

Control of Respiratory Tract Infections during Hajj Pilgrimage: A Narrative Review

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Abstract

Introduction: Factors contribute to high prevalence of respiratory disease among Alhaj pilgrims include physical exhaustion, sleep deprivation, and heat stress, inevitable overcrowding, both in housing and ritual sites. The aim of this review was to determine the magnitude and determinants of respiratory infections and pneumonia during the Hajj pilgrimage.

Methods: An online search was conducted in PubMed, Scopus and Cochrane to identify eligible articles. 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. Non-experimental studies such as reviews, letters, case reports, and systematic reviews were excluded from the review. Each of the selected articles was reviewed in full by two reviewers.

Results: Before each Hajj, the Saudi Ministry of Health disseminates the health requirements for issuance of travel visas, and provides advice about public health guidelines to prevent the spread of respiratory and gastrointestinal infections. 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.

Conclusions: 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.

Keywords: Respiratory infections, Control, Hand hygiene, Hajj, Saudi

Introduction

Upper respiratory tract infections (URTI) is defined as any person who reported having developed at least one of the constitutional symptoms (fever, headache, myalgia) and one of the local symptoms (running nose, sneezing, throat pain, cough with/or without sputum) [1]. Viral respiratory tract infections (RTIs), including influenza, are a major burden to public health. Fear of the global spread of serious respiratory disease persists in the light of past pandemics, such as the severe acute respiratory syndrome (SARS), the influenza A (H1N1) pdm09 virus, and the recent emergence of the Middle East respiratory syndrome coronavirus (MERS-CoV). Mass gatherings such as the Hajj pilgrimage pose a particular risk for transmission of respiratory viruses [2]. Health authorities require cost-effective measures that prevent or limit the global transmission of respiratory diseases. This study aims to evaluate the efficacy of facemasks in preventing laboratory-confirmed respiratory viral infections and syndromic RTIs. Mass gatherings such as the Hajj pilgrimage pose a particular risk for transmission of respiratory viruses. Health authorities require cost-effective measures that prevent or limit the global transmission of respiratory diseases.

Although a number of non-immunization and non-pharmacologic interventions like personal hygiene, the wearing of facemasks, and screening and quarantine of travelers to slow international spread were tested during the emergency global response to severe acute respiratory syndrome (SARS), their use during the differing conditions of an influenza or corona pandemic has not been systematically evaluated in Alhaj season [3]. Close contact among pilgrims aggravates the spread of infection and acute respiratory infection is very common among the acute infectious diseases of pilgrims [4]. Outbreaks of respiratory illness of viral etiology have been recognized in many isolated communities after contact

with the outside world. On microbiological survey, about 10.8% of Hajj pilgrims presenting with upper respiratory tract symptoms had a positive viral throat culture [5]. Furthermore, the presence of many pilgrims from different countries around the world and overcrowding considerably increase the risk to contract infectious diseases, particularly respiratory and gastrointestinal infections, resulting in considerable demand for antibiotic use. Antibiotic-resistant gastrointestinal and respiratory organisms have been frequently isolated from Hajj pilgrims [6]. The great majority of these infections involve the upper respiratory tract, but infections of the lower respiratory tract are also frequent. There is widespread agreement that the factors initiators of upper respiratory tract infections are viruses [7]. The number of respiratory viruses that are pathogenic for man is enormous. In all tropical climate countries, acute respiratory infection stands as a leading cause of hospitalization and death [8].

Surveillance of acute respiratory infection in defined populations to monitor prevailing pathogens and to determine population groups at special risk are important for taking preventive measures. However, pneumonia due to secondary bacterial infection is the most important complication of the lower respiratory tract. Respiratory tract infections during pilgrimage season have long been thought to be a dominant health problem and ranked as the second leading cause of morbidity among pilgrims, with a very high fatality rate. This and the fact that this important health problem has not been well-defined motivated us to explore the bacteria and viruses commonly involved in the aetiology of the respiratory tract infections among pilgrims who were referred to one hospital and three dispensaries during the 1991 and 1992 pilgrimage seasons [8]. Factors contribute to high prevalence of respiratory disease among Alhaj pilgrims include

physical exhaustion, sleep deprivation, and heat stress, inevitable overcrowding, both in housing and ritual sites. 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), greatly increases the risk of acquiring and spreading infectious diseases, especially respiratory diseases [9]. The aim of this review was to determine the magnitude and determinants of respiratory infections and pneumonia during the Hajj pilgrimage.

Methods

An online search was conducted in PubMed, Scopus and Cochrane to identify eligible articles. Key phrases such as “Prevention of respiratory tract infections” and “control of respiratory tract infections” during Hajj and Umrah were used to search the articles. 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 cohorts studies. 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. Non-experimental studies such as reviews, letters, case reports, and systematic reviews were excluded from the review. Each of the selected articles was reviewed in full by two reviewers.

Results

Before each Hajj, the Saudi Ministry of Health disseminates the health requirements for issuance of travel visas, and provides advice about public health guidelines to prevent the spread of respiratory and gastrointestinal infections. Continuous monitoring of emerging infectious diseases ensures that, for example, infection with the Middle East respiratory syndrome coronavirus (MERS-CoV) in an individual

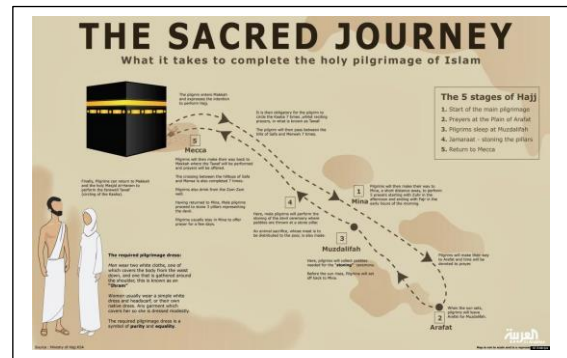
28 is not transmitted to other pilgrims, thereby avoiding a worldwide epidemic [10]. Furthermore, the Saudi Ministry of Health also advises all pilgrims to comply with the common public health guidelines to prevent the spread of respiratory infections. A wide range of viral and bacterial infections of the upper and lower respiratory tract can occur during the Hajj. Over the past decade, the emergence of several new coronaviruses and influenza viruses such as influenza A H1N1, severe acute respiratory syndrome (SARS)-CoV, and MERS-CoV have been a concern for the Saudi Ministry of Health. MERS-CoV was first identified as a new virus that causes fatal respiratory disease after identification of a novel β coronavirus from a patient in Jeddah Saudi Arabia, who died from a severe respiratory illness.

The current focus of research is on MERS-CoV and other respiratory viral infections and best strategies to prevent them. All communicable diseases of importance at mass gatherings are monitored—eg, respiratory tract infections, food poisoning, diarrhoeal diseases, invasive meningococcal disease, viral haemorrhagic fevers (dengue, Alkhurma, Marburg, Crimean Congo Ebola, and Lassa), yellow fever, polio, and plague [11]. Generally, the use of alcoholic hand rubs for sustaining a good hand hygiene is pivotal in controlling respiratory viral infections but is not widely accepted among Muslim pilgrims due to the fact that alcohol is forbidden in Islam. Crowdedness is a common occurrence peculiar with all the rituals involved during Hajj pilgrimages and poses a major risk for the spread of respiratory illness. However, a nested case-control study conducted with Iranian Hajj pilgrims in 2010 revealed no association between direct contact with sick pilgrims with average daily presence in the holy areas and respiratory tract infections [12].

Several studies of pilgrims from different countries have shown that the effect of face masks in helping prevent respiratory tract infections during Hajj is not achievable and remains unknown due to some improper usage and compliance [13, 14]. Upper respiratory tract infections such as MERS-CoV shows clinical signs and symptoms that have varied from asymptomatic to highly severe pneumonia with acute

respiratory distress syndrome (ARDS), septic shock, and eventually death as a result of several organ failures [15]. Health education interventions have been proven to increase pilgrims' knowledge of respiratory illnesses. However, some studies suggested that knowledge of and attitudes toward respiratory illness such as MERS-CoV among the Hajj pilgrims are usually not up to the optimum level when compared to their practices of protective measures. Both, viral or bacterial respiratory tract infections are very common among pilgrims in all age and sex groups, and is regarded as the most common disease among pilgrims in some reports [16]. The reports show conflicting results about the effects of preventive measures [17]. Among the most common pathogens isolated from the respiratory specimens are Haemophilus influenzae Klebsiella pneumoniae Moraxella catarrhalis S. pneumoniae Staphylococcus aureus and Pseudomonas aeruginosa. Overcrowding and extreme climatic condition during pilgrimage increase the risk of transmission of communicable diseases especially the meningococcal disease and respiratory tract infections (RTIs).

Despite implementation of various prevention methods, such as hand hygiene, face masks and influenza vaccination, the number of local pilgrims that had reported cough and/or other respiratory illness, upon returning to Malaysia remains high (>90%) . To effectively implementing preventative measures, epidemiology of respiratory-associated pathogens among local Hajj pilgrims must be well understood. Massive gathering during Hajj pilgrimage is the key factor that increases risk of respiratory infections and subsequent spread of the disease .. Overall, (87.3%) of the cultured sputa were positive for at least a single respiratory bacterium. However, all the respiratory symptoms, excluding sore throat, were not statistically significant to be influenced by either gender or age groups. Regarding the association of gender, age groups and respiratory symptoms with bacterial acquisition, it was noted that the number of male pilgrims found positive with bacterial isolates were higher (89.9%), as compared to female (83.6%). A study found that above 80% of the pilgrims who had presence with any of the respiratory symptoms were positive with at least single bacterium [18]. The presence of a large number of pilgrims from several



parts of the world in congested and crowded areas, especially when performing the circumambulation of the Kaaba inside the Grand Mosque in Mecca and when using the pedestrian tunnels leading to the Jamarat bridge in Mina, where each pilgrim performs the ritual of "Jamarat" (stoning the columns symbolizing the Devil), greatly increases the risk of spreading infectious diseases , particularly respiratory diseases.

In addition, respiratory diseases are major causes of hospital admission during the Hajj, with pneumonia being a leading cause of hospitalization in intensive care units. In a recent study of Indonesian pilgrims, respiratory diseases were found to be the second most common cause of death, immediately after cardiovascular diseases [19]. Respiratory viruses, especially influenza virus, are the main cause of acute respiratory infection (ARI) during the Hajj. However, although international outbreaks of Neisseria meningitidis serogroup W135 occurred in 2001 and 2002 , no respiratory epidemics linked to the Hajj have been reported to date. The transmission routes of the most common respiratory viral pathogens are diverse, including direct contact between an infected person and healthy individuals, indirect contact with contaminated surfaces, and droplet and airborne transmission at short range. The effectiveness of face mask use in preventing respiratory illness during the Hajj has been evaluated in various studies. The effectiveness of hand hygiene practices in preventing respiratory illness during the Hajj has been evaluated in only a few studies. A study conducted among US Hajj pilgrims during the Hajj confirmed that hand

hygiene was associated with a reduced risk of respiratory illness . In 2009, a study among US pilgrims showed that their compliance with cough etiquette was 46.2%, with, however, no significant beneficial effect on the prevalence of respiratory symptoms . However, in a recent nested case-control study among Iranian pilgrims during the Hajj, the mean daily presence in holy places and direct contact with ill pilgrims in the same room appeared to have no effect on the incidence of respiratory tract infections . In a study conducted among US pilgrims during the Hajj, the observance rates of social distancing and contact avoidance were 34.4% and 24.2%, respectively, with a significant beneficial effect on the occurrence of respiratory symptoms during the Hajj [20] .As most data were obtained from cross-sectional studies on a relatively small number of patients, it has been estimated that 1 in 3 pilgrims will experience respiratory symptoms, which usually start at the end of, or shortly after the end of, the Hajj season. Although the CDC suggests that surgical face masks do not provide adequate filtering of small respiratory particles, it may be desirable to use them, particularly in semi-closed areas. Encouraging respiratory hygiene measures such as frequent hand washing and the use of alcohol hand rubs and disinfectants are essential measures in preventing cross-infection [21]. In summary, respiratory tract infection during Hajj continues to exert a burden on pilgrims. Future studies should focus on the prevention, diagnosis, epidemiology and management of these respiratory diseases in this large heterogeneous population, as Mecca will always be "once-in-a-lifetime destination" for all capable Muslims.

Conclusions

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. 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.

Conflict of interests

The authors declared no conflict of interests.

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