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Effective means of the intervention health education for prevention of respiratory infection among Hajj pilgrims: Systemic review 2024

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Abstract

Background

The Islamic Hajj pilgrimage to Mecca is one of the world's largest annual mass gatherings. Inevitable overcrowding during the pilgrims' stay greatly increases the risk of acquiring and spreading infectious diseases, especially respiratory diseases. Factors contribute to high prevalence of respiratory disease among AL hajj pilgrims include physical exhaustion, sleep deprivation, and heat stress, inevitable overcrowding, both in housing and ritual sites . The prevalence of respiratory illness has continued to surge among Hajj pilgrims from different countries despite having some practices of preventive measures. Respiratory illnesses during Hajj could be due to many reasons and many factors that promote disease spread. These factors include overcrowding, cigarette smoking, and direct contact with infectious agents particularly viruses promote the spread of respiratory infections. However, due to the longer duration of the pilgrimage, there are high chances of pilgrims contracting various respiratory illnesses due to exposure to respiratory pathogens.

Aim of this systematically reviews: To determine the effective of the implemented the intervention health education to help prevent respiratory tract infections during Hajj. in Saudi Arabia2024.

Method: The MEDLINE/PubMed and Scopus databases were searched for all relevant papers published prior to 2018 to 2024 that evaluated the prevalence of clinical symptoms of respiratory infections, including pneumonia among Hajj pilgrims, as well as their influenza and pneumococcal vaccination status

Results: The Saudi health authority has recommended annual seasonal influenza vaccination during each Hajj season to curtail the risk of spreading respiratory tract infections as far back as the 2005 Hajj season especially for those at high risk of influenza and other respiratory tract complications

Conclusion: Large multinational follow-up studies are recommended for clinic, Hajj pilgrims' knowledge, attitudes, and practices toward respiratory tract infections are used as the determinant of the effectiveness of the health education interventions. Knowledge and application of basic hygiene principles, use of face masks, following cough etiquettes, engaging in social distancing, and engaging in other measures are highly important .

Keywords: Effective, intervention, health education, prevention, respiratory, infection, Hajj pilgrims.

Background:

The yearly "Hajj" (also known as the pilgrimage to Mecca) in the Kingdom of Saudi Arabia (KSA) is the "Fifth Pillar of Islam" and is mandatory once in a lifetime for all adult Muslim who are physically and financially able. [1]The Hajj is one of the world's largest annual mass gatherings. In 2024, around 3.3 million foreign visitors, from more than 180 countries, gathered in the KSA to complete the Hajj, in addition to over 2.5 million domestic Hajj pilgrims [2]. Also, about 6–9 million pilgrims perform the "Umrah" (also known as the lesser pilgrimage) each year. The Hajj and its rituals are physically demanding for Hajj pilgrims, the majority of whom are elderly [3], with chronic conditions. Although the Hajj rituals only take one week, pilgrims usually stay in the Saudi Arabia .

Acute respiratory infections (ARIs) are a major public health burden, causing serious morbidity and mortality, especially in vulnerable populations such as travellers. [4] The burden of ARI is very high in the Eastern Mediterranean Region, a region that hosts many of the planet's mass gatherings (MGs). For instance, the incidence of ARI in Pakistan in 2003 was 4403 per 10,000 person-years, and among Omani children under 5 years of age in 2013 was 11,200 per 10,000 person-years, while the prevalence of community-acquired pneumonia among hospitalized patients in the Kingdom of Saudi Arabia (KSA) in 2013 was 30.3 % [5]. Currently, the coronavirus disease of 2019 (COVID-19) pandemic has affected over 600 million people with about 6.5 million fatalities (as of 10 October 2022) [6]. Ever- increasing and faster international travel intensifies the transmission of ARIs, especially in MG settings [7]

Pilgrims usually stay in the Saudi Arabia for several weeks throughout the month-long Hajj season, presenting a major public health and infection control concern, and a challenge both for the Saudi authorities, as well as for the national authorities of the countries of origin of the pilgrims. In addition to physical exhaustion, sleep deprivation [8], and heat stress , inevitable overcrowding, both in housing and ritual sites, especially in Mina encampment (this is approximately a 3-kilometer square area where pilgrims are accommodated in air-conditioned semi-permanent tents, some with up to 50–100 people) and inside the Sacred Mosque in Mecca (with up to six pilgrims per square meter) [9], greatly increases the risk of acquiring and spreading infectious diseases [10], especially respiratory diseases [9]. To minimize the spread of infections during the pilgrimage or in the pilgrims' home countries upon their return, vaccination and non-pharmaceutical interventions are thus recommended by national and international public health agencies [11]

In particular, airborne infections are a major public health issue and a significant cause of morbidity at Hajj. Respiratory illness is the leading cause of hospitalization during Hajj and the second or third most common cause of admission to the intensive care unit (ICU) during Hajj [12]. Furthermore, many airborne infections have emerged in recent decades, including severe acute respiratory syndrome (SARS) in 2003,[13] the influenza A (H1N1) pdm09, the Middle East respiratory syndrome coronavirus (MERS-CoV) in 2012, and, more recently, the novel coronavirus disease 2019 (COVID-19) in 2019, presenting a major public health and infection control challenge for both the authorities in KSA and the national authorities in the pilgrims' countries of origin [14]

A handful of systematic reviews have provided a comprehensive overview of available evidence on the burden of respiratory infections in Hajj [15]; however, no study was undertaken to compare the burden of infections at Hajj among participants from low and middle-income countries (LMIC) and high-income countries (HIC).[16] This comparison is important, as it can inform future public health policy and identify potential prevention and control strategies. [17]

Methodology

Aim of the study:

To determine the effective of the implemented the intervention health education to help prevent respiratory tract infections during Hajj . In Saudi Arabia2024 .

Study design:

Systematic reviews using Online searching engines were using databases to identify relevant articles through the included electronic databases: Google Scholar, PubMed, and Saudi Digital Library (SDL), data extracted from published articles were systematically analyzed for determining the health education for prevention of respiratory infection among Hajj pilgrims in Saudi Arabia to achieving higher level.

Search strategy:

Published articles about "health education interventions" and "prevention of respiratory tract infections" during Hajj and Umrah were retrieved from Science Direct, Scopus, Cochrane databases, and PubMed using the words "Hajj and respiratory tract infections," "influenza," influenza-like illness," and "health education." A total of 250 articles written in English published between January 2018 and August 2024 were retrieved. These articles included randomized controlled trials (RCTs), quasi experimental studies (non-RCTs), non-randomized trials, pre– post interventions with a control group, qualitative studies, cross-sectional studies, and prospective cohort's studies.

Searches and Data Sources

A comprehensive search was performed to obtain studies on the Effective means of the intervention health education for prevention of respiratory infection among Hajj pilgrims. The databases used in the search included ProQuest and Scopus, and the keywords used were 'intervention ', 'health education', 'Saudi Arabia' , 'prevention ' , 'respiratory infection' 'Hajj pilgrims' . These keywords were used to find articles with matching terms in their abstracts or titles. To discover the most recent studies and literature on our review topic, the search was limited to articles published between 2018 and 2024.

Inclusion criteria

The retrieved articles were then assessed for relevance. Published studies and reviews explored pre and post Hajj health education interventions for prevention of respiratory infections and literature covering various prevention guidelines such as use of facemasks, vaccination, cough etiquette, and social distancing during Hajj were included.

Exclusion Criteria

Exclusion Criteria studies such as reviews, letters, case reports, and systematic reviews were excluded from the review. Using the aforementioned criteria, a total of 7 articles were eventually selected for the present narrative review

Data Extraction

As this review relies heavily on a prior systematic review that included online articles, the findings could be affected by selection bias. However, efforts were made to collect the necessary information for the appropriate review, explanation, and interpretation of the available literature. Studies were excluded if they investigated health insurance outside Saudi Arabia, review studies, studies were not directly related to health insurance, and studies were excluded if they were published before 2018.

The process of selecting the articles, which are contained in this review .

Literature searches were independently done, and the title and abstracts were screened by two researchers for eligibility based on the inclusion criteria. Each of the selected articles was reviewed in full by two authors. The data were extracted from the included papers by two authors . The extracted data were checked and verified by the authors to ensure the accuracy of the data included.. After excluding studies with sample sizes under 80 and response rates under 60%, 7 articles were included in this review.

Table1: Summary of Findings of the effective means of the intervention health education for prevention of respiratory infection among Hajj pilgrims

Author, Date, Country	Region	Study design	Study aim	Results
Albutti et al (2024) (18)	Kingdom of Saudi Arabia	Randomization and intervention	To assessed the feasibility of establishing a large-scale trial to explore the relationship between practising hand-hygiene and r-ates of ARI in Umrah pilgrimage amidst the COVID-19 pandemic..	This is the first interventional study that explored the relationship between HH use and ARI rates among Umrah pilgrims during the pandemic of COVID-19. This pilot study showed that a large trial is feasible in Umrah pilgrimage; however, it failed to provide conclusive evidence on the protective role of HH. Inconclusiveness of this pilot study is predictable as it is an underpowered study, the primary aim of which was to assess the feasibility of conducting

				a definitive trial in Umrah setting. Implementing such a trial during an exceptional Umrah season was challenging and led to some limitations. Only selective domestic pilgrims were recruited; therefore, the generalizability of the results is restricted. Furthermore, the short stay of Umrah pilgrims in Makah coupled with COVID-19 restrictions made it difficult to obtain biological samples for laboratory diagnosis of infections, and rather syndromic definitions of ILI and COVID-19 were used. Consequently, a proportion of asymptomatic pilgrims may have been missed out, and atypical presentations of novel COVID-19 variants may not have been identified. Additionally, due to their short stay in Makah, we had to contemplate concluding the follow-up by seven days. The median incubation periods of the most prevalent respiratory viruses **Conclusions** This pilot RCT recommends that implementing a future full-scale RCT to investigate the role of HH in preventing and containing ARIs is feasible in MG settings including Umrah pilgrimage amidst a global pandemic, and such a study would need to be very large given the low rates of outcomes observed here. However, this pilot trial failed to demonstrate any evidence of HH effectiveness against syndromic ARIs.
Alzeer et al (2023) (19)	Saudi Arabia	prospective study	To perform microorganism surveillance inside Hajj tents and assess the similarities between microorganisms isolated from tent bio aerosol samples and nasopharyngeal swabs (NP) of tent occupants.	This study for the first time identifies respiratory viruses and bacteria isolated from Hajj tent bio aerosols over time, with parallel NP samples from tent occupants. Analysis of tent bio aerosols showed a progressive increase in the percentage of samples with airborne pathogens detected over the 4 days of sampling. K. pneumonia was a major contributor to tent bio aerosol contamination, present overall in 60% of bio aerosol samples, and increasing from 7.5% to 20% across the sampling . **Conclusions** Respiratory tract infections are common among pilgrims attending annual Hajj in Mecca, Saudi Arabia. Pilgrims

				typically spend most of the Hajj period inside ventilated tents, where microorganisms may be transmitted through bio aerosols and droplets. The data suggest that the Hajj tent environment may contribute to the spread of airborne infections during Hajj. This can have important ramifications for novel pathogens with pandemic potential.
Bokhary et al. (2022) (20)	Saudi Arabia	Cross-section	To patterns and appropriateness of antibiotic prescription among a cohort of pilgrims who were treated for URTIs during the 2018 Hajj season.	Highlighted URTIs and their symptoms as being among the most common complaints of pilgrims and responsible for most healthcare visits. However, very little information is known on the structure of the microbial population and the contribution of AMR bacteria associated with such illnesses in Hajj settings. Homophiles influenza was the most commonly isolated bacterial species in our study, accounting for 60.0% of recovered bacterial isolates (66.7% of the bacterial infected cohort). Similar findings were seen in Malaysian Hajj pilgrims, with H. influenza accounting for 60.0% of bacterial isolates (70.9% of the infected cohort) . We found that all H. influenza isolates were resistant to ampicillin. Interestingly, this poses a challenge to the primary healthcare centers during Hajj as they only provide azithromycin and amoxicillin, with H. influenza likely to be resistant to the latter. Furthermore, other prominent bacterial organisms that was isolated in this study (Staphylococcus aurous, Streptococcus**.** **Conclusions** highlights the need for implementing laboratory identification of the etiological agents and related AMR profiles when treating URTIs in Hajj, rather than relying on clinical assessment alone, also highlighted URTIs and their symptoms as being among the most common complaints of pilgrims and responsible for most healthcare visits. However, very little information is known on the structure of the microbial population and the contribution of AMR bacteria associated with such illnesses in Hajj settings. Interestingly, this poses a

				challenge to the primary healthcare centres during Hajj as they only provide azithromycin and amoxicillin, with H. influenza likely to be resistant to the latter. Furthermore, other prominent bacterial organisms that were isolated in this study (Staphylococcus aureus, Streptococcus.
El-Kafrawy, et al (2022) (21)	Saudi Arabia	cross-sectional analytical study	To investigate the genetic diversity of HRV among pilgrims with respiratory symptoms during Hajj 2019	HRV infection may cause exacerbations of chronic respiratory disease and is associated with pneumonia, especially among children, the elderly, and patients who are immune compromised. In our study, the majority (39/53; 73.58%) of individuals with was over 60 years old. Thus, particular attention must be given to preventive healthcare and the medical needs of elderly pilgrims by the healthcare workers at the Hajj. The disseminating of human-to-human HRV among pilgrims may have been increased by the crowded conditions in the Hajj season. This has implications for transmission of other respiratory tract viruses, including SARS-CoV-2 and influenza. Moreover, the pilgrims with HRV came from 21 countries, mainly Indonesia (15 cases), India (nine cases), and Morocco (four cases); followed by Somalia and Sudan (three cases each), followed by pilgrims coming from Saudi Arabia, Bangladesh, and Nigeria with two positive cases each and finally pilgrims coming from Turkey, Egypt, Syria, the United States, France, Oman, Tunisia, Dominica, Ethiopia, Togo, Fiji, Chad, and Afghanistan with one positive case each. **Conclusions** We show that sequencing studies of respiratory tract viruses in pilgrims are important. We provide preliminary evidence of high diversity of HRV genotypes circulating among pilgrims in a restricted area during the Hajj. This high diversity in a small number of individuals in a short period during the Hajj season requires further study in parallel with genetic sequencing of other respiratory viruses such as SARS-CoV-2 and influenza so that

				evidence based preventive measures can be delineated and enforced.
Harimurti et al (2022) (22)	Saudi Arabia and Indonesian	A prospective multi-site longitudinal	To investigate the dynamics of Streptococcus pneumonia colonization and to investigate antibiotic susceptibility of pneumococcal strains in Indonesian pilgrims.	Although we found a difference proportion in antibiotic use in Saudi Arabia between the carriage and non-carriage group, the results were heavily relied on the self-reported data from study subjects. Data on antibiotic use were collected by interviewing the subjects upon arrival at the Hajj dormitory to recall their history of antibiotic use in Saudi Arabia. They may not be able to clearly identify whether they took antibiotics or any other medications. Thus, non-differential misclassification of antibiotic uses may lead to overestimation of the number of antibiotic use in both carriage and non-carriage groups. The Indian pilgrims study suggested the increased carriage of antibiotic-resistant pneumococci in the post-Hajj cohort may be associated with self-medication and excessive use of antibiotics. Regarding to antibiotic use, in this study, we found that acquired S. pneumonia in post-Hajj showed less susceptibility compared to pre-Hajj. However, the non-susceptibility pattern in post-Hajj is still similar with pre Hajj with tetracycline, penicillin and cotr-imoxazole are detected to be less susceptible. A study about antibiotic resistance pattern of S. pneumonia in Saudi Arabia reported that S. pneumonia showed high resistant to erythromycin, penicillin, clarithromycin and cefuroxime **Conclusions** Our study revealed the acquisition of some vaccine serotypes (PCV13 and PPSV23) in Indonesian Hajj pilgrims nasopharynx . These findings might suggest the potential role of pneumococcal vaccine before departure to reduce nasopharyngeal colonization and invasive pneumococcal diseases during Hajj pilgrimage
	Saudi Arabia		To evaluate the risk potential of COVID-	Only able to perform Hajj and Umrah in old age after saving money for that reason. The prevalence of mortality

Alahmari. et al (2021), (23)		Retrospective pre and post-study	19 among Hajj pilgrims, the effectiveness of preventive measures and the potential effect of the Hajj ritual as a huge mass gathering on the epidemiological situation of the Saudi Arabian population.	will be high in such elderly pilgrims. Further, pilgrims from low socioeconomic countries with suboptimal healthcare quality and education represented a significant proportion of the pilgrims. Such factors contribute to the substantial risk of related mortality and morbidity from their participation in Hajj . We found a notable reduction in the reported number of upper respiratory tract infections (11.6 cases per 100,000), compared to a previous report that showed an incidence rate of 2200 per 100,000 cases. Additionally, the rate of non-communicable diseases was 68 cases per 100,000 in the present study, compared to 1600 per 100,000 cases in a previous report . Such figures reflect the effectiveness of the preventive measures during the pandemic in limiting Hajj attendees to pilgrims without a high rate of comorbidities and ensuring their fitness to perform rituals, strict application of social distancing and shortening the period of Hajj stay, which used to take more than a month and stretch to two months for international pilgrims. **Conclusion** Overall, proceeding with Hajj in 2020 and 2021 allowed a spiritual sense of security and psychological wellbeing for Muslims worldwide. The Saudi mitigation plans ensured the safety of pilgrims and accompanying personnel and successfully limited the risk of COVID-19 transmission inside and outside the country. The success story of Hajj in 2020 and 2021 during the pandemic represents a successful model for planning, achieving and managing future MGs by integrating technology with global and national health policies and public health measures. Maintaining effective communication strategies and health education for frontline healthcare professionals, government officials, Hajj working personnel and the general populations are vital elements in the success and preparedness of the forthcoming 2022 Hajj.

Zuraina et al (2022) (24)	Kelantanese Malaysian Hajj pilgrims	cross- sectional study.	To perform a diagnostic screening of intended bacteria associated with RTIs among Malaysian Hajj pilgrims by using a newly developed PCR assay.	Overall, the developed single-tube, thermo stabilized multiplex PCR assay of this study has the accuracy of above 90.0% during the diagnostic evaluation. Based on the properties and performance (rapidity, simplicity, detection limit and accuracy) of this assay, it could provide an easier, faster, and reliable tool for bacterial detection in the diagnosis of RTIs. As a new developed assay, it can be applied as either a triage and/or an add-on test to the existing diagnostic tools . However, it is known that qualitative-based PCR assays are restricted by their inability to distinguish between normal flora and pathogenic-bacteria. Hence, in addition to microbiological diagnosis, clinical presentations and radiographic findings are useful to facilitate the diagnosis and therapeutic decision by the clinicians. **Conclusions** This assay has the potential use as a triage test to facilitate in the initial laboratory detection of the target bacteria from sputum specimens. It can also be used as an add-on test, especially when the sputum culture is negative or when the confirmation of closely related target species is needed. In future studies, the primers used for this assay may be applied in the development of quantitative based PCR assays, which have been widely used for microbial diagnosis in clinical areas.

Results and discussion

The usability and outcome of Effective means of the intervention health education for prevention of respiratory infection among Hajj pilgrims are based on Vision 2030. 7 articles were selected that compliant with the theme of this present systematic review (Table 1). Among the 7 reviewed articles, articles have explained, health education interventions have been proven to increase pilgrims' knowledge of respiratory illnesses (17). Information dissemination is a key factor in health education for mass gatherings, and it involves various modes, e.g., web-based, flip charts, lectures, discussions, symposia, posters, fliers, public addresses, and radio and television messages , The effectiveness of these various modes has both merits. Different intervention health education was explained in different articles, articles highlight the strengths and weaknesses of health education. Finally, articles have provided recommendations health education practices.

Health education packages and awareness kits are designed in such a way that cultural, ethnic, and language diversity are prioritized for the prevention of infectious diseases during Hajj. The Saudi Ministry of Health partners with relevant authorities in various countries that have annual pilgrims to map out and produce appropriate interventions for education and awareness including vaccination guidelines and the precautions to be taken prior to departure to Saudi Arabia and during the Hajj. Various health educational materials (guides, pocket cards, stickers, leaflets, fliers, and posters) have been developed in English, Arabic, Urdu, and several other languages (25). However, training and

educating healthcare workers and professionals who are always the first to encounter cases during the pilgrimage have been paramount in terms of the effectiveness of prevention of respiratory tract infections. The training of the healthcare workers will ensure prevention and spread of diseases through early detection and contact tracing (26)

In addition, many of these studies have investigated the epidemiology of respiratory tract infections among pilgrims by estimating the common prevalence of upper respiratory tract infection (URTI), acute respiratory infection (ARI) or influenza-like illness (ILI), which were inconsistently defined across studies by a combination of general symptoms (e.g. cough, sore throat and fever). Overall prevalence of ILI varied in these studies from 8% to 78.2% (27–16,18) previous studies . In a recent large study, conducted among 3364 Egyptian pilgrims between 2012 and 2015, the prevalence of ILI was 30.4% (ILI was defined according to the World Health Organization definition as the presence of measured fever of ≥38 C°, and cough; with onset within the last 10 days) (28)

Recently, few published studies have shown the importance of educational interventions in the improving Hajj pilgrims' knowledge, attitudes, and beliefs about respiratory infections. That substantial misunderstandings about protective measures and the dangers of respiratory infections persist among Hajj pilgrims from Australia. Similarly (29) , (25) showed that French Hajj pilgrims were familiar with the preventive measures for respiratory infections such as use of hand disinfectant (77.4%), use of disposable handkerchiefs (89.8%), and use of face masks (79.6%). In addition, 97.4% of the French pilgrims were vaccinated against seasonal flu, 5.8% against H1N1, and 31.4% against pneumococcus. However, no work has been published regarding the barriers to and facilitators of the uptake of preventive measures. However, a study conducted among international Arab pilgrims showed that health education is inadequate improving their knowledge of health hazards (28).

Conclusion

Many non-pharmaceutical interventions are worth implementing on their own merit, even if the evidence for their effectiveness for preventing respiratory infectious diseases during the Hajj is sometimes weak and has rarely been studied in large populations. Respiratory diseases are by far the main reason for consultation among pilgrims attending primary health care centers during the Hajj. Current evidence indicates that simple physical interventions would be useful for reducing the spread of respiratory viruses. Some studies have addressed the impact of face mask use during the Hajj on the prevalence of both respiratory symptoms and viral pathogens using PCR assays from pilgrim nasal samples, and no significant effect was observed. By contrast, no positive effect of frequent hand washing or using hand sanitizer was observed among pilgrims on the occurrence of respiratory symptoms during the Hajj or on the prevalence of respiratory viruses as investigated by PCR assays on nasal swabs during the Hajj. However, the use of disposable handkerchiefs had no significant beneficial effect on the prevalence of either respiratory symptoms among pilgrims during the Hajj or viral pathogens from their nasal samples, as recently reported.

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