

Respiratory Tract Infections and its Preventive Measures among Hajj Pilgrims, 2010: A Nested Case Control Study

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ABSTRACT

Background: Respiratory tract infections are very common among the Hajj pilgrims. Some preventive measures including Influenza vaccination, using face mask and salt water gargling have been considered to control these infections and the reports show conflicting results about the effects of each one of these measures. This study is trying to assess the effects of these recommendations on respiratory tract infections.

Methods: According to nested case-control design, in a cohort consisting of 338 Iranian pilgrims, the outcome examined, was all types of respiratory tract infections other than common colds. With occurrence of any patient in convoy, data collection form was completed for that person. On the same day, two people were randomly selected as control group from among pilgrims who have not affected so far.

Results: During Hajj, 32 pilgrims (9.5%) were affected by respiratory tract infections other than common colds. In univariable logistic regression analysis, salt water gargling (OR = 2.4, $P = 0.08$), existence of other patient in the room (OR = 2.14, $P = 0.19$), age over 60 years (OR = 1.84, $P = 0.15$) and the education more than or equal to 3 years (OR = 1.93, $P = 0.16$) were effective in the respiratory tract infections ($P < 0.2$). However, multivariable logistic regression analysis showed that none of the above mentioned factors are significantly associated with these infections.

Conclusions: This study showed that measures such as seasonal influenza vaccination, use of face masks and personal prayer carpet have no effect on the incidence of respiratory tract infections. However, washing throat and mouth with salt water can be considered the most effective preventive measures.

Keywords: Common cold, Hajj, Iran, logistic models, prevention, control

INTRODUCTION

Annually, more than 2.5 million Muslims from about 140 countries go on the Hajj pilgrimage, which is the largest mass gathering in the world.^[1] The presence of such a vast number of

people in the holy places, especially in the cities of Mecca and Medina, and the massive pilgrim crowds in certain places at certain times, causes infectious diseases to spread more easily. Racial, cultural and health differences, as well as the level of access to health, medical and welfare services at the time of stay in these places are important factors that increase the risk of communicable diseases.^[1]

Both, viral or bacterial respiratory tract infections are very common among pilgrims in all age and sex groups,^[1] and is regarded as the most common disease among pilgrims in some reports.^[2,3] Some studies have also reported the prevalence of different types of these infections up to 85.3%.^[4] To prevent these infections, some preventive measures have been recommended for the pilgrims,^[1,5,6] such as mandatory injection of tetravalent meningococcal meningitis vaccine, recommendation to inject seasonal flu vaccine, and using surgical masks. On the other hand, each country plans and implements some specific measures to prevent and control these diseases among pilgrims. More than 100,000 Iranians in about 600 caravans undertook the Hajj in 2010. According to the current policies of the Hajj Medical Center of Iran, before traveling any caravan, a physician examines the pilgrims and convoys in that caravan during the trip. Common diseases detected among pilgrims are treated in the caravan itself, or referred to the medical center, if needed.

The reports show conflicting results about the effects of preventive measures^[5,7-9] for respiratory tract infections and in fact, a precise study on the effects of each one of these preventive measures has been rarely done.

This research is trying to examine the effects of general preventive measures on respiratory tract infections through a nested case-control study, which is more precise design than ordinary case-control studies.^[10]

METHODS

Design

We used nested case-control design, which is based on risk set sampling. The studied cohort consist two caravans (338 pilgrims), one of which was the first to enter Mecca, and the other the first

to enter Medina. The outcome of this study was all types of respiratory tract infections other than the common cold including tonsillitis, pharyngitis, laryngitis, sinusitis, otitis media, bronchitis, pneumonia and Influenza. These patients usually required oral or intravenous antibiotics in addition to symptomatic treatment. All patients recognized in a clinically basis. As soon as any patient in the caravans was identified, a data collection form was completed for that individual. Considering that the level of presence in Saudi Arabia and the amount of contact with all types of viruses and bacteria are regarded as risk, on the day of identifying each patient, two pilgrims in the same caravan were randomly selected as control group. Each control pilgrim was not affected by the mentioned outcome at the time of investigation, although these pilgrims may be enrolled as a case in future days. Thus, two controls were selected for each case.

Definition and measures

Every pilgrim who become ill with studied disease and had consent to participate, was enrolled in the study. All pilgrims who did not get the studied disease at time of selection and had consent to participate, could be enrolled as controls.

Body mass index (BMI) is calculated by dividing the weight in kilograms to height square in meter. If another patient with studied disease existed in the same room then the pilgrim considered as having "room contact". Room area defined as per capita area of pilgrim's room. The mean of times spent by pilgrims in Masjedonnaby and Masjedolharam were considered as "mean daily presence in holy places". If the pilgrims used face masks in crowding, even occasionally were considered as "using face mask". Pilgrims considered as vaccinated against influenza if they vaccinated by this vaccine since two years before traveling to Saudi Arabia. Pilgrims, who washed their mouth and throat with salt water at least once a day, were considered as having "salt water gargling". Pilgrims with a past history of at least one systemic diseases including Asthma, Diabetes mellitus, Hypertension, COPD and cardiovascular diseases were considered as having "systemic diseases". Present or past smoker with any type and amount of smoking were considered as smokers. If the pilgrims used personal prayer carpet in holy places were considered as "using personal prayer carpet".

Statistical analysis

The data were evaluated using conditional logistic regression by STATA software. The effect of each preventive measure on the occurrence of respiratory tract infections was studied through a univariable model. At the next stage, all variables which were significant in the first stage ($P < 0.2$), were entered into the multiple models, and the Adjusted Odds Ratio was obtained for each one of the variables.

RESULTS

During the Hajj pilgrimage, 32 people (9.5%) of the cohort (338 pilgrims) were affected by respiratory tract infections. According to the explained method, 63 members of the cohort were selected as controls. Description of cases and controls, in terms of age, sex, education and other factors which influence the incidence of respiratory tract infections, are presented in Table 1.

Sixty nine percent of the patients were treated with symptomatic treatment and oral antibiotics, and 27.5% required treatment through intravenous antibiotics as well. In addition, 79.3% of the patients fully recovered through the treatment administered in the caravan, but 17.2% were referred to the Hajj Medical Center, and finally 3.4% of the total patients were hospitalized in that center.

Univariable logistic regression analysis showed that among the variables studied, only gargling with salt water, presence of other patients in the room, age and level of education, have $P < 0.2$ and can be associated with respiratory tract infections. Among these variables, gargling with salt water with OR = 2.4 and $P = 0.08$ had the strongest relationship [Table 2].

The multivariable logistic regression model showed that none of the factors listed above were significantly associated with the outcome being studied. For example, presence of the other patient in the room increases the risk of outcome by 2.67 times, but this effect is not significant, according to the confidence intervals of OR [Table 2].

DISCUSSION

This study showed that respiratory tract infections have considerable prevalence among the pilgrims. These results are similar to that of the other studies on Iranian pilgrims.^[4] The

Table 1: Distribution of factors affecting respiratory tract infections in Hajj Pilgrims, 2010

Variables	Controls (%)	Cases (%)	P value
Sex			0.517
Female	28 (44.4)	12 (37.5)	
Male	35 (55.6)	20 (62.5)	
Age			0.125
<60	38 (60.3)	14 (43.8)	
≥60	25 (39.7)	18 (56.2)	
Education (year)			0.139
>2	45 (71.4)	18 (56.3)	
0-2	18 (28.6)	14 (43.7)	
Room contact			0.228
No	52 (82.5)	23 (71.9)	
Yes	11 (17.5)	9 (28.1)	
Room area			0.712
>4 m ²	18 (28.6)	8 (25.0)	
0-4 m ²	45 (71.4)	24 (75.0)	
Mean daily presence in holy places			0.661
0-2 h	10 (15.9)	4 (12.5)	
≥3 h	53 (84.1)	28 (87.5)	
BMI (kg/m ²)			0.828
<30	50 (79.4)	26 (81.3)	
≥30	13 (20.6)	6 (18.7)	
Face mask usage			0.425
Yes	36 (57.1)	21 (65.6)	
No	27 (42.9)	11 (34.4)	
Influenza vaccination			0.898
Vaccinated	48 (76.2)	24 (75.0)	
Not vaccinated	15 (23.8)	8 (25.0)	
Salt water gargling			0.082
Yes	31 (50.0)	10 (31.2)	
No	31 (50.0)	22 (68.8)	
Systemic diseases			0.513
No	34 (54.0)	15 (46.9)	
Yes	29 (46.0)	17 (53.1)	
Smoking			0.713
No	56 (88.9)	30 (93.8)	
Yes	7 (11.1)	2 (6.2)	
Personal prayer carpet			0.293
Yes	46 (73.0)	20 (62.5)	
No	17 (27.0)	12 (37.5)	

results also showed that the current preventive measures including wearing face masks, seasonal flu vaccination, and use of personal prayer carpet were not effective enough in the prevention of these infections. However, the seasonal flu vaccination has been recommended, especially in high-risk

Table 2: The role of protective measures and other individual factors on respiratory tract infections among Hajj Pilgrims, 2010

Independent variables	Cases and controls No. (%)	Crude odds ratio (95% CI) ^a	P value	Adjusted odds ratio (95% CI) ^b	P value
Sex					
Female	40 (42.11)	1	-		
Male	55 (57.89)	1.31 (0.56-3.05)	0.53		
Age					
<60	52 (54.74)	1	-	1	-
≥60	43 (45.26)	1.84 (0.80-4.21)	0.15	1.64 (0.60-4.48)	0.33
Education (Year)					
>2	63 (66.32)	1	-	1	-
0-2	32 (33.68)	1.93 (0.77-4.81)	0.16	1.24 (0.42-3.70)	0.69
Room contact					
No	75 (78.95)	1	-	1	-
Yes	20 (21.05)	2.14 (0.68-6.7)	0.19	2.67 (0.78-9.15)	0.12
Room area					
>4 m ²	26 (27.37)	1	-		
0-4 m ²	69 (72.63)	1.29 (0.37-4.49)	0.68		
Mean daily presence in holy places					
0-2 h	14 (14.74)	1	-		
≥3 h	81 (85.26)	1.27 (0.38-4.22)	0.70		
BMI (kg/m ²)					
<30	76 (80.00)	1	-		
≥30	19 (20.00)	0.92 (0.34-2.48)	0.87		
Mask usage					
Yes	57 (60)	1	-		
No	38 (40)	0.64 (0.23-1.78)	0.39		
Influenza vaccination					
Vaccinated		1	-		
Not vaccinated		1.09 (0.41-2.88)	0.87		
Salt water gargling					
Yes	41 (43.62)	1	-	1	-
No	53 (56.38)	2.40 (0.89-6.47)	0.08	2.30 (0.79-6.74)	0.13
Systemic diseases					
No	49 (51.58)	1	-		
Yes	46 (38.95)	1.29 (0.55-3.04)	0.56		
Smoking					
No	86 (90.53)	1	-		
Yes	9 (9.47)	0.54 (0.10-2.79)	0.46		
Personal prayer carpet					
Yes	66 (69.47)	1	-		
No	29 (30.53)	1.70 (0.61-4.70)	0.31		

^aUnivariable conditional logistic regression, ^bMultivariable conditional logistic regression, CI=Confidence intervals

individuals or those over 65 years of age.^[5,11,12] The influenza vaccine has been proved by other researchers to have no effect in the prevention of respiratory infections,^[8,13,14] and it has even been seen that the use of seasonal influenza vaccine prolongs the period of sore throat.^[7] However, methodological problems of the studies

and the applied methods, including laboratory or demographic studies, should be considered when comparing these results. It should also be noted that recommendations to take a seasonal influenza vaccine is due to its preventive effect on the incidence of flu and reduction of the risk of pandemic swine flu.

Other studies, like the results of this study, have shown that wearing face masks has no effect on respiratory infections.^[7,15] Although the CDC does not recommend wearing it,^[5] the Saudi Ministry of Health recommends that pilgrims wear face masks.^[11,16] The recommendation to wear masks is probably because of its role in the prevention of tuberculosis,^[6] which has not been studied among the pilgrims. The effect of using a personal prayer carpet has not been studied in other reports. Probably, the close contact of the pilgrims with each other, and their presence in crowded places are the main causes for transmission of respiratory infections, so it hinders a possible protective role played by the personal prayer carpet. No similar study has been conducted on the usage of salt water gargling. Although, the effect of this action on the prevention of respiratory infections was not significant in the multiple logistic model, it seems that the reason for it is the relatively small sample size in the study. In other words, through studies with a larger sample size, it may be concluded that lack of gargling with salt water increases the risk of respiratory infections by 2.3 times. Similarly, it can be said that staying with other patients in the same room increases the risk of respiratory infections by 2.67 times.

As can be seen in Table 2, factors such as age, sex, level of education, area of the room, smoking, systemic diseases, obesity, and the average daily hours of gathering together in the holy places have no effect on respiratory tract infections. In other words, any age and sex group with different individual conditions is likely to get exposed to viral and bacterial causes of these infections.

As mentioned above, the relatively small sample size is one of the limitations of this study. An increase in the sample size would make it possible to study the role of factors associated with respiratory infections in any of the holy places (Mecca, Medina, Mina, etc.). In this study, the cases were of those who were diagnosed clinically by a caravan physician. If the rapid test diagnosis is applied along with the acceptable sensitivity and specificity to diagnose cases, the accuracy of the study will increase.

CONCLUSIONS

Flu vaccinations wearing face masks, personal prayer carpet, smoking, obesity, etc., do not affect

the incidence of respiratory infections during the Hajj, and if this study is to be undertaken with a larger sample size, according to the appropriate selected methodology, some evidence will be obtained showing the prophylactic effect of gargling with salt water in the prevention of these infections.

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