

# Non-pharmaceutical interventions for the prevention of respiratory tract infections during Hajj pilgrimage

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**Summary** Overcrowding during the yearly Hajj mass gatherings is associated with increased risk of spreading infectious diseases, particularly respiratory diseases. Non-pharmaceutical interventions (e.g., hand hygiene, wearing face masks, social distancing) are known to reduce the spread of respiratory viruses from person to person and are therefore recommended to pilgrims by public health agencies. The implementation of effective public health policies and recommendations involves evaluating the adherence to and effectiveness of these measures in the specific context of the Hajj. This review summarizes the evidence related to the effectiveness of non-pharmaceutical interventions in preventing the spread of respiratory infectious diseases during the Hajj. Overall, although hand hygiene compliance is high among pilgrims, face mask use and social distancing remain difficult challenges. Data about the effectiveness of these measures at the Hajj are limited, and results are contradictory, highlighting the need for future large-scale studies.

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## 1. Introduction

Annually, over two million Muslims from more than 180 countries gather in the Kingdom of Saudi Arabia (KSA) to

perform the pilgrimage to Mecca, also known as the “Hajj”. The Hajj is the fifth pillar of Islam and is mandatory for all adult Muslims who are physically and financially capable at least once in their lifetime. The pilgrims usually stay in the KSA for up to 4 weeks. Upon arrival in Mecca, the holiest city in Islam, most Hajj pilgrims begin their visit by performing the “Umrah” (also known as the minor pilgrimage). The rituals of the Umrah can be undertaken at any time of the year and include the circumambulation of the Kaaba (*Tawaf*) in very crowded conditions (Fig. 1) and seven trips

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(Sa'i) between two small mountains (*Al-Safa* and *Al-Marwah*) inside the Grand Mosque (*Al-Masjid al Haram*). The Hajj, which retraces the footsteps of the Prophet Mohamed over approximately one week, is performed from the 8th to the 13th of the last month of the lunar Islamic calendar, called "*Dhul Hijja*" (i.e., "the month of Hajj"). As part of the Hajj rituals, pilgrims travel to different sacred places located around the city of Mecca, including Mina, where they camp during the 5-day period of the Hajj in tents (Fig. 2) in close contact with others; the plain of Arafat for the culminating experience of the Hajj; and Muzdalifah. While not required as part of the Hajj, most pilgrims leave Mecca after a final circumambulation of the Kaaba (*Tawaf al-Wada*), traveling to the city of Medina to visit Islam's second holiest site, the Mosque of the Prophet, which contains Muhammad's tomb.

The presence of a large number of pilgrims from many 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 [1], particularly respiratory diseases [2]. It was reported that the prevalence of respiratory symptoms among a cohort of French pilgrims during the 2012 Hajj was 90%, with cough (83%) and sore throat (78%) as the most commonly reported symptoms [3]. Similarly high prevalences of respiratory symptoms were observed in both Iranian and Malaysian cohorts of pilgrims [4,5]. Respiratory diseases are by far the main reason for consultation among pilgrims attending primary health care centers during the Hajj [6]. In addition,



Fig. 2 The Mina tents.

respiratory diseases are major causes of hospital admission during the Hajj [7], with pneumonia being a leading cause of hospitalization in intensive care units [8]. In a recent study of Indonesian pilgrims, respiratory diseases were found to be the second most common cause of death, immediately after cardiovascular diseases [9]. Respiratory viruses, especially influenza virus, are the main cause of acute respiratory infection (ARI) during the Hajj [10–13]. High prevalences of rhinovirus [3] and *Streptococcus pneumoniae* [14] were found in pilgrims returning from the Hajj, highlighting the potential of pilgrims to spread these infections to their household contacts upon return to their countries of origin. However, although international outbreaks of *Neisseria meningitidis* serogroup W135 occurred in 2001 and 2002 [15,16], no respiratory epidemics linked to the Hajj have been reported to date.

The transmission routes of the most common respiratory viral pathogens are diverse [17], including direct contact between an infected person and healthy individuals, indirect contact with contaminated surfaces, and droplet and airborne transmission at short range. Current evidence indicates that simple physical interventions would be useful for reducing the spread of respiratory viruses [18]. Consequently, in addition to vaccination, non-pharmaceutical interventions are recommended by various national and international public health agencies, including the Saudi Ministry of Health (MoH), the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC), to prevent the spread of infections during the pilgrimage or in the pilgrims' home countries upon their return [19–21]. These measures include maintaining hand hygiene, particularly hand washing with soap and water and the use of hand sanitizer; using disposable tissues when coughing or sneezing and disposing of these tissues in a

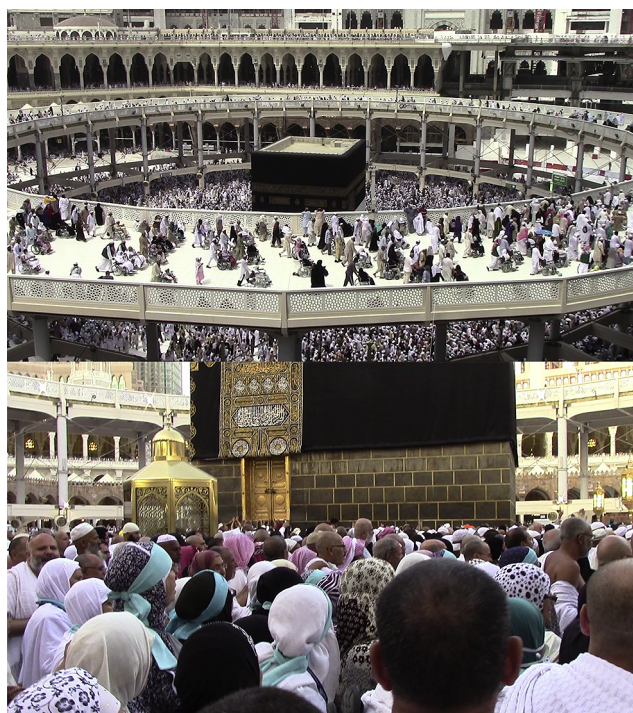


Fig. 1 The circumambulation of the Kaaba (*Tawaf*) in the Grand Mosque in Mecca.

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