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Changes in the prevalence of influenza-like illness and influenza vaccine uptake among Hajj pilgrims: A 10-year retrospective analysis of data

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ABSTRACT

Background: Influenza is an important health hazard among Hajj pilgrims. For the last ten years, pilgrims are being recommended to take influenza vaccine before attending Hajj. Vaccination coverage has increased in recent years, but whether there has been any change in the prevalence of influenza-like illness (ILI) is not known. In this analysis, we examined the changes in the rate of ILI against seasonal influenza vaccine uptake among Hajj pilgrims over the last decade.
Method: Data for this analysis is a synthesis of raw and published data from eleven Hajj seasons between 2005 and 214. For seven Hajj seasons the data were obtained from studies involving pilgrims of UK, Saudi Arabia and Australia; and for the remaining four Hajj seasons data were abstracted from published studies involving pilgrims from multiple countries. The data from both sources were synthesised to estimate the relative risk (RR) of acquisition of ILI in vaccinated versus unvaccinated pilgrims.
Results: The pooled sample size of the included studies was 33,213 with most pilgrims being in the age band of 40–60 years (range: 0.5 to 95 years) and a male to female ratio of 1.6. The pilgrims originated, in order of frequency, from Iran, Australia, France, UK, Saudi Arabia, Indonesia, India, Algeria, Ivory Coast, Nigeria, Somalia, Turkey, Syria, Sierra Leone and USA. Except for one year (2008), data from individual years did not demonstrate a noticeable change in the rate of ILI against influenza vaccine coverage, however the combined data from all studies suggest that the prevalence of ILI decreased among Hajj pilgrims as the vaccine coverage increased over the last decade (RR 0.2, $P < 0.01$).
Conclusion: This analysis suggests that influenza vaccine might be beneficial for Hajj pilgrims. However, controlled trials aided by molecular diagnostic tools could confirm whether such an effect is real or ostensible.

1. Introduction

Influenza is a common yet preventable health hazard among travellers that affects 5% to 15% of febrile travellers returning from subtropical and tropical regions with an incidence of one influenza-associated event per 100 person-months abroad [1–4]. The risk is much higher among attendees of mass gatherings such as Hajj pilgrimage and World Youth Day [5,6]. For instance, three separate influenza outbreaks were reported during World Youth Day 2008 in Sydney; a quarter of influenza cases were caused by oseltamivir-resistant strains [5].

As the world's largest annual mass gathering, Hajj attracts millions of people from all corners of the world in Mecca, Saudi Arabia. The gathering has been taking place on specific days of the Arabic lunar calendar without interruption since 632 AD [7]. Since the lunar calendar is shorter than the Gregorian calendar, Hajj advances each year by 10–12 days, and therefore the event occurs throughout the annual seasonal cycle. Another 5 million Muslims visit Mecca and Medina (another holy city north of Mecca) throughout the year on the minor pilgrimage called 'Umrah'. A complex interplay of severe crowding, communal accommodation, environmental pollution, physical exertion and inadequate personal care occurs during Hajj and Umrah; pilgrimage is associated with an increased risk of both acquisition and transmission of respiratory tract infections (RTIs) [6,8]. A large proportion of pilgrims suffer from at least one respiratory symptom (e.g., cough, sore throat and rhinorrhea) [9,10]. Symptoms of RTIs are the most common medical presentation among pilgrims attending primary health care centres, hospital or outpatient clinics [11]. Pneumonia, including those caused by influenza, is the leading cause of hospital admission and a major contributor of intensive care unit (ICU) admission and mortality among Hajj attendees [12]. Comparative studies have consistently demonstrated that Hajj attendance significantly amplifies the risk of infection with respiratory viruses including influenza, by up to eight times, irrespective of whether Hajj takes place in summer or winter [10,13]. For example, an attack rate of influenza as high as 10% has been reported when Hajj took place in summer in 1992 [14], as well when the event took place during the winter of 2006 [15].

To reduce the risk of transmission of influenza at Hajj, since 2005, the Ministry of Health (MoH), Saudi Arabia has been recommending annual seasonal influenza vaccination for all Hajj pilgrims in general, but those at high-risk of developing severe complications of influenza in particular [16].

Previously influenza vaccine uptake was as low as 0.7% in 2003 [17], but increased following the MoH recommendation, in an impressive, but overall linear fashion reaching about 95% during the 2009 pandemic year and maintaining an acceptable rate of >80% in recent years [18–22].

Most individual studies have failed to demonstrate a significant protective effect of influenza vaccine among Hajj pilgrims [23,24], but a recent meta-analysis of observational studies demonstrated the vaccine to be significantly effective against laboratory-confirmed influenza [25]. However, despite these promising findings (vaccine being effective and the coverage increasing) the prevalence of laboratory confirmed influenza has remained essentially unchanged over the last decades [22].

Nevertheless, the possible association of the prevalence of clinical influenza (i.e., influenza-like illness [ILI]) and influenza vaccination have not been assessed yet. Therefore, in this study, we have evaluated the relationship of influenza vaccine on the prevalence of ILI among Hajj pilgrims based on available data from 2005 to 2014. In the year 2006, two Hajj events took place, the first in January, and the second in December. This data synthesis applies to all eleven Hajj festivals that occurred between 2005 and 2014.

2. Methods

2.1. Data sources

Data for this study originated from two sources. First, for the Hajj seasons 2005, 2006 (January), 2007, and 2011 to 2014, the data derived from studies conducted by our team in the UK, Saudi Arabia or Australia as summarised in Fig. 1. Some of these data, including methodological details, are already published [15,26–29]. We used individual subject data from these studies for this analysis.

For the Hajj festivals in 2006 (December), and 2008 to 2010, a literature search for influenza vaccine at Hajj was conducted which identified eighteen studies; of these four most consistent studies were included based on whether ILI was defined using an identical or matching definition to ours (i.e., as a triad of cough, subjective

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