latrines without superstructures or flush/pour-flush toilets that are not connected to a sewer or septic tank. These facilities pose challenges in terms of hygiene and sanitation, potentially leading to health hazards and environmental issues. Open defecation is another concerning aspect of sanitation, referring to the percentage of households that do not have access to any sanitation facility and resort to defecating in the open. Open defecation poses severe health risks, as it allows human waste to contaminate water sources and the environment, leading to the spread of waterborne diseases.
To identify areas with inadequate sanitation coverage, one can use various indicators and monitoring mechanisms. The WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation, and Hygiene (JMP) is a key source for global estimates of progress on WASH (Water, Sanitation, and Hygiene) issues, including sanitation. JMP uses indicators like "safely managed sanitation services" to assess access to improved and hygienic sanitation facilities that effectively separate excreta from human contact and ensure safe disposal or treatment of excreta (Wagari et al., 2022).

Defense Strategies against Tuberculosis in ASEAN Countries

In ASEAN countries, tuberculosis (TB) control efforts face several challenges related to sanitation, including inadequate diagnostics and treatment, weak patient management leading to poor adherence, and the need for expansion of the World Health Organization (WHO) Directly Observed Therapy, short course (DOTS) program (Murray, 2006; Organization, 2008; Pradipta et al., 2021). However, there are several best practices and success stories in addressing TB in the context of sanitation challenges. For instance, the USAID Sustainable HIV and Tuberculosis Response from Technical Assistance (SHIFT) project partnered with Vietnam's National Tuberculosis Program (NTP) in seven priority provinces to improve TB detection and treatment (USAID, 2020). Additionally, the Control and Prevention of TB (CAP-TB) project, a

cooperative agreement focused on developing a model for multidrug-resistant tuberculosis to improve rapid detection and treatment outcomes for this disease in Asia, has been successful in strengthening health systems and TB platforms (USAID, 2023).

International organizations such as the WHO and USAID play a crucial role in supporting TB control efforts in ASEAN countries. The WHO provides global leadership on matters critical to TB, develops evidence-based policies and standards for TB prevention, care, and control, and stimulates the creation and dissemination of valuable knowledge related to TB (Uplekar et al., 2015). USAID works with partners across different projects around the world to support patients with TB, including the CAP-TB project and the SHIFT project in Vietnam (USAID, 2020, 2023). To address TB in the context of sanitation challenges, several strategies have been proposed. These include strengthening basic TB services, accelerating TB case-finding and treatment, and preventing TB exposure of staff and patients through workplace and administrative control measures (Arinaminpathy et al., 2019; Murray, 2006; Organization, 2008). Contextually sensitive approaches are urgently needed to address such challenges and improve TB prevention, detection, and treatment (Chikovani et al., 2019).

Challenges in Implementing TB Defense Strategies Related to Sanitation

The implementation of TB defense strategies related to sanitation in ASEAN countries faces several significant challenges that must be addressed to effectively combat the spread of tuberculosis. One of the primary obstacles is the rapid urbanization experienced in many nations, which has resulted in overcrowded living conditions, particularly in slums and informal settlements (Durand-Lasserve, 2006). These densely populated urban areas become breeding grounds for TB transmission, as infected individuals are in close contact with vulnerable individuals. However, the task of implementing proper sanitation measures in such crowded environments is daunting due to limited space and infrastructure constraints, making it challenging to effectively control the disease's spread (Sims & Kasprzyk-Hordern, 2020).

In addition to urban overcrowding, certain rural and remote regions in ASEAN countries suffer from limited access to sanitary facilities. In these areas, the lack of proper sanitation infrastructure hampers disease prevention efforts and contributes to the rapid dissemination of TB. Poor hygiene practices further increase the risk of infection and exacerbate the challenges faced in controlling TB in these underserved regions.

Moreover, TB remains burdened by social stigma and misconceptions, hindering early diagnosis and treatment-seeking behavior (Marahatta et al., 2020). The association of TB with stigma creates barriers to promoting timely case detection and adherence to treatment regimens. Overcoming this stigma and increasing public awareness about TB, including its symptoms, transmission methods, and the availability of free treatment services, are essential to reducing the disease's overall burden.

Best Practices and Success Stories in Addressing TB in the Context of Sanitation Challenges

In the fight against tuberculosis (TB) amid sanitation challenges, several best practices and success stories have emerged. Community-based initiatives have proven to be effective in engaging local communities and stakeholders in TB control efforts (Donessouné et al., 2023). By empowering individuals to take charge of their health, participating in disease prevention activities, and providing support to TB patients during treatment, these initiatives foster a sense of ownership and responsibility within the community. Health education campaigns, community outreach programs, and the involvement of local leaders in advocacy efforts are key components of such initiatives.

Integration of services has been another crucial approach. By incorporating TB control efforts into existing healthcare services and sanitation programs, a more comprehensive strategy is formed (WHO, 2020). For example, integrating TB screening into general health check-ups or

linking TB control with maternal and child health services helps in early identification and treatment of TB cases.

Moreover, public-private partnerships have played a pivotal role in addressing TB challenges effectively (Babacan, 2020). Collaboration between the public and private sectors harnesses expertise, resources, and technology, resulting in a more robust defense against TB. Private healthcare providers, NGOs, and corporate partners have contributed to TB control efforts through financial support, specialized medical services, and community engagement activities. This synergy between different sectors enhances the reach and impact of TB control strategies, making progress towards a TB-free future.

CONCLUSION

The research findings reveal that the ASEAN region faces a moderate to high burden of tuberculosis, with the Philippines having the highest incidence rate. Access to improved sanitation services varies among countries, with some still facing challenges in ensuring adequate access. To address these issues, targeted interventions and collaborative efforts among governments, healthcare systems, and international organizations are crucial to combat tuberculosis effectively and improve overall public health and sanitation standards in the ASEAN countries.

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