

Addressing Public Health Challenges of Hajj Pilgrims: A Comprehensive Narrative Review

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ABSTRACT

Introduction: The Hajj pilgrimage is a pillar of Islam that must be carried out by every able-bodied Muslim. However, millions of pilgrims who gather each year face complex health challenges, including advanced age, comorbidities, and extreme environmental conditions. This study aims to identify the health risks of hajj pilgrims and the challenges in efforts to improve pilgrim health.

Methods: The research method used is a narrative review, collecting related literature from various sources. The results of the study indicate that hajj pilgrim mortality is still high, mainly caused by cardiovascular disease, respiratory disorders, and heat stroke.

Results: The mortality rate among Hajj pilgrims ranges from 1-3 per 1,000 per season, with 461 deaths recorded in 2024. Cardiovascular diseases (70%), respiratory infections, and heat stroke are the leading causes. Risk factors include advanced age, diabetes, hypertension, and extreme temperatures. Pilgrims' low compliance with vaccinations, especially meningitis and influenza, increases the risk of disease outbreaks. The crowded environment facilitates respiratory disease transmission, while limited access to healthcare and language barriers further complicate medical response. Health outreach, vaccination programs, international collaboration, and telemedicine are strategic measures that can help reduce mortality rates among Hajj pilgrims by improving health awareness, managing chronic conditions, and ensuring timely medical care.

Conclusion: In conclusion, more comprehensive health interventions and are needed to reduce morbidity and mortality among hajj pilgrims.

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INTRODUCTION

The Hajj is the fifth pillar of Islam that must be performed by every Muslim once in a lifetime for those who are physically, mentally, and financially able from various circles and age groups. The Hajj, one of the world's largest mass gatherings, takes annually place in Mecca, Saudi Arabia. In 2024, the total number of Hajj pilgrims will be 1,833,164 people (1). Indonesia is a country with a Muslim majority population and every year is able to send around 221,000 Hajj pilgrims to Saudi Arabia (2). In 2024, Indonesia has an additional quota so that the number of pilgrims taking part in the Hajj pilgrimage will be greater than the previous year, namely 241,000 pilgrims divided into 554 groups from 14 embarkation points (2).

Mass gatherings has the potential to result in widespread health impacts. The large number of Muslims from all over the world who perform the Hajj pilgrimage in one place with 70% of the activities being physical, increases the potential risk of communicable disease, noncommunicable disease, crowd safety, heat-related sickness even death. Every year there are always Hajj pilgrims who die due to weak health conditions. In 2023, there were 774 Indonesian Hajj pilgrims who died, the majority of whom were elderly pilgrims (3). In 2024, the number of deaths of Hajj pilgrims decreased to 461 pilgrims, with most of the pilgrims who died being in the elderly and high-risk groups (3). The most common causes of death in the last 10 years are cardiovascular disease, respiratory infections, chronic obstructive pulmonary disease (COPD), diabetes mellitus, hypertension, stroke, and geriatrics (3). Cardiovascular disease, respiratory disorders and heat stroke are the main causes of mortality among Hajj pilgrims, with an average death rate of 1-2 per 1,000 pilgrims per Hajj season (4). From a global health and human security standpoint, it is crucial to enhance the foundational capabilities in managing mass gatherings and to conduct research on the risks associated with these events to protect pilgrims health.

The government provides reinforcement in efforts to improve and maintain the health of the Hajj Pilgrims which is stated in various forms of policies ranging from legal arrangements to regulations and ministerial decisions. People who will perform the Hajj pilgrimage must meet several requirements including health requirements this is stated in Law Number 8 of 2019 concerning the Implementation of the Hajj and Umrah Pilgrimages. However, despite these measures, cases of declining health conditions among pilgrims still occur.

This study aims to identify the health risks and the challenges in efforts to improve the health of the Hajj pilgrims. Previous research on health risks during Hajj generally focused on identifying common health issues faced by pilgrims; however, there is still a lack of comprehensive analysis that integrates these factors with the existing challenges and strategies to improve pilgrims health. The findings of this study will contribute by proposing actionable strategies to enhance the health of Hajj pilgrims, with an emphasis on reducing morbidity and mortality rates.

METHOD

This research method uses a qualitative approach with a narrative review type. This narrative review is a review by collecting literature with a particular subject and then synthesizing it with the aim that readers get a comprehensive background, identify and describe a problem that is of interest and understand knowledge or highlight the importance of the new topic (5, 6). The steps in carrying out a narrative review are conducting a search, identifying keywords, reviewing the abstract and contents of the article, ranking and synthesizing the contents of the article and then integrating it into the writing (5).

A literature and news search related to the topic of the health of the hajj pilgrims as a inclusion criteria, has been conducted in the Pubmed, Proquest, Science Direct and Google Scholar databases, using the keywords; "Hajj Pilgrim", "Risk factor", "Death" and "Health Status". We use these databases because they offer a wide range of academic resources across various disciplines, making them essential for gathering diverse perspectives. Furthermore, data analysis was carried out by summarizing and synthesizing the findings in the selected literature. The results of the synthesis are in the form of a narrative about the status and health risks of the hajj pilgrims and the challenges in efforts to improve the health status of the hajj pilgrims.

In the selection of literature for this research, there is a possibility of selection bias. To address this, we conducted a comprehensive literature search using clear inclusion and exclusion criteria, assessed the quality of the studies, and involved multiple evaluators to ensure objectivity. We excluded older studies is that we aimed to obtain

data that is relevant to the current situation and incorporates the latest advancements in knowledge, ensuring that the data is more accurate and reliable.

RESULTS

The author has synthesized the results of the analysis of various studies and related references that have been selected based on their relevance and quality and then presented as follows.

Outcome of Hajj Pilgrims Mortality Rate (Health Degree)

Table 1. Indonesia Hajj Pilgrims Mortality Rate

Variable	Years				
	2018	2019	2022	2023	2024
The number of pilgrims who departed	221.000	231.000	100.051	229.000	241.000
The number of pilgrims who passed away	386	453	89	774	461
Mortality rate (per 1000 people)	3	2	2	1	3

The mortality rate of hajj pilgrims is still quite high, mainly caused by cardiovascular disease, respiratory disorders, and heat stroke. Several studies show that the average death rate of hajj pilgrims reaches 1-2 per 1,000 people per hajj season (7, 8). Research by Rustika shows that the mortality rate of hajj pilgrims is influenced by various health factors, including pre-existing medical conditions, health management during the pilgrimage, and health services available in Mecca. Pilgrims with underlying diseases such as diabetes and hypertension show a higher risk of death (9, 10). Research conducted in Saudi Arabia reported that 70% of deaths were caused by cardiovascular disease, with heat stroke being the main cause during the Hajj season with its extreme temperatures (11). The elderly age group (over 60 years) and people with chronic diseases such as diabetes and hypertension have a higher risk of mortality (12). In 2018, 386 Indonesian hajj pilgrims died in Saudi Arabia, with the highest number of cases coming from the Surabaya embarkation. This increase in deaths reflects significant health challenges, especially related to managing chronic diseases before and during the hajj journey (10). The pre-Hajj health check-up program, especially for early detection of comorbidities, has been proven to help reduce the risk of death, although its implementation in several countries is still uneven (13).

Factors Affecting the Health of Hajj Pilgrims (Risks)

Various risk factors affect the health of pilgrims, such as age, comorbidities, environmental conditions and population density during the pilgrimage. In addition, behavioral habits such as lack of understanding about disease prevention also contribute to health problems among pilgrims (10).

One of the most significant risk factors for pilgrims is advanced age, especially in pilgrims with a history of chronic disease (14). Older pilgrims often have compromised immune systems and may suffer from pre-existing medical conditions such as heart disease, diabetes, and respiratory disorders. These conditions can exacerbate the stress of pilgrimage and complicate health management. Elderly pilgrims are particularly vulnerable during physically demanding rituals, increasing their likelihood of experiencing health complications such as heat stroke, dehydration, and cardiovascular distress.

Physical environmental conditions, such as the density of pilgrims and exposure to extreme temperatures, also pose major challenges in maintaining the health of Hajj pilgrims (15). The sheer population density in the holy sites, such as during Tawaf (the act of walking around the Kaaba), puts pilgrims in close proximity to one another, facilitating the spread of infectious diseases. These environmental conditions heighten the risk of heat-related illnesses, dehydration, and respiratory distress, particularly for those with pre-existing health issues. Crowded conditions, in particular, create an environment conducive to airborne transmission of diseases such as the flu or respiratory infections, making it critical to maintain effective crowd control and ensure health guidelines are followed.

In addition, the level of knowledge and awareness of pilgrims regarding health protocols, such as meningitis and influenza vaccinations, also affects their health during the Hajj (9). Many pilgrims are unaware of the basic health protocols that can prevent diseases, such as vaccination requirements or hygiene practices. For instance, despite

meningitis vaccination being mandated by the Saudi government, there are reports of lack of awareness among pilgrims, especially domestic ones, who may not have adequate access to information or vaccination services. This lack of awareness increases the likelihood of outbreaks, with certain infectious diseases like meningitis posing a serious threat. A study shows that most of the pilgrims infected with infectious diseases were those who did not comply with pre-Hajj health protocols, including vaccination (16). Among infectious diseases, meningitis remains a major concern due to its contagious nature and the high density of pilgrims in confined spaces. While the government mandates the meningitis vaccination, challenges such as access and compliance create gaps in protection. In addition, the risk of acute respiratory infections (ARI) is also high due to close contact in densely populated areas (17). ARIs are commonly contracted during Hajj, given the close contact between individuals in crowded settings. Pilgrims may not be aware of the importance of respiratory hygiene, further exacerbating the risk of transmission.

Other factors such as physical and mental readiness, as well as long waiting times, also affect the health readiness of pilgrims to perform the Hajj (10). Mental and physical readiness are vital factors in pilgrims' ability to perform the Hajj safely. Long waiting times in crowded areas can lead to mental exhaustion, anxiety, and stress, which in turn can have negative effects on immune function and overall health. Moreover, the rigorous physical demands of the pilgrimage, such as long walks, climbing stairs, and standing for extended periods, may strain individuals who are not physically prepared. This physical strain, coupled with fatigue, can leave pilgrims vulnerable to health problems ranging from heat exhaustion to cardiovascular incidents.

Challenges in Implementing Health Programs during Hajj

The implementation of health programs during the Hajj faces a multitude of complex challenges, rooted in logistical, cultural, and communication barriers. These challenges must be understood in depth to design effective and sustainable health strategies for the pilgrimage, where millions of pilgrims gather in a confined space and time frame. The main challenge in implementing the Hajj health program is ensuring that vaccination and health check-up policies (istithaah) are met. Rustika noted that the main challenge in implementing health programs during the Hajj is limited resources, both in terms of medical personnel and health facilities. In addition, coordination between various health institutions and the government also hampers the effectiveness of health programs (9). The density of pilgrims in one area is also a major problem, which worsens access to health facilities and causes delays in handling emergency cases (18). In addition, the language barrier between health workers and pilgrims from various countries often causes misunderstandings regarding medical instructions (19). Cultural factors also play a role, where some congregations feel no need to comply with certain health protocols due to reasons of belief or ignorance (20). In some countries, the level of knowledge and awareness of the importance of meningitis vaccination and prevention of infectious diseases is still low, so that vaccination programs are not optimally implemented. Factors such as lack of information and education, limited access to health services, and administrative constraints, especially for domestic pilgrims, hinder the optimal implementation of the Hajj pilgrim health program (21).

Strategies to Improve the Health of Hajj Pilgrims

The health of Hajj pilgrims is shaped by a variety of factors, including pre-existing health conditions, environmental stressors, and access to healthcare. Several strategies have been implemented to improve the health of Hajj pilgrims, including pre-departure health education, mandatory vaccination programs and improving medical infrastructure in Saudi Arabia (22).

A crucial strategy to improve the health of Hajj pilgrims is the strengthening of health socialization through widespread health promotion initiatives. One of the key components of this effort is the health Istithaah program, which ensures that pilgrims meet health requirements before their journey. Socialization of this program is essential, particularly through mass media and Hajj guidance groups (10). These channels can help reach a broad audience, educating pilgrims about the importance of pre-Hajj health check-ups, vaccinations, and chronic disease management. The use of television, radio, and social media platforms to disseminate information on health protocols can enhance awareness and compliance. Many pilgrims, especially from rural areas or underserved communities, may lack access to healthcare professionals, making public health campaigns an effective tool for improving overall health literacy before departure.

For instance, community-based health education programs, like those implemented by the Indonesian government, aim to raise awareness among pilgrims regarding the health requirements (23). These programs focus on early detection and prevention of diseases such as meningitis, and they ensure that pilgrims are adequately prepared to meet the health criteria for travel. Such initiatives have shown to increase health compliance and reduce the risk of infectious disease transmission among pilgrims.

Another critical strategy is the increase in access to vaccinations, particularly the mandatory meningitis vaccination. Vaccination is one of the most effective means of preventing the spread of infectious diseases, and ensuring that all pilgrims receive necessary vaccinations before departure is vital for maintaining public health. The literature highlights the need for expanded meningitis screening and vaccination programs, especially in countries with limited healthcare infrastructure. For example, involving local health institutions in the screening and vaccination process can enhance the health readiness of pilgrims, ensuring that they are fully vaccinated before they embark on their journey to Saudi Arabia (9). In addition to meningitis, there are other preventive vaccines, such as those for influenza and pneumonia, that should be considered to further protect pilgrims from common infectious diseases. The timeliness of vaccination, ensuring that all pilgrims meet health requirements well in advance, can reduce complications related to preventable diseases. Public health authorities must ensure that vaccination services are widely available, accessible, and adequately promoted, particularly in countries with large numbers of pilgrims.

The use of technology, particularly telemedicine, offers significant opportunities to enhance health management before and during the pilgrimage. The implementation of telemedicine applications enables pilgrims to access online medical consultations, both before departure and while in Saudi Arabia (24). Pilgrims with pre-existing conditions or concerns about their health can consult with healthcare professionals, receive personalized advice, and manage their conditions more effectively. These digital platforms can provide valuable guidance on medication, preparation tips, and how to handle health issues during the pilgrimage. Telemedicine also enhances the ability of healthcare providers to offer remote monitoring of pilgrims' health, making it easier to detect early signs of medical complications such as dehydration, heatstroke, or cardiovascular distress. For example, pilgrims who are unable to visit medical centers in Mecca can still consult doctors remotely, ensuring that they receive timely interventions.

The health of Hajj pilgrims is heavily influenced by their ability to manage chronic conditions, such as diabetes, hypertension, and heart disease. Pilgrims with these conditions face higher risks of complications, including heatstroke, cardiovascular events, and stroke. As such, it is vital to ensure that pilgrims undergo pre-departure health check-ups, where chronic diseases can be identified and managed (13). Providing pilgrims with the tools, medications, and knowledge necessary to manage their health before and during Hajj can significantly reduce the risk of mortality. Strategies such as health screenings and early detection of these conditions are critical in preventing the exacerbation of chronic diseases during the pilgrimage.

The varying mortality rates and health outcomes between sending countries underscore the importance of international collaboration in improving Hajj health programs. Countries with strong pre-departure health programs, such as those offering extensive health screenings and education for pilgrims, tend to have better health outcomes. Conversely, countries with less robust health programs see higher rates of complications and death among their pilgrims. This suggests that collaborative efforts between sending countries and Saudi health authorities are essential to standardize health protocols and ensure that all pilgrims receive the same level of care and attention.

In general, the literature analyzed shows that age and comorbidity are the main predictors of health risks for Hajj pilgrims. However, some studies show variations in mortality rates between sending countries, which may be due to differences in pre-departure health programs. Challenges in health infrastructure in Saudi Arabia are also consistent throughout the literature, but international collaboration and new technologies such as telemedicine provide hope for future improvements.

DISCUSSION

This study explores the health challenges faced by Hajj pilgrims, focusing on mortality rates, health risk factors, challenges in implementing health programs, and strategies to improve the health of Hajj pilgrims. Each of these factors is crucial in understanding the overall health landscape during the Hajj season and has significant implications for public health management both in the countries of origin and within Saudi Arabia.

Based on the literature, the elevated mortality rates among Hajj pilgrims, with a clear focus on the role of age and comorbidities (like diabetes and hypertension) as key risk factors for mortality. Studies consistently highlight that cardiovascular diseases are the leading cause of death among pilgrims, with one study showing that more than 70% of deaths are attributed to heart disease (26). This finding is significant because it links advanced age and the presence of chronic diseases with increased vulnerability, particularly in physically demanding conditions such as the Hajj pilgrimage. The physical strain of Hajj rituals such as extensive walking, standing for long periods, and exposure to extreme temperatures poses additional stress on the cardiovascular system, exacerbating the risks for older pilgrims and those with existing medical conditions.

However, there are still limitations in the scope of the population studied, because most studies only focus on certain countries such as Indonesia or Saudi Arabia, so the generalization of the findings is limited (9, 10). This limitation highlights the need for broader, more inclusive studies that encompass a diverse range of Hajj pilgrims from various countries. Moreover, to reduce mortality rates, improvements in pre-Hajj health check-ups and chronic disease management are essential. These programs should be more comprehensive and universally implemented across different countries, ensuring early detection and effective management of risk factors.

While the study highlights practical strategies like pre-departure health education and vaccination programs, it would benefit from further elaboration on the role of international collaboration and the integration of new technologies in addressing health challenges during the Hajj. The discussion could expand on how multinational partnerships between countries of origin and Saudi Arabia could help standardize health protocols, improve the quality of health screenings, and facilitate better medical preparedness for pilgrims. Additionally, the potential of new technologies, such as telemedicine and mobile health applications, to improve real-time health monitoring and provide remote consultations could be explored in more depth. These innovations could enhance the quality of care available to pilgrims, especially in crowded areas like Mina and Arafah, where medical facilities may be stretched.

By focusing only on particular national cohorts, studies may overlook global variations in pre-existing health conditions and health management practices. This limitation calls for broader, internationally representative studies that capture the health dynamics of pilgrims from diverse regions. Additionally, there is a need for comprehensive data that includes information on pilgrims from low-income countries, who may have limited access to healthcare before the pilgrimage. Such data is crucial in providing a global perspective on health risks during Hajj and in formulating inclusive health strategies. Particularly in the pre-departure health check-up programs and chronic disease management, lies in the systemic barriers that many countries face. These barriers include discrepancies in healthcare infrastructure, access to resources, and healthcare delivery practices. Many countries, especially those with low-income populations, may not have the capacity to implement comprehensive health screenings or provide essential vaccinations for their pilgrims due to financial or logistical constraints. For instance, the quality and availability of healthcare vary widely from one country to another, with some nations struggling to provide basic healthcare services, let alone pre-Hajj check-ups. These disparities can create inequities in health preparedness, affecting the effectiveness of health interventions. Additionally, the current reliance on the healthcare systems in pilgrims' home countries may not always align with the demands of the Hajj pilgrimage. Pre-departure health check-ups, while important, may not be thorough enough or standardized across all countries, leading to inconsistent health management. Without international coordination and standardized health protocols, efforts to prevent chronic diseases or manage existing conditions before departure may be insufficient. Therefore, improvements are needed in the pre-Hajj health check-up program and chronic disease management to reduce mortality rates (27). Strategies such as health outreach, increased vaccination, and international collaboration in implementing health programs can help reduce the risk of disease during the Hajj (11).

Health Outreach and Education

Widespread health outreach programs are essential for improving health literacy among pilgrims. Expanding pre-departure health education can reduce risks associated with preventable diseases. Educational initiatives should be expanded through mass media, social media, and community-based programs to ensure wide-reaching information dissemination.

Vaccination Programs

Increasing access to vaccinations, particularly for diseases like meningitis, is critical for reducing infectious disease risks. While the Saudi government mandates certain vaccinations for all pilgrims, there is still evidence of non-compliance due to lack of awareness and limited access to vaccines, especially among domestic pilgrims. Thus, improving access to vaccination services and increasing public health campaigns on vaccination can significantly decrease the spread of infectious diseases during the pilgrimage.

International Collaboration

International collaboration is important to address these challenges and implement health programs for Hajj pilgrims. Countries of origin, Saudi health authorities, and global health organizations must work together to ensure standardized health protocols are followed. This collaborative approach can address health disparities and promote a more coordinated effort in managing health risks. Shared research and best practices among countries with large numbers of pilgrims can lead to better preparation and improved health outcomes. One of the main challenges in managing health during Hajj is the lack of uniform health protocols across countries. Different nations have varying standards for pre-departure health check-ups, vaccinations, and chronic disease management, which can lead to disparities in pilgrims' health preparedness. International collaboration can lead to the development of standardized health protocols that all countries follow, ensuring consistency in the care that pilgrims receive before and during the pilgrimage. Additionally, collaborating on research regarding health risks, mortality rates, and the effectiveness of interventions would provide a more comprehensive understanding of the health challenges faced by pilgrims. By pooling data from different countries, researchers can identify common risk factors, track disease outbreaks, and monitor the effectiveness of pre-departure health programs. Vaccination is one of the most effective ways to prevent infectious diseases during Hajj. However, as seen with meningitis and other diseases, compliance with vaccination programs remains a challenge. International collaboration can facilitate joint vaccination campaigns, ensuring that pilgrims from all nations are adequately vaccinated before departure. For instance, Saudi health authorities could collaborate with countries of origin to streamline vaccine distribution and administration. International collaboration can also provide cultural and linguistic support. Hajj pilgrims come from diverse cultural and linguistic backgrounds, which can complicate the delivery of health services. Effective international collaboration can help bridge language barriers and ensure culturally sensitive healthcare for all pilgrims. Countries of origin can work with Saudi health authorities to train medical staff in cultural competence and language support, ensuring that pilgrims receive care in a language they understand and in a culturally appropriate manner. Telemedicine platforms can also provide multilingual support, enabling pilgrims to consult with healthcare professionals in their native languages.

Telemedicine and Digital Health

Telemedicine and digital health tools have the potential to enhance the accessibility and quality of healthcare for pilgrims. Telemedicine can play an essential role in these outreach programs by providing remote consultations and educational resources to pilgrims before they leave for Hajj. Through telehealth platforms, pilgrims can receive personalized guidance on managing chronic conditions, preparing physically for the pilgrimage, and adhering to health protocols. Furthermore, during the pilgrimage itself, telemedicine can provide real-time support for pilgrims facing medical issues in remote or overcrowded areas, offering advice on treatment or directing them to nearby medical facilities. Digital platforms could be used to track vaccination records, send reminders, and facilitate easy access to vaccination centers for pilgrims. Based on the above discussion, health outreach, vaccination programs, international collaboration, and telemedicine are strategic measures that can help reduce mortality rates among Hajj pilgrims by improving health awareness, managing chronic conditions, and ensuring timely medical care.

CONCLUSIONS

In conclusion, factors such as advanced age, comorbidities, extreme environmental conditions, and crowding play a major role in increasing the health risks of pilgrims. Cardiovascular diseases, respiratory disorders, and heat stroke are the main causes of death. The government and related parties are trying to improve the quality of pilgrims' health through health policies, pre-Hajj health checks, and mandatory vaccination programs. Although these efforts have helped reduce the death rate, there are still challenges such as the lack of awareness of pilgrims regarding health

protocols and limited access to health facilities. Future strategies include increasing health socialization, access to vaccination, international collaboration and integration of telemedicine and digital health, it is hoped that the morbidity and mortality rates of Hajj pilgrims can continue to decline in the future.

Moreover, this study contributes to advancing knowledge by emphasizing the critical role of health outreach, vaccination programs, international collaboration and telemedicine in enhancing health preparedness. By addressing the health needs of pilgrims proactively, these strategies can help mitigate the risks associated with infectious diseases and chronic conditions. As global health concerns continue to rise, it is imperative that further research focuses on broadening the scope of studies to include diverse populations and regions, as well as developing more effective strategies for managing health during the Hajj.

AUTHOR'S CONTRIBUTION STATEMENT

HS, R, ATI, and SRA conceptualized and designed the study. HS, R, ATI, and SRA analyzed and interpreted the results. HS, R, ATI, and SRA drafted the manuscript.

CONFLICTS OF INTEREST

The authors declare no competing financial, institutional, or personal interest.

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