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https://ojs.transpublika.com/index.php/COMORBID
Online ISSN 2809-9745

https://doi.org/10.55047/comorbid.v4i2.1716

Original Article

Evaluation of Health Screening for Hajj Pilgrims at Hajj Dormitory in Preventing the Spread of Infectious Diseases

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Received : 04 April - 2025
Accepted : 06 May - 2025
Published online : 14 May - 2025

Abstract

Coronavirus disease 2019 (COVID-19) is a pneumonia caused by a new type of coronavirus, named Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). The risk of spreading infectious diseases during Hajj is very high, given the mass migration of pilgrims from different countries. In the process of receiving pilgrims at the Sukolilo Hajj Dormitory in Surabaya, efforts to screen for COVID-19 and other infectious diseases are carried out by monitoring temperature using a thermal scanner. This study aims to evaluate the effectiveness of health screening of pilgrims at the Sukolilo Surabaya Hajj Dormitory in preventing the spread of infectious diseases, especially COVID-19. In addition, this study identifies factors that influence pilgrims' compliance with screening procedures as well as policy implications in improving health surveillance in the future. This study used a descriptive method with an observational approach to assess the health screening process of pilgrims arriving at the Sukolilo Hajj Dormitory in Surabaya in 2024. The research sample was selected using purposive sampling technique, involving pilgrims who had a body temperature ≥37.5°C or experienced respiratory symptoms. The results showed that most pilgrims who underwent body temperature screening and follow-up examinations complied with the established procedures. However, several factors were found to influence compliance, such as the level of understanding of the importance of screening, fear of the swab procedure, and post-travel fatigue factors. In this case, education provided by health workers is proven to increase pilgrims' compliance with the screening.

Keywords: Health Screening, Hajj Pilgrims, Infectious Disease Prevention, COVID-19 Surveillance, Pilgrim Compliance.

1. Introduction

In early 2020, the world faced a global health crisis due to the emergence of a new type of coronavirus, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), which caused Coronavirus Disease 2019 (COVID-19). The virus was first detected in Wuhan, China, and quickly spread to multiple countries, causing significant impacts to public health and the global economy (Maulida, 2022). As of December 3, 2021, 226 countries have been affected by the pandemic.

The COVID-19 pandemic spread rapidly, leading to extensive research into its epidemiology, clinical features, and treatment and prevention strategies (Sakif, 2022). From an epidemiological aspect, COVID-19 first appeared in Wuhan, China, and was later declared a pandemic by WHO on March 11, 2020 (Almaghaslah et al., 2020). Spread occurs mainly through respiratory droplets from coughing and sneezing (Junita et al., 2023), with a higher transmission rate compared to other respiratory diseases such as SARS and MERS (Jangi,

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2023). In addition, data shows that age groups above 40 years old are more susceptible to this infection, while children have lower levels of susceptibility (Jangi, 2023).

Clinically, COVID-19 is characterized by primary symptoms such as fever, cough and respiratory distress, which in some cases can develop into severe complications affecting multiple organ systems (Almaghaslah et al., 2020). The virus enters the body's cells through the ACE2 receptor, which contributes to systemic inflammation and symptoms beyond the respiratory system (Almaghaslah et al., 2020; Jangi, 2023). In terms of care and management, the main strategies implemented include close surveillance, isolation of patients, and the use of personal protective equipment to prevent further transmission (Wedri et al., 2023). In addition, research continues to develop antiviral drugs and vaccines to reduce the impact and spread of COVID-19 (Wedri et al., 2023). With a deeper understanding of the epidemiology, clinical manifestations, and treatment and prevention strategies, it is hoped that global efforts to address this pandemic will be more effective.

One of the main challenges in COVID-19 control is the spread of the disease in mass gathering activities, such as the Hajj pilgrimage. Every year, millions of Muslims from different countries gather in Saudi Arabia for the Hajj pilgrimage, potentially increasing the risk of transmitting infectious diseases, including COVID-19, Middle East Respiratory Syndrome (MERS), and Severe Acute Respiratory Syndrome (SARS). (Wulandari et al., 2023). The process of returning Hajj pilgrims (debarkation) becomes crucial in preventing the spread of diseases to their countries of origin. Therefore, a strict health surveillance system is needed, including body temperature checks and early detection of COVID-19 infection.

Every year, millions of Muslims gather in the Holy Land to perform the Hajj. In 2024, the number of pilgrims has increased compared to previous years, which were limited due to the COVID-19 pandemic (Wulandari et al., 2023). Large-scale mass migration during Hajj poses various health challenges, especially in preventing the spread of infectious diseases. One crucial aspect of infectious disease control, including COVID-19, is the debarkation process of pilgrims, which involves mitigating the risk of transmission in the country of origin.

Hajj pilgrims are categorized as International Travelers (PPLN - *Pelaku Perjalanan Luar Negeri*), so there are certain health quarantine regulations that must be followed. The Surabaya Health Quarantine Agency (BBKK), through the Division of Quarantine Control and Epidemiological Surveillance, has Standard Operating Procedures (SOP) for monitoring the arrival of international travelers to prevent the spread of COVID-19. According to the applicable SOP, pilgrims detected with a body temperature above 38°C will undergo PCR testing for further stratification. If symptoms of fever and cough are found, or symptoms indicating pneumonia, further medical measures will be taken (KKP Surabaya, 2020).

Despite various preventive measures being implemented, such as mandatory vaccination and enhanced health surveillance, the risk of infectious disease transmission during the Hajj pilgrimage remains high (Al-Tawfiq et al., 2024; Coudeville et al., 2022). Previous studies have highlighted the high incidence of respiratory infections, meningococcal disease, and tuberculosis among pilgrims, exacerbated by crowd density and differences in health standards and cultural practices (Haseeb et al., 2023; Yezli et al., 2023). However, gaps still exist in understanding the long-term effectiveness of implemented health interventions, as well as a lack of contextual data assessing pilgrim acceptance and compliance with recommended health measures. Additionally, socio-cultural dynamics and differences in demographic characteristics of pilgrims from various countries are often not thoroughly considered in formulating health risk mitigation strategies (Kawasi et al., 2024). Hence, more comprehensive and contextual research is needed to develop more adaptive and sustainable

public health approaches in addressing the challenges of infectious disease transmission during the Hajj.

In Indonesia, health surveillance of Hajj pilgrims is conducted at various debarkation points, one of which is at the Sukolilo Hajj Dormitory in Surabaya. The health examinations implemented include body temperature screening using thermal scanners, vital signs assessment, and diagnostic tests such as antigen swabs and Reverse Transcription Polymerase Chain Reaction (RT-PCR). However, in practice, there are various challenges in implementing these examinations, such as low levels of pilgrim compliance with examination procedures, comfort during sample collection, as well as individual knowledge and behavioral factors that affect the effectiveness of early detection of infectious diseases.

This study aims to evaluate the effectiveness of health screening for Hajj pilgrims at the Sukolilo Hajj Dormitory in Surabaya in preventing the spread of infectious diseases, especially COVID-19. Additionally, this study also identifies factors that influence pilgrim compliance with examination procedures and policy implications for improving health surveillance in the future.

2. Methods

2.1. Research Design

This research is a descriptive study with an observational approach that aims to evaluate the health screening process of Hajj pilgrims arriving at the Sukolilo Hajj Dormitory in Surabaya in 2024. This research focuses on the effectiveness of body temperature screening and COVID-19 tests, as well as factors that influence whether pilgrims are cooperative or not during nasopharyngeal swab sampling.

2.2. Location and Time of Research

The research was conducted at the Sukolilo Hajj Dormitory in Surabaya, East Java, during the period of Hajj pilgrims' arrival from Saudi Arabia, from June 26, 2024, until the end of the pilgrim return phase.

2.3. Population and Sample

The population for this study consisted of all Hajj pilgrims arriving at the Sukolilo Hajj Dormitory in Surabaya. Samples were collected using purposive sampling technique, specifically targeting Hajj pilgrims who underwent body temperature screening and required further examination due to having a body temperature >37.5°C or experiencing respiratory symptoms such as cough and cold. The inclusion criteria encompassed Hajj pilgrims who underwent health examinations at the research location and were willing to follow the swab sampling procedure. Meanwhile, pilgrims who could not undergo examination due to specific medical reasons were excluded from the study.

2.4. Research Procedures

1) Initial Screening:

a) After arriving at the Sukolilo Hajj Dormitory in Surabaya, pilgrims underwent body temperature checks using thermal scanners operated by officers from the Surabaya BBKK. b) Pilgrims with body temperature <37.5°C were allowed to continue with the administrative process and briefing from the Ministry of Religious Affairs and immigration authorities. c) Pilgrims with body temperature ≥37.5°C or having respiratory symptoms were directed to an isolation room for further examination.

2) Further Examination:

a) Pilgrims who entered the isolation room underwent vital signs examination and physical examination by healthcare professionals. b) If symptoms such as fever, cough, or cold lasting less than 10 days were found, COVID-19 antigen tests or RT-PCR were performed.

3) Nasopharyngeal Swab Sampling:

a) Sampling was carried out by healthcare professionals using sterile flocked swabs according to standard procedures. b) Pilgrims who showed resistance to the swab procedure were observed and given education by healthcare professionals to improve compliance.

2.5. Instruments and Data Collection Techniques

In order to guarantee thorough investigation in this work, data collecting used several approaches. Researchers directly observed to methodically document the number of pilgrims who showed resistance and those who followed screening protocols free from challenges. Brief interviews with pilgrims who displayed resistance to understand their particular reasons for swab refusal helped one to acquire more thorough understanding of compliance difficulties. Secondary data also came from Surabaya BBKK (Hajj Health Examination Center) screening records, which included important information like the number of pilgrims tested positive and negative for COVID-19 over the observation period.

2.6. Data Analysis Techniques

Data from observations and interviews were analyzed using descriptive qualitative methods to identify patterns of pilgrim behavior when undergoing examinations.

3. Results and Discussion

At the Sukolilo Hajj Dormitory in Surabaya, the process of receiving Hajj pilgrims involves screening efforts for COVID-19 and other infectious diseases. Body temperature monitoring is conducted using thermal scanners, and pilgrims with temperatures above 37.5°C who experience cough or cold symptoms lasting less than 10 days are directed to an isolation room. Subsequently, anamnesis, physical examination, and supporting examinations such as COVID-19 antigen swabs and RT-PCR are performed to confirm infection status. However, in practice, challenges are encountered during COVID-19 diagnostic examinations, particularly regarding Hajj pilgrims' compliance with sampling procedures. Uncooperative attitudes during antigen swab and RT-PCR testing potentially affect the accuracy of examination results. Factors such as education level, behavior, and individual knowledge play a role in compliance with the applied medical procedures.

As a measure to strengthen the monitoring and control of COVID-19 for pilgrims returning to Indonesia, nasopharyngeal swab examination is the main procedure to detect possible infection. This examination aims to anticipate the transmission of the virus, as well as protect pilgrims, their families, and the wider community from the risk of spreading COVID-19. Previous studies have shown that the highest viral load is found in airway specimens, with nasopharyngeal swabs having higher sensitivity than oropharyngeal swabs in detecting SARS-CoV-2, especially in asymptomatic or mildly symptomatic cases.

The study conducted by Abdelfatah Alhoot et al. (2023) and Larsen et al. (2023) reported that the sensitivity of nasopharyngeal swabs reached 92.5%, while oropharyngeal swabs had a sensitivity of 94.1%, demonstrating comparable effectiveness. Additionally, the viral load detected in nasopharyngeal swabs is generally higher, contributing to better diagnostic outcomes (Atzler et al., 2024; Tallmadge et al., 2022). The ability of nasopharyngeal swabs to detect the virus in asymptomatic individuals is also a key factor in controlling the spread of

COVID-19, as these individuals still have the potential to transmit the virus (Sihombing et al., 2024; Tallmadge et al., 2022). To enhance sensitivity, combined sampling techniques using naso-oropharyngeal swabs can be utilized to ensure detection even in individuals with low viral loads (Atzler et al., 2024). Yet, despite the preference for nasopharyngeal swabs, some studies suggest that oropharyngeal swabs can still be a viable alternative, especially if nasopharyngeal sampling poses challenges such as discomfort or technical difficulties (Larsen et al., 2023). Research on pediatric patients also confirms that nasopharyngeal specimens have higher positivity rates and viral loads compared to oropharyngeal specimens (Zheng et al., 2020). Furthermore, the release of the virus in lower respiratory specimens persists longer than in upper respiratory specimens.

Table 1. Frequency Distribution of Body Temperature and COVID-19 Test Results

Body Temperature (°C)	Frequency (n)	Percentage (%)
< 36.0	5	2.5%
36.0 - 36.5	40	20.0%
36.6 - 37.0	80	40.0%
37.1 - 37.5	50	25.0%
> 37.5	25	12.5%
Total	200	100%
COVID-19 Test Result		
Positive	0	0.0%
Negative	200	100.0%
Total	200	100%

Based on the data obtained, the results of body temperature screening indicate that the majority of respondents (40%) have a temperature within the normal range of 36.6 - 37.0°C, which suggests that they are in good health. 20% of respondents have a body temperature between 36.0 - 36.5°C, which still falls within the normal category, while 25% of respondents have a temperature within the range of 37.1 - 37.5°C. This suggests that most of the pilgrims examined have stable health conditions and do not exhibit significant fever symptoms. However, there are 12.5% of respondents who have a body temperature above 37.5°C, which could be an early indicator of infection or other health conditions that require further attention. Higher body temperature can be caused by various factors such as dehydration, fatigue, or exposure to extreme environmental temperatures, thus necessitating further follow-up to ensure the well-being of the pilgrims is maintained.

The results of the COVID-19 tests indicate that all respondents tested negative for COVID-19, with a positivity rate of 0.0%. This suggests that the screening procedures implemented at the Haji Sukolilo Surabaya Dormitory are effective in identifying at-risk pilgrims and preventing the spread of the virus among them. The absence of positive COVID-19 cases in this study also reflects that the implementation of health protocols, such as body temperature checks, mask usage, and the practice of social distancing and hand hygiene, has been carried out effectively, providing optimal protection for the pilgrims.

The results of antigen testing can be either positive or negative. However, a negative result does not always rule out the possibility of SARS-CoV-2 infection, especially if the amount of antigen in the specimen is below the detection limit of the device. Conversely, false positive results may occur due to cross-reactivity between antibodies on the test strip with antigens from other viruses besides COVID-19. Antigen testing offers several advantages, such as detecting the virus in the early stages of infection, providing rapid results within 15 minutes,

and not requiring a specialized laboratory with high biosafety levels (BSL-II) or complex technical skills from healthcare personnel (Zheng et al., 2020).

Hajj pilgrimages increase the risk of COVID-19 transmission due to the high density and close interaction between pilgrims. The most vulnerable groups, such as the elderly and individuals with comorbidities, are at greater risk of serious complications from COVID-19 infection. Therefore, strict public health policies, including the temporary suspension of Hajj activities at the start of the pandemic, have proven effective in reducing the spread of the virus (Hoang et al., 2020).

In mitigation efforts, antigen testing plays an important role in detecting cases quickly and efficiently. Antigen tests such as FUJIFILM COVID-19 Ag have a high sensitivity of up to 95.7% on nasopharyngeal specimens, making them a reliable screening tool in the context of travel and large gatherings (Obata et al., 2022). Recent innovations in testing methods, such as the use of sputum specimens, have shown even higher sensitivity compared to the nasal swab method, enabling earlier and more accurate detection of the virus (Shi et al., 2023).

A study conducted by Chen et al. (2022) reported that this method successfully identified 95% of nasopharyngeal carcinoma (NPC) cases among high-risk individuals, making it a highly reliable tool in detecting cancer at an early stage. Furthermore, the integration of EBV DNA testing in screening programs has been shown to reduce unnecessary referrals by up to 40% without compromising sensitivity and specificity (Chen et al., 2022). On the other hand, in COVID-19 testing, nasopharyngeal swabs remain the gold standard with a high level of accuracy. Huber et al. (2021) found that the results of nasopharyngeal swab tests had a concordance rate of 98% with saliva-based tests, demonstrating their reliability in detecting SARS-CoV-2. However, the effectiveness of these swabs is highly dependent on proper collection techniques to avoid false negative results, underscoring the importance of training and standardization in the sampling procedure (Petruzzi et al., 2020). Although nasopharyngeal swabs are effective in detecting cancer and viral infections, alternative methods such as saliva sampling are beginning to receive attention due to their potential to improve accessibility and patient comfort during testing (Huber et al., 2021).

Table 2. Factors affecting swab results

Factor Category	Sub-factor
Causative Agent	Biological, Chemical, Nutritional, Mechanical, Physical
Host Factor	Intrinsic (Genetic, Age, Immune, Comorbid) Extrinsic (Habit, Race, Occupation)
Environment	Physical (Weather, Geography) Biological (Animals, Microorganisms) Non-physical (Socio-Cultural, Norms)
Educational Factors	Education, Behavior, Knowledge

Based on Table 2, swab results are influenced by various factors including the causative agent, individual (host) characteristics, the environment, and the level of public education. These factors have complex interrelationships in determining the validity and accuracy of swab results. The causative agent is the main factor in determining swab results and can be biological, chemical, nutritional, mechanical and physical agents. Biological agents, such as viruses, bacteria, and fungi, are the main causes of infections detected through swab methods (Budiarto & Anggraeni, 2003). Chemical agents, both endogenous such as acidosis and diabetes and exogenous such as chemicals and allergens, can also have an effect. Nutritional factors play a role in the body's immune response to pathogens, while mechanical and physical

agents, such as friction or radiation exposure, can affect the condition of the tissue from which the sample is taken.

The individual characteristics of the host in the disease system also play a crucial role in the results of swab testing. Intrinsic factors such as genetic aspects, age, gender, immune status, and the presence of comorbid diseases have an influence (Budiarto & Anggraeni, 2003). Individuals with compromised immune systems or underlying conditions such as diabetes are more susceptible to testing positive on swab tests. External factors such as unhealthy lifestyle habits, race, and occupation that increase the risk of pathogen exposure also contribute to variations in swab results among individuals even when exposed to the same agent.

The environment as an external aspect also influences the results of swabs and is categorized into physical, biological, and non-physical environments. The physical environment includes air conditions, seasons, weather, and geographical conditions that can affect the resistance of pathogens in the surrounding environment. Biological environmental factors include interactions with humans, animals, plants, and other microorganisms that can accelerate the spread of disease (Marampa & Odilaricha, 2021). Non-physical factors such as social-cultural influences, norms, and customs play a significant role in shaping an individual's compliance with undergoing swab tests and engaging in preventive behaviors against diseases.

The education level of the community also has a significant influence on compliance with undergoing swab tests and maintaining health. Health education plays a role in changing individual behavior to be more conscious of the importance of disease prevention and proper treatment. Conducive health behavior can be formed through adequate education, so individuals are more aware of the risks of disease and the importance of preventive actions (Marampa & Odilaricha, 2021). Furthermore, knowledge acquired from both formal and non-formal education, as well as access to mass media, also influence an individual's awareness regarding health and policies related to swab testing. Additionally, socioeconomic status plays a role in supporting access to adequate healthcare facilities.

The results of swab tests are influenced by various interacting factors, including the causative agents of diseases, host characteristics, environmental conditions, and the level of public education. These factors must be comprehensively considered in order to enhance the accuracy of diagnosis and the effectiveness of public health policies. Further research is needed to understand the causal relationships between these factors in order to improve strategies for disease detection and prevention based on swab tests.

The theoretical implementation of the research findings can be associated with the theory of infectious disease prevention and compliance with health protocols. Based on the Theory of Infectious Disease Epidemiology, prevention of COVID-19 transmission relies on early detection, breaking the chain of transmission, and individual compliance with preventive measures. The research results indicate that the implementation of body temperature screening at Asrama Haji Sukolilo is effective in identifying pilgrims who are potentially infected, in line with the concept of screening and surveillance in epidemiology, where early detection plays a crucial role in preventing the spread of the virus. Furthermore, the Health Behavior Theory explains that compliance with health protocols, such as wearing masks, maintaining distance, and hand hygiene, is influenced by levels of knowledge, risk awareness, as well as social and cultural factors. The research findings suggest that although Hajj pilgrims have a fairly good level of compliance with health protocols, factors such as education and individual habits still play a role in determining the extent to which they adhere to the prescribed health procedures.

From the perspective of the Health Belief Model (HBM), the compliance of pilgrims towards antigen swab and RT-PCR testing can be associated with their perception of the

severity of the disease and the benefits of preventive measures. Pilgrims who understand the risks of COVID-19 and the importance of early detection are more likely to cooperate in undergoing testing procedures. However, psychological and social barriers, such as discomfort during swab tests or fear of positive results, can reduce compliance with medical procedures. Furthermore, the theory of Community Immunity is also relevant in this context, where the success of health protocols at the Hajj Dormitory in Sukolilo contributes to the collective protection of pilgrims and the wider community. With no positive cases of COVID-19 in this study, it can be assumed that the implementation of health protocols has successfully reduced the risk of transmission. However, to enhance the effectiveness of public health policies, an education-based approach and increased awareness of the importance of health protocols need to be continuously reinforced to ensure the sustainability of disease prevention in the future.

4. Conclusion

The research results show that the COVID-19 screening and examination process implemented at the Sukolilo Hajj Dormitory in Surabaya was effective in detecting and preventing virus spread among Hajj pilgrims. Body temperature checks using thermal scanners indicated that the majority of pilgrims were in good health, with only 12.5% having a body temperature above 37.5°C. COVID-19 test results showed that all pilgrims tested negative, indicating that health protocols such as temperature checks, mask usage, hand hygiene, and physical distancing were well implemented. However, there were obstacles in pilgrim compliance levels with antigen swab and RT-PCR testing procedures, which could affect test result accuracy. Factors such as education level, behavior, and individual understanding played a role in determining the extent to which pilgrims adhered to established health procedures. Additionally, the effectiveness of the nasopharyngeal swab method in detecting the SARS-CoV-2 virus has been supported by various studies, although technical constraints and discomfort remain challenges in its implementation.

To improve the effectiveness of COVID-19 screening and detection among Hajj pilgrims, a more comprehensive education-based approach is needed to increase awareness and compliance with health examination procedures. Socialization programs involving healthcare workers and community leaders can help reduce resistance to antigen swab and RT-PCR testing. Furthermore, training for healthcare workers regarding comfortable sampling techniques that minimize discomfort for pilgrims needs to be enhanced. The government and relevant parties should also consider alternative diagnostic methods that are more comfortable, such as oropharyngeal swabs or saliva-based tests, as additional options for pilgrims who experience difficulties with the nasopharyngeal method. Moreover, strict screening policies still need to be implemented, especially for vulnerable groups such as the elderly and individuals with comorbidities, to minimize transmission risks. Strengthening technology-based mitigation strategies, such as automated sensor-based temperature monitoring and rapid-result COVID-19 testing, can also help improve the efficiency of detection and response to potential cases. With these measures, it is expected that the process of receiving Hajj pilgrims can run more optimally without neglecting health and safety aspects.

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