

ORIGINAL ARTICLE

The impact of preventive measures on acute illnesses among pilgrims during Hajj season

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ABSTRACT

Background: Hajj is an annual religious ritual that takes place for a specific period in Makkah city. Every year, the Kingdom of Saudi Arabia hosts more than two million pilgrims from more than 160 countries around the world for Hajj. It is crucial to minimize illnesses among pilgrims. This study aimed to assess the impact of preventive measures on acute illnesses among pilgrims.

Methods: A retrospective cross-sectional study was conducted during the Hajj season from August to September 2019. A random sample was extracted from electronic evaluation forms filled by professional health care workers at two airports in Saudi Arabia including pilgrims before their departure and after the end of hajj season.

Results: The study included 2,479 pilgrims. The most frequently associated comorbidity was Diabetes Mellitus in 49.54%. Upper respiratory tract infection was found in 39.17% and was the most common illness reported. Comorbidities had a crude odds ratio (OR) of 2.67 with a *p*-value of 0.000 and an adjusted OR of 2.80 with *p*-value of 0.000. The pre-Hajj examination had an OR of 0.37 with a *p*-value 0.000 that remained significant even after adjusting age and gender. Hajj health education had a crude OR of 0.17 with a significant *p*-value of 0.000 and adjusted OR 0.39 with *p*-value 0.003.

Conclusion: Based on the current observation, strict compliance with standard pre-Hajj clinical examination, health education, and the use of umbrella during Hajj seasons is recommended to reduce the impact of acute illness among pilgrims.

Keywords: Hajj, preventive measures, health education, chronic diseases, mass gatherings.

Introduction

For many years, mass gatherings for religious, sports, and cultural events have posed a risk for many recorded hazards [1]. This has led to improved planning of mass gathering events and imposing risk assessment tools to minimize the spread of communicable diseases, stampedes, and many other non-infectious hazards [2-4].

In the southwest part of Asia, the Arabian Peninsula, a religious mass gathering (Hajj) is performed annually by pilgrims that come across the globe in the city of Makkah, Kingdom of Saudi Arabia (KSA). Every year, KSA hosts more than two million pilgrims from more than 160 countries worldwide to perform Hajj rituals [5]. During these rituals, pilgrims travel from one Holy site

to another demanding a tremendous form of physical activity leaving those with pre-existing illnesses and comorbidities at high risk of poor outcomes [6,7].

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Annually, these events require extensive planning and coordination by many governmental sectors to ensure a safe Hajj experience for the pilgrims [8,9]. Over the years, the Saudi Ministry of Health provided high-quality health services for all Hajj pilgrims without any charge. By allocating more than 25 hospitals, and more than 155 permanent and seasonal health centers that were devoted for providing different levels of medical care, during Hajj every year [10].

Although several studies were conducted in the past few years to determine the pattern of diseases among pilgrims, most of these studies were hospitals based and documented the pattern of hospital admission among Hajj pilgrims [11-13]. Therefore, this study aimed to determine the impact of preventive measures on acute illnesses among pilgrims during Hajj season 2019 to guide the optimal allocation of health resources and services during future Hajj seasons.

Subjects and Methods

A retrospective cross-sectional study was conducted during the Hajj season (1440) in the period from August to September 2019. A systematic random sampling technique was used to recruit pilgrims after the end of the Hajj season from the two main airports (King Abdul Aziz Airport- in Jeddah city and Prince Mohammed bin Abdulaziz International Airport in Madinah city). All pilgrims were included, and no one was excluded.

The sample size was calculated using the Raosoft sample size calculator. The population size was estimated at 2,500,000 pilgrims, confidence level set at 95%, margin of error at 2%, and the response distribution at 50%. Therefore, the calculated sample size was 2,399 pilgrims [14]. Data were extracted from a standardized electronic evaluation form that was used to collect data from the pilgrims by trained health care workers. This form contained socio-demographic variables (age, gender, marital status, and level of education), comorbidities, presence of acute illnesses, and preventive measures (pre-hajj health examination, health education, and the use of umbrella). Data were then entered into electronic sheets by two professional data collectors and any discrepancies were solved by the primary investigator.

Care was taken to maintain data confidentiality by securing electronic sheets with strong passwords and only restricting access to data collectors after signing confidentiality agreement forms. Pre-Hajj examination was defined as a detailed clinical history, physical examination, diagnostic workup, and management given to pilgrims before Hajj rituals whether in the country of origin or when arriving at KSA [15]. Health education was defined as all forms of health education about Hajj rituals whether in the country of origin or when arriving at KSA including food safety, avoiding heat exhaustion, preventing infectious diseases, required vaccinations, and others [15].

Comorbidities were classified based on the International Classification of Diseases, Revision 10 diagnostic codes [16]. The primary outcome of this study was the impact of preventive measures on acute illnesses among pilgrims.

Descriptive statistics were used to describe categorical variables that were presented by counts and percentages. In contrast, continuous variables were presented as means and standard deviations when data were normal or as medians and interquartile ranges otherwise.

Univariable and multivariable logistic regression models after adjusting for age and gender were used to obtain the crude and the adjusted odds ratio (OR) and their associated 95% confidence interval (CI) for the demographic data, comorbidities, and preventive measures with outcome of interest. All percentages were rounded to one decimal place. The statistical significance was set at a *p*-value of < 0.05. The analysis was done using statistical package for the social sciences 24 (IBM-SPSS-24).

Results

The study included 2,479 pilgrims from the two main airports in KSA before their departure after the end of the Hajj season. Age distribution in years was as follows: 0.1% (*n* = 3) were 18 and less, 6% (*n* = 147) were between 18-30 years, 46.1% (*n* = 1,143) were between 31-50 years, 32.7% (*n* = 811) were between 51-64 years, 14.9% (*n* = 370) were 65 years and above. Males represented 58.3% (*n* = 1,446) of the sample, whereas females represented 41.7% (*n* = 1,033). The education level among pilgrims showed that only 22.4% (*n* = 555) were highly educated compared to 15.0% (*n* = 371) who were illiterate (Table 1).

Out of the total sample, 39.6% (*n* = 981) reported comorbidities. The most common associated comorbidities out of the total number of pilgrims with comorbidities were diabetes mellitus in 49.54% (*n* = 486), hypertension in 40.16% (*n* = 394), osteoarthritis in 13.76% (*n* = 135), and many others (Figure 1).

Among Hajj pilgrims, 45.4% (*n* = 1,126) reported the presence of acute illnesses during Hajj season 2019. The most commonly reported illnesses out of the total number of pilgrims with the presence of acute illnesses were; upper respiratory tract infection 39.17% (*n* = 441), followed by hypertension 21.75% (*n* = 245), gastroenteritis 16.25% (*n* = 183), and others (Table 2).

Preventive measures among Hajj pilgrims' season 2019 included: pre-Hajj health examination 95.4% (*n* = 2,364), health education 96.7% (*n* = 2,396), and umbrella use 83.7% (*n* = 2,074) (Table 3).

The reason for not using the umbrella by pilgrims varied widely; 5.9% (*n* = 24) thought that it affects the religious reward for Hajj, 25% (*n* = 101) thought they did not need it, 29.4% (*n* = 119) could not provide it, 23% (*n* = 93) constantly forgot it, 13.3% (*n* = 54) had a nonfunctioning umbrella, and 3.4% (*n* = 14) had missing data (Figure 2).

Several variables were explored using univariate and multivariate logistic regression after adjusting for age and gender with the outcome of interest. Crude and adjusted OR were calculated for age and gender 0.91 and 1.04, respectively, with no significant *p*-value.

Gender had an OR of 1.39 with a significant *p*-value of 0.001 that remained significant after adjusting for age. Comorbidities had a crude OR of 2.67 with *p*-value

Table 1. Frequency distribution of sociodemographic variables among Hajj pilgrims season 2019.

Variables	Category (N = 2,479)	Frequency	Percent
Age (N = 2,474)	<18	3	0.1
	18-30	147	6
	31-50	1,143	46.1
	51-64	811	32.7
	≥65	370	14.9
Gender	Males	1,446	58.3
	Females	1,033	41.7
Marital status	Single	270	10.9
	Married	2,196	88.6
	Missing	13	0.5
Educational level	Illiterate	371	15.0
	Primary	710	28.6
	Secondary	843	34.0
	University	555	22.4

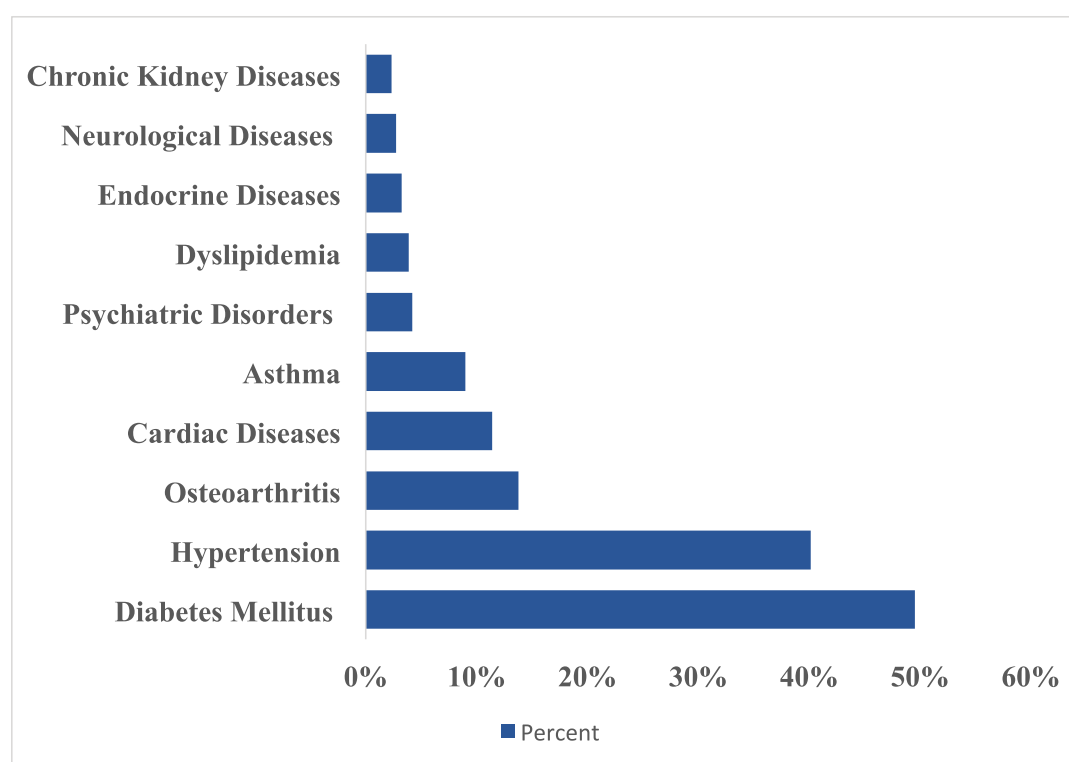


Figure 1. Comorbidities associated with Hajj pilgrims season 2019.

of 0.000 and an adjusted OR of 2.80 with p -value of 0.000. The pre-Hajj examination had an OR of 0.37 with a p -value of 0.000 that remained significant even after adjusting for age and gender p -value of 0.000. Hajj health education had a crude OR of 0.17 with a significant p -value of 0.000 and adjusted OR 0.39 with p -value of 0.003 (Table 4).

Discussion

This study was conducted to address the impact of preventive measures on the presence of acute illnesses among Hajj pilgrims during season 2019. Although age had no significance in the logistic regression analysis,

nearly 78.8% of pilgrims were in the age group between 31 and 64 years. Moreover, this age group was also considered to be the most frequent among Hajj pilgrims in previous studies as the physical demand required during Hajj and the strict selection criteria of Hajj pilgrims from different countries led to this age groups to be more frequent [15,17,18]. Gender had a significant crude and adjusted OR supported with previous reports, Hajj statistics, and population statistics confirming the current findings that male pilgrims 58.3% were more frequent than the opposite gender [5,13,19,20]. Addressing the educational level is of utmost importance in abiding to preventive measures and health instructions to prevent illnesses during Hajj season. Surprisingly, only 22.4%

Table 2. Presence of acute illnesses among Hajj pilgrims season 2019.

Variables	Category (N = 1,126)	Frequency	Percent
Heat exhaustion	Yes	181	16.07
	No	945	83.93
Gastroenteritis	Yes	183	16.25
	No	943	83.75
Anxiety/Depression	Yes	55	4.88
	No	1,071	95.12
Presyncope/Syncope	Yes	69	6
	No	1,057	94
Upper respiratory tract infection	Yes	441	39.17
	No	685	60.83
Asthma attacks	Yes	49	4.35
	No	1,077	95.65
Trauma	Yes	30	2.66
	No	1,096	97.34
Skin rash/exfoliation	Yes	39	3.46
	No	1,087	96.54
Hyperglycemia/Hypoglycemia	Yes	181	16.07
	No	945	83.93
Hypertension	Yes	245	21.75
	No	881	78.25
Cardiac chest pain	Yes	51	4.52
	No	1,075	95.48
Convulsions/Epileptic seizures	Yes	17	1.51
	No	1,109	98.49
Mental setbacks: anxiety/depression/panic attacks	Yes	27	2.40
	No	1,099	97.60

Table 3. Preventive measures among Hajj pilgrims season 2019.

Variables	Category (N = 2,479)	Frequency	Percent
Pre-Hajj health examination	Yes	2,364	95.4
	No	115	4.6
Health education	Yes	2,396	96.7
	No	83	3.3
Source of health education	Leaflets	450	18.2
	Newspaper	187	7.5
	Hajj booklet	193	7.8
	TV	79	3.2
	Radio	72	2.9
	Internet	79	3.2
	Lectures	1,403	56.6
	Missing	16	0.6
Umbrella use	Yes	2,074	83.7
	No	405	16.3

of Hajj pilgrims had a high level of education although matching a previous report yet it puts pressure on concerned authorities to apply more efforts in providing health education for Hajj pilgrims with less level of education [15,18]. The current study reported that 39.6% of the studied pilgrims were suffering from one or more comorbidities with a significant crude OR 2.67 which

was similar to a previous study around 40% [21]. The most commonly associated comorbidities were diabetes mellitus (49.54%) and hypertension (40.16%) followed by osteoarthritis (13.76%). More or less similar results were reported by previous studies [21,22].

The present study recorded that 45.4% of the studied participants developed illnesses during Hajj season,

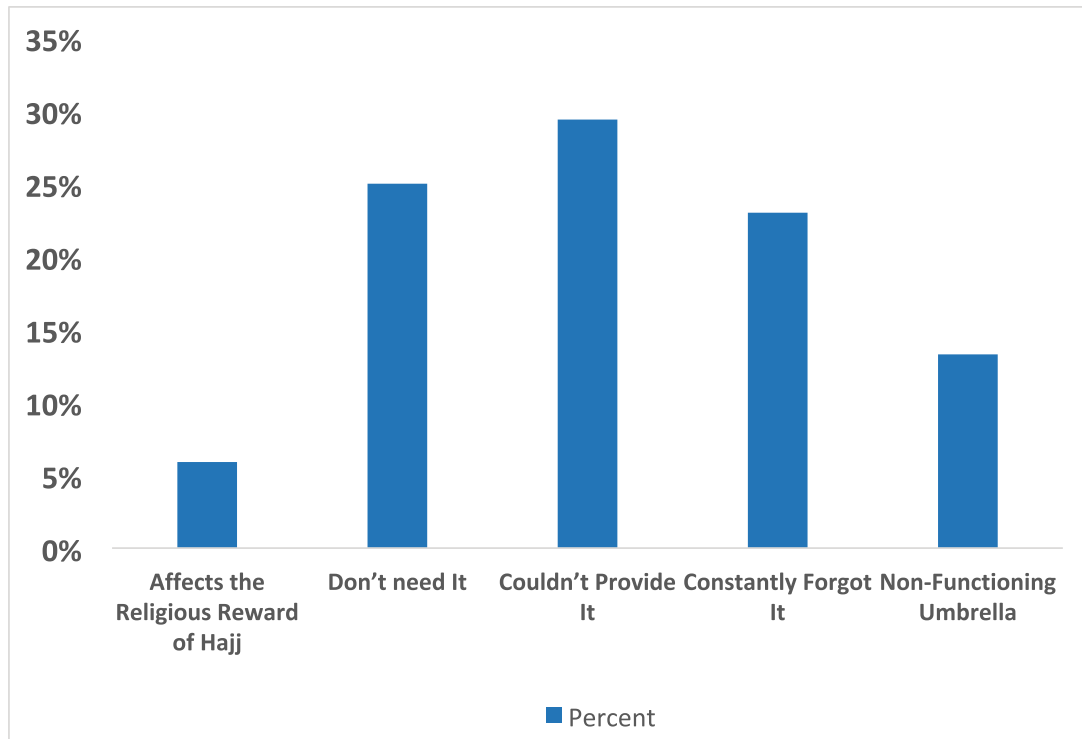


Figure 2. Reasons for not using umbrella by Hajj pilgrims' season 2019.

Table 4. Univariable and multivariable logistic regression of demographic data, comorbidities, and preventive measures among Hajj pilgrims' season 2019.

Variables	Univariable		Multivariable	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age	0.91 (0.83-1.00)	0.058	1.04 (0.93-1.16)	0.452
Gender	1.39 (1.11-1.53)	0.001	1.39 (1.16-1.66)	0.000
Comorbidities	2.67 (2.26-3.15)	0.000	2.80 (2.34-3.37)	0.000
Pre- Hajj examination	0.37 (0.32-0.44)	0.000	0.39 (0.33-0.47)	0.000
Hajj health education	0.17 (0.09-0.031)	0.000	0.39 (0.21-0.73)	0.003
Source of health education	1.06 (1.03-1.09)	0.000	1.01 (0.98-1.05)	0.476
Educational level	1.08 (0.99-1.17)	0.058	1.06 (0.96-1.16)	0.226
Umbrella use	0.68 (0.55-0.85)	0.000	0.81 (0.64-1.03)	0.083
Marital status	1.5 (1.13-1.88)	0.004	1.25 (0.94-1.66)	0.116

most commonly upper respiratory tract infection, as many factors contributed to the transmission of communicable diseases whether airborne or droplet agents among pilgrims including; physical exhaustion, extreme heat, and extended stays at Hajj sites with the close contact among pilgrims [7,11,13,22]. Hypertension and gastroenteritis were other common illnesses among pilgrims confirming that cardiovascular and infectious diseases were common illnesses among pilgrims as reported by previous reports and necessary measures should be taken to screen for such illnesses [6,13]. Moreover, illnesses like heat exhaustion, trauma, and skin exfoliation were illnesses reported among pilgrims in previous Hajj seasons [11,23].

It was found in the present study that the pre-Hajj examination was a significant factor affecting the impact of the occurrence of illnesses during the Hajj season with

the group who received pre-Hajj examination (95.4%), were less likely to develop illness during Hajj season (OR = 0.37%, 95% CI = 0.32-0.44). These findings matched with previous reports addressing the importance of standardizing protocols to examine pilgrims before Hajj rituals and mandating detailed clinical history, physical examination, lab workup, and treating illnesses before arriving for Hajj [18,22,24].

Nevertheless, Hajj health education is of same importance to prevent illnesses during Hajj with a crude OR 0.17 and a p-value of 0.000. Nearly 96.7% of pilgrims had some form of health education before starting Hajj rituals which was slightly more compared to a previous study around 95.8% in 2018 whether in the country of origin, when reaching points of entry in the KSA, during the stay in Makkah and Madinah, or self-health education [21]. The targeted material for

health education includes knowledge about preventive measures such as hand hygiene, wearing a facemask, cough etiquette, and social distancing to prevent the transmission of communicable diseases [11,15]. It also involves basic knowledge about food safety, heat exhaustion and umbrella use, required vaccinations, and means of trauma and stampedes prevention [15,18,25].

The umbrella is commonly used as a preventive measure against certain illnesses during Hajj seasons. A recent study showed that almost 55% of Hajj pilgrims used a solar umbrella regularly during Hajj rituals [18]. The current study elaborated more than one reasons for not using an umbrella and its role in preventing illnesses during Hajj season, 83.7% of pilgrims used the umbrella and 16.3% did not. It had a significant crude with an OR of 0.68 but became insignificant after adjusting for age and gender which might indicate that the crude OR was biased. Furthermore, the most common two reasons for not using the umbrella during Hajj were that they could not provide it, or they did not need it. Solving these issues by enhancing Hajj campaigns for each country to provide umbrellas for their pilgrims during Hajj season and increasing the awareness of its importance in preventing certain illnesses such as heat exhaustion and heatstroke.

Comprehensive pre-Hajj examination, health education programs, and umbrella use during Hajj are strategic preventive measures that should be planned for all those who intended to perform Hajj to avoid illnesses among pilgrims. Further cohort studies were recommended during future Hajj seasons to address other preventive measures' impact on illnesses among pilgrims.

This study addressed the most effective preventive measures on illnesses among Hajj pilgrims but not without any limitations. First, the study design was cross-sectional with all its limitations as a study design. Second, many variables were missing such as lab results and radiological imaging that could have added to the value of this study. Third, this study targeted two airports during data collection and further data could have been extracted from different points of entry.

Conclusion

Comprehensive pre-Hajj examination, health education programs, and umbrella use during Hajj were strategic preventive measures that should be planned for all those who intended to perform Hajj to avoid illnesses among pilgrims. Various concerned national and international entities are required to unify Hajj protocols to ensure a safe Hajj season every year. The implementation of standardized pre-Hajj examination for pilgrims from their original countries, diverse health education materials, and promoting the use of umbrella during Hajj season could significantly prevent illnesses among pilgrims during Hajj.

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Conflict of interests

The authors declare that there is no conflict of interest regarding the publication of this article.

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Consent to participate

Written informed consent was obtained from all the participants.

Ethical approval

Ethical approval was granted from the King Abdul Aziz Airport-Islamic Port, Prince Mohammed bin Abdul-Aziz International Airport and Ethical Committee of the Research (IRB No. 20-0532) dated: 20 Dec 2020.

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