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The inevitable Hajj cough: Surveillance data in French pilgrims, 2012–2014

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Summary
Background: Respiratory tract infections are the most common infection affecting Hajj pilgrims, and the ``Hajj cough'' is considered by pilgrims almost *de rigueur*.
Methods: French pilgrims were recruited between January 2012–December 2014 and information on demographics, medical history, compliance with preventive measures and health problems during travel were collected.
Results: A total of 382 pilgrims were included with 39.3% aged $\geq$65 years and 55.1% suffering from a chronic disease, most frequently hypertension and diabetes. The prevalence of cough was 80.9% and a high proportion presented with associated sore throat (91.0%), rhinitis (78.7%) and hoarseness (63.0%). Myalgia was reported in 48.3% of cases and subjective fever in 47.3%. The incubation time of respiratory symptoms was 7.7 days (range 0–25 days) and 51.9% of pilgrims presenting with a cough during their stay were still symptomatic on return. Among pilgrims with a cough, 69.4% took antibiotics. The prevalence of cough was significantly higher among females than men, but age, chronic conditions and preventive measures had no significant effect.
Conclusions: The Hajj cough is highly common, likely a result of crowded conditions at religious places. Pilgrims should be advised to carry symptomatic relief for the Hajj cough such as cough suppressant, soothing throat lozenges and paracetamol. Use of antibiotics should be discouraged.

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1. Introduction

Every year around 2–3 million Muslims from over 180 countries arrive in the Kingdom of Saudi Arabia (KSA) for a pilgrimage to the holy places of Islam [1]. The crowded conditions within a confined area in close contact with others leads to a high risk of pilgrims acquiring and spreading infectious diseases during their time in Saudi Arabia [2]. Respiratory tract infections are the most common infections affecting pilgrims [3], and the ``Hajj cough" is considered by pilgrims almost *de rigueur* [4]. Attack rates of respiratory symptoms of about 50–90% have been recorded among pilgrims from various nationalities [5–7]. Early reports from the 1978 Hajj season indicated that upper tract respiratory infections already formed the bulk of the work-load of medical teams attending pilgrims [8]. Recent data indicate that 60% of ill pilgrims consulting at Mina primary health structures suffer respiratory tract infections [9]. Respiratory tract infection is the leading cause of hospitalization in Saudi Hospitals during the Hajj, up to 57% in one study [10]. Pneumonia accounts for 30–40% of hospitalizations in tertiary care structures [10,11] and for 27% of admission in intensive care units where they are responsible for 55% of sepsis [12,13] during the Hajj.

To better characterize the “Hajj cough” symptoms and its outcome, this study provides a clinical description of respiratory symptoms experienced by a cohort of French Hajj pilgrims during three consecutive Hajj seasons.

2. Material and methods

2.1. Participants

Pilgrims who planned to take part in the Hajj were recruited from 2012 through 2014 from a private specialized travel agency in the city of Marseille, which organizes travel to Mecca. Participants were asked to participate in the study on a voluntary basis if they were 18 years of age or older and were able to provide consent.

2.2. Study design

Upon inclusion, the participants were interviewed by Arabic-speaking investigators using a standardized pre-travel questionnaire that collected information on demographics and medical history. A post-travel questionnaire, that collected clinical data, vaccination status, and compliance with preventive measures, was completed during a face-to-face interview just prior to the departure for France. Health problems that occurred during the pilgrims' stay were recorded by a medical doctor who traveled with them. Subjective fever was defined as the pilgrim's report of feeling feverish. Influenza-like illness (ILI) was defined according to the presence of the triad of a cough, sore throat, and subjective fever [14]. The protocol was approved by our Institutional Review Board. It was performed in accordance with the good clinical practices recommended by the Declaration of Helsinki and its amendments. All participants gave written informed consent.

3. Statistical analysis

The Pearson's Chi-square test and Fisher's exact test, as appropriate, were applied to analyze the categorical variables. Statistical analyses were performed using SPSS software package version 17 (SPSS Inc., Chicago, IL). P values of 0.05 or less were considered significant.

4. Results

4.1. Demographics, chronic medical conditions and preventive measures

A total of 382 pilgrims were included over three years (96.5% participation rate) with a sex ratio M/F of 0.61 and a mean age of 60.6 years (range 22–85 years). Thirty-nine point three percent of pilgrims were aged 65 years and over. The majority was born in various countries in North Africa (91.6%) and most of them were first-time pilgrims to the Hajj (73.6%). A chronic disease was noted in 55.1%, including hypertension (30.2%), diabetes (27.5%), chronic cardiac disease (8.4%), chronic respiratory disease (7.6%), immune deficiency (1.3%) and chronic renal disease (0.3%). Thirty-one point six percent of pilgrims declared having received the influenza vaccination in 2012 before participating in the Hajj; however none received the vaccine in 2013 and 2014 as it had not been made available in France before the departure dates. 45.8% of participants reported receiving the 23-valent pneumococcal polysaccharide vaccination (PPSV23; Pneumo 23®) in the past 5 years before participating in the Hajj. Fifty-three point seven percent used face masks during the Hajj, 41.6% washed their hands more frequently than usual, 56.0% used hand sanitizer and 93.4% used disposable tissues.

4.2. Clinical symptoms and use of antibiotics

The prevalence of cough was 80.9% (ranging from 69.8% in 2014 to 86.8% in 2013). Symptoms are depicted in Fig. 1. Dry cough was reported by 59.6% pilgrims and productive cough by 63.8%. Among pilgrims with cough (n = 309) a high proportion presented with associated sore throat (91.0%), rhinitis (78.7%) and voice failure (63.0%). A proportion of 48.3% reported myalgia and 47.3% subjective fever. Forty-six point 2 percent of pilgrims had ILI. Pilgrims with cough had associated dyspnea in 21.0% of cases; gastrointestinal symptoms were less frequently associated including diarrhea (10.0%), nausea (7.9%) and vomiting (4.2%). 11.4% of pilgrims with cough had associated conjunctivitis. The incubation time of respiratory symptoms among pilgrims with Hajj cough was 7.7 days (range 0–25 days) with the majority of pilgrims having onset of symptoms during the first week of stay (58.5%) (Fig. 2). 51.9% of pilgrims presenting with cough during their stay were still symptomatic at the end of their sojourn. Among pilgrims with cough, 69.4% took antibiotics and two (0.7%) were hospitalized.

4.3. Factors affecting the occurrence of cough

The prevalence of cough was significantly higher ($p = 0.005$) among females than men (85.3% vs 73.6%, respectively). Age and chronic conditions had no significant association with the prevalence of cough, pilgrims with chronic respiratory disease showed a slightly increased prevalence of cough. None of the preventive measures were effective in reducing cough prevalence with the exception of influenza vaccine, but the effect was not statistically significant (Table 1).

5. Discussion

Our study has some limitations. First it was only conducted among French pilgrims and included a relatively small

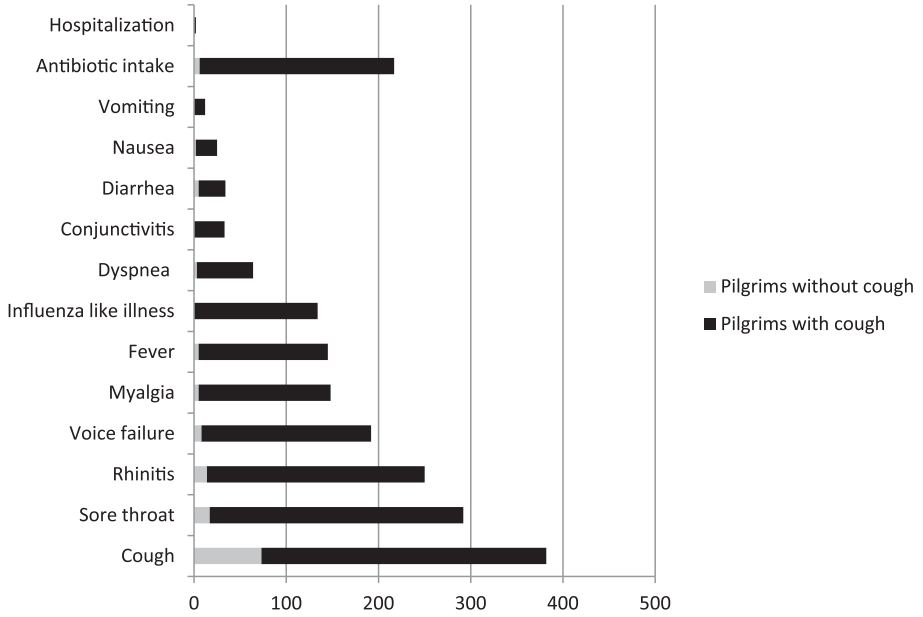

Figure 1 Symptoms associated with cough among French pilgrims during the Hajj 2012–2014.

number of individuals so that our results cannot be extrapolated to all Hajj pilgrims. Second, our clinical description was only based on functional symptoms reported by pilgrims through a questionnaire. It is thus lacking information on clinical signs that could have resulted from physical examination and bias recall may have influenced our results. Nevertheless, we believe that this study provides a useful basic description of the "Hajj cough" which may guide health providers when preparing Hajj pilgrims.

Our survey shows that the "Hajj cough" affected a very high proportion of French pilgrims with an attack rate culminating to 86.8% in 2013. The onset of symptoms was rapid following arrival in Saudi Arabia and persistent symptoms were observed in one out of two pilgrims despite extensive use of antibiotics. The "Hajj cough" affected all individuals independently on their age, comorbidities, vaccination status and use of individual non-pharmaceutical preventive measures against respiratory tract infections. Female were more likely than men to suffer Hajj cough and we have no explanation for this observation. Fortunately, the disease was mild with a low rate of hospitalization and complications. Microbiological studies based on PCR detection in respiratory samples were conducted among same cohorts of French pilgrims in the years 2012 and 2013 before departing from France and just prior to leaving Saudi Arabia [15–20]. We observed a high rate of acquisition of viruses, notably rhinovirus, coronavirus E229 and, influenza virus A (H3N2) to a less extent and of *Streptococcus pneumoniae*. A large study based on the same protocol was conducted in 2013 among pilgrims from different nationalities and confirmed these results. It also showed a significant acquisition of *Haemophilus influenzae* and *Klebsiella pneumoniae* [21]. Sampling at the time of symptoms was conducted in a small subset of French pilgrims in 2012 only and included a restrictive panel of pathogens so that no strong conclusions can be drawn on the role of the respective microbes in the

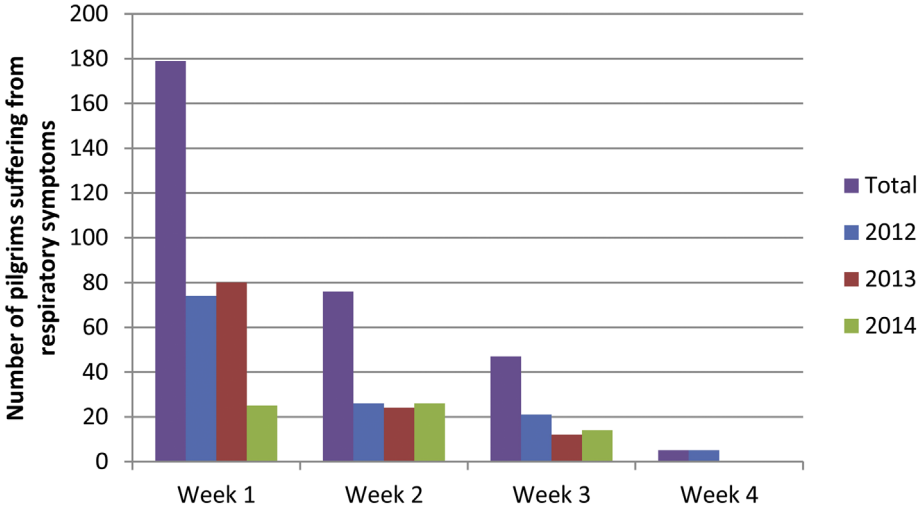

Figure 2 Onset of respiratory symptoms, by week among French pilgrims during the Hajj 2012–2014.

Table 1 Prevalence of cough among pilgrims, according to demographics, chronic medical conditions and preventive measures against respiratory infections.

	Yes	No	p value
Female	85.3	73.6	0.005
Aged 65 years and over	83.9	85.0	0.812
Diabetes	78.9	81.4	0.576
Hypertension	76.5	82.7	0.159
Chronic respiratory disease	93.1	73.8	0.081
Chronic cardiac disease	81.3	80.8	0.951
Chronic renal disease	100.0	80.7	0.625
Immune deficiency	100.0	80.5	0.272
Vaccination against influenza	75.2	82.0	0.135
Vaccination against invasive pneumococcal disease	82.1	77.1	0.278
Use of face mask	81.4	78.4	0.477
Frequently hand washing	82.4	78.8	0.401
Use of hand sanitizer	81.7	77.4	0.310
Use of disposable tissues	81.5	63.3	0.017

pathogeneses of the "Hajj cough". Nevertheless, both clinical and microbiological data indicate that transmission of respiratory pathogens in the context of the Hajj is highly frequent, which is likely the result of overcrowding with a density of 6–8 people per square meter close in certain areas in the Grand Mosque [22]. It is also likely that housing conditions in large collective tents at Mina encampment play a role in the transmission of respiratory viruses [23]. Finally, air pollutants may play a role through their irritant effect since an increase of carbon monoxide, nitrogen dioxide and tropospheric ozone levels is observed during Hajj compared to non-Hajj periods [24]. Physicians must be alert to the circulation of common pathogens at the Hajj, which silently cause much more casualties than the newcomer like Middle-East Respiratory syndrome (MERS) Coronavirus which occupy the forefront of the stage and get all the headlines, despite only 8 Umrah-associated MERS cases over an estimated 20 million pilgrims who visited Mecca from 2012 through 2014 [25,26].

At the moment, none of the usual preventive measures against respiratory tract infection have been proven effective, including vaccination against influenza which is recommended for all Hajj pilgrims by French authorities and vaccination against pneumococcal infections which is recommended for at risk pilgrims suffering chronic conditions and or for those aged 60 years and over [27]. The "Hajj cough" seems therefore inevitable and self-treatment should be provided to pilgrims at pre-travel advice. We suggest symptomatic treatment, using cough suppressants such as dextromethorphan, decongestants to relieve nasal congestion such as phenylephrine and pseudoephedrine, with careful use among patients with hypertension, and paracetamol for symptomatic treatment of fever, myalgia and sore throat. The use of antibiotics is questionable since the respective causality of bacteria and viruses in the pathogenesis of the "Hajj cough" is not fully established. Nevertheless, prescription of antibiotics to Hajj pilgrims suffering mild respiratory symptoms is frequent in local health care structures: 95–99% patients consulting at the Ear, Nose and Throat clinic of a Hospital in Mecca were prescribed antibiotics while 85–92% presented with upper tract respiratory infection including pharyngitis and tonsillitis [28,29]. Similarly, patients consulting at various primary health care centers in Mina found that 54% patients were prescribed antibiotics while 61% suffered respiratory tract infection with pharyngitis and the common cold the most frequent [9]. A cohort survey conducted among Iranian pilgrims in 2007 showed that 84% experienced respiratory symptoms and that 72% took antibiotics [30]. In a cohort survey conducted among Indonesian pilgrims, 63% suffered ILI during their stay in the KSA, of which 94% took antibiotics that were mostly obtained over the counter [31]. A recent cohort survey showed that 35% pilgrims from Australia used antibiotics during their stay, the main reason being upper respiratory tract infection. Thirty percent obtained antibiotics from a local pharmacy without prescription and 48% pre-emptively carried an antibiotic with them from Australia [32]. The apparent overall overuse of antibiotics by pilgrims is of concern with regards to the development of drug resistance. In this context, the development of point-of-care diagnostic tests would further enhance the ability to differentiate bacterial from viral infections and so decrease antibiotic use [33].

6. Conclusions

The Hajj cough is highly common, likely a result of crowded conditions at religious places. It affects all individuals independently of their age, comorbidities, vaccination status and use of classical, individual, non-pharmaceutical preventive measures against respiratory tract infections including hand hygiene, use of face mask use and social distancing which effectiveness at the Hajj has been poorly investigated [34]. Clinical symptoms are non severe, with few hospitalizations necessary and symptomatic treatment should be prescribed with attempts to reduce antibiotic use in non-severe low-risk cases, unless there is evidence of bacterial infection.

Conflict of interest

None.

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