

Acute respiratory viral infections among *Tamattu'* Hajj pilgrims in Iran

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ABSTRACT: Respiratory infections are among some common health difficulties which may occur in journeys. *Tamattu'* Hajj, an annual congregation of more than 2 million (including 100000 Iranian) pilgrims from all over the world, embodies circumstances, e. g. close contact, shared sleeping accommodations and the dense air pollution, which potentially facilitate airborne respiratory disease transmission. With pilgrims' returning home, respiratory infections may be spread to different countries, leading to considerable expenditures imposed mainly on National Health Systems. Thus, this study was conducted to investigate acute respiratory viral infections among Hajj pilgrims. In this descriptive-analytical study, serum samples were taken from 338 Iranian pilgrims in order to be investigated, through enzyme-linked immunosorbent assay (ELISA), for antibodies to given viruses. 84 % of studied pilgrims, during their journey, presented with symptoms of infectious diseases, among which Adenoviruses (23.7%) occurred more prevalently compared to the other two viruses of concern, i. e., Influenza (3.6%) and RSV (7.4%). Several factors are involved in rate and type of acute respiratory infections among Hajj pilgrims. Despite high rate of infection with Influenza and Adenoviruses, since massive gatherings may help all pathogenic respiratory agents cause pandemics, other infectious agents should be seriously addressed as well.

[Dr. Reza Imani, Dr. Ali Karimi and Dr. Roya Habibian. **Acute respiratory viral infections among *Tamattu'* Hajj pilgrims in Iran.** *Life Sci J* 2013;10(3s):449-453]. (ISSN: 1097-8135). <http://www.lifesciencesite.com>. 69

Keywords: Hajj, Respiratory tract infections, RSV, Adenoviruses, Influenza

INTRODUCTION

Respiratory tract infection refers to a number of infectious diseases involving respiratory tract, which is further classified into two categories, upper respiratory tract infection (URI or URTI) and lower respiratory tract infection (LRI or LRTI) (1).

Acute upper respiratory tract infection is a common illness during Hajj and responsible, within this period, for more than half of admissions to hospitals in Saudi Arabia (2-4).

Diagnosis and treatment of pneumonia in a crowded situation is a medical challenge requiring quick decision making and awareness of its origin. In 2003, pneumonia was the most important cause of hospital admissions during Hajj (accounting for 39%); and the second cause of ICU admissions

(responsible for 22%) (5, 6), with a reported mortality of 17% (7).

Viruses primarily infecting the respiratory tract include influenza, adenoviruses, parainfluenza viruses, respiratory syncytial virus (RSV), coronaviruses, human metapneumovirus, rhinoviruses and enteroviruses (8, 9). RSV belongs to the family Paramyxoviridae and the genus Pneumovirus (3). Respiratory syncytial virus, a prevalent respiratory viral pathogen in elderly people(10), was shown to cause 1-3% new respiratory illnesses in symptomatic international Hajj pilgrims (11). Adenoviruses are an important reason for disease of upper and lower respiratory tract, with types 1, 2, 3, 5 and 7 accounting for about 85% of all infections (12). Adenovirus infections occur worldwide and their transmission varies from

sporadic to epidemic. Because of being stable, Adenoviruses can be easily transmitted in the environment (13). Influenza is caused by a virus that mainly attacks the upper respiratory tract (nose, throat, bronchi, and rarely the lungs) (14, 15). Regarding that 6% of pilgrims with URTI have influenza, nearly 24,000 pilgrims might annually acquire influenza infections during the Hajj (11). In Rashid et al.'s study, influenza A was responsible for 56.7% of the confirmed cases followed by RSV (24%) and influenza B accounted for 18.9% (16).

Because of their worldwide occurrence, ease of spread in the community and considerable morbidity and mortality, respiratory virus infections represent an important public health issue (17). On the other hand, respiratory involvements continue to threaten Hajj pilgrims, showing inadequate efficacy of vaccination measures against influenza and the potential role of other pathogens (18).

Surprisingly, while 90% of Iranian pilgrims (2005, total number: 100000) were vaccinated against influenza, 80% of them suffered from respiratory involvements (19). Mortality from respiratory virus infections in healthy individuals in developed countries is rare (8). However, since global congregations such as the Hajj pilgrimage provide an opportunity for viral infections to be easily transmitted to different regions of the world, probably imposing stupendous health burdens on pilgrims' own societies, the present study investigates acute viral respiratory infections, through enzyme-linked immunosorbent assay (ELISA), among Greater Hajj (2007-2008) pilgrims of Chaharmahal va Bakhtiari province, Iran, to provide a crude estimate of these infections.

PATIENTS AND METHODS

With coordination of Hajj and Pilgrimage Organization of Chaharmahal va Bakhtiari province, 338 Greater (*Tamattu'*) Hajj pilgrims (2007-2008) were enrolled for this descriptive-analytical study. Pilgrims were eligible if they were originally from and resident of the Province. In case of not providing informed consent and lack of access, e. g. death, they were excluded from the study.

Two serum samples were taken from each pilgrim prior to departure and after returning home and were kept, following isolation, at -70°C . Then, three separate total serologic tests were performed using enzyme-linked immunosorbent assay (ELISA) to investigate three viruses (Influenza, Adenoviruses, and RSV) respective IgG antibodies.

In addition, pilgrims' medical profile and clinical signs and symptoms, e.g. cough, fever, sore throat, etc., were obtained through questionnaire. A

checklist including demographics, disease symptoms, and drugs taken and given antibodies' titers was developed to collect each pilgrim's data; the obtained data was analyzed by means of *t* test and *t*-paired (SPSS software, version 11.5).

RESULTS

In the present study, 338 Greater Hajj (2006-2007) pilgrims were investigated for respiratory infections. After reviewing questionnaires and examining pilgrims, 284 (84%) pilgrims were identified with respiratory diseases' signs and symptoms and the rest ($n=54$, 16%) presented no signs and symptoms.

Among pilgrims investigated, cough (84.3%), hoarseness (64.6%) and sore throat (62%) were found to be the most prevalent respiratory signs and symptoms. In addition, rhinorea (54.2%), wheezing (53.3%), headache (44.1%), myalgia (38.4%), fever (36.4%), dyspnea (22.2%), nausea (7.9%), diarrhea (4.9%) as well as vomiting (1.9%) comprised other clinical signs and symptoms observed.

As illustrated, Pharyngitis (18.9%) is the most prevalent symptom detected among these pilgrims.

Given the results, 68.8%, 7.2%, and 24% patients had normal, less than ($T<37^{\circ}\text{C}$) and higher than ($T>38^{\circ}\text{C}$) normal body temperature, respectively.

According to the results, 199 (83.6%) examined patients were given analgesics. Furthermore, antibiotic, Dexamethasone and antihistamine were prescribed for 173 (77.2%), 119 (59.8%) and 186 (78.8%) of subjects, respectively. Also, 198 (69.7%) of 284 pilgrims were delivered vaccine and the rest were not. Regarding the data, 22 (7.7%) pilgrims had pre-Hajj history of respiratory diseases.

The mean IgG Influenza Antibody titer for all pilgrims was 1.14 ± 0.37 and 1.16 ± 0.48 before departing and after returning, respectively. *t*-paired indicated that the difference between these two rates is not significant ($p>0.05$). Also, the given rates for contracted pilgrims (patients) before departing and after returning were 1.15 ± 0.39 and 1.14 ± 0.51 , respectively, indicative of no significant difference based on *t*-paired ($p>0.05$). In non-patient group, also, antibody titer, before departing and after returning, was 1.1 ± 0.3 and 1.2 ± 0.37 , respectively. No significant difference, in this case, was observed ($p>0.05$). (Table 1)

Meanwhile, 12 (3.6%) pilgrims were, according to changes in titer of IgG antibody to influenza, infected with influenza virus.

The results obtained indicated 80 (23.7%) pilgrims had antibodies to adenoviruses.

Examining IgG and IgM antibodies' titer suggested that 25 (7.4%) pilgrims were infected with Respiratory Syncytial Virus.

DISCUSSION

This study performed to examine acute viral respiratory infections among Greater Hajj (2007-2008) pilgrims of Chaharmahal va Bakhtiari province, Iran, found a rate of 84% for respiratory signs and symptoms. Despite numerous medical preparations by Saudi Government and other nations, viral respiratory tract infections particularly Influenza are so common that more than half of pilgrims contract respiratory diseases during the Hajj, (11, 20) which is somehow compatible with the rate we obtained for respiratory signs and symptoms and indicative of the potential inadequacy of medical efforts conducted for both protection of pilgrims and prevention of infectious diseases from being transmitted to different countries (20).

However, respiratory viruses in a study were detected in about one third (32.5%) of pilgrims' nasal wash samples, while influenza, Adenovirus and RSV, by culture and immunofluorescent staining, were observed in 9.8%, 5.4% and 1.6% of the patients, respectively, (21) which is not in line with our findings. Having isolated 54 viruses from 500 symptomatic pilgrims, Balkhy et al. also obtained results (50% for influenza B and 5.5% for influenza A) in contrast to ours and found a high prevalence for Influenza in upper respiratory infections (11).

On the other hand, throat swabs of 761 patients with infected upper respiratory tract were positive for viral pathogens in 152 (20%), with highest rates for influenza A and Adenovirus (22), relatively consistent with this study. Our findings are also partly confirmed by El Sheikh et al.'s study that offered influenza A and Adenovirus as predominant viruses after the pattern of virus prevalence was investigated in identical pilgrimage seasons of 1991 and 1992 (23).

In addition, of the Influenza-positive cases 29% (8/28) had recently been immunized against influenza. However, Influenza was more common in those who had contact with a pilgrim suffering from a respiratory illness compared to those who did not (17% versus 9%) and the overall rate obtained for RSV was 4% (9/202), (16) highlighting the necessity of re-examining health arrangements made, largely collaboratively, by different countries in order to ensure the pilgrims' as well as the whole nation's health both during and after the Hajj.

Furthermore, the most prevalent sign among British Hajj pilgrims, according to a study, was sore throat (72%) followed by cough (68%), which is to some extent in agreement with our subjects' perceptions but inconsistent with our findings given rate of viral agents such as rhinovirus (13%) and Influenza (10%) (15). Alborzi et al. in terms of symptoms such as cough with the highest prevalence (83.5%), achieved results relatively similar with those obtained here (21).

Since influenza vaccine based on statistics could not immunize Hajj pilgrims against respiratory infections efficiently, (16, 19) potential emergence of new drift strains in addition to inappropriate vaccine management, including delivery and maintenance, should be more carefully considered. Consequently, it seems logical to seek for Influenza strains with a potential difference from the vaccine strains (21).

Accordingly, other preventive measures should also be more seriously addressed. For example CDC- and WHO-recommended protective behaviors, such as contact avoidance, social distancing and hand hygiene, during the Hajj contributed to reduced occurrence and duration of respiratory illness during and after the Hajj (24, 25).

In conclusion, the comprehensive immunization of pilgrims against Influenza, if supplemented by a confirmed vaccine for Adenoviruses, could comprise a much more efficacious effort targeted at reducing respiratory diseases rate. In addition, no unique etiologic agent seems to be involved in respiratory diseases, not to mention other potential causative factors, e. g. smoking, seasonality, alcohol, vaccination, age, underlying diseases, etc.

ACKNOWLEDGEMENT

We would like to thank Research and Technology Department of ShahreKord University of Medical Sciences for giving a grant (No: 560) for this paper and Cellular and Molecular Research Center for helping us.

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Table I. Mean and Standard Deviation of IgG influenza antibody before departure and after return

	Before departure	after return	P-value
All pilgrims	0.37 ± 1.14	0.48 ± 1.16	0.86
Patients	0.39 ± 1.15	0.51 ± 1.14	0.93
Non- Patients	0.3 ± 1.1	0.37 ± 1.2	0.19