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ORIGINAL ARTICLE

Medical convoy: interfacility transfer of hospitalized patients during Hajj season 2019

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ABSTRACT

Background: Millions of Muslims gather annually in Makkah, Saudi Arabia, for pilgrimage (the Hajj). Some medical conditions need specialized care involving transfer outside the hospital. However, providing health care to emergency cases in such unparalleled mass gatherings is challenging. This study aimed to describe the medical conditions of patients transferred by the medical convoy team in well-equipped ambulances to Arafah in Makkah during the Hajj season in 2019.

Methods: Patients' data were extracted via a standardized electronic evaluation form. The treating physicians made the primary diagnoses in the admitting secondary or tertiary healthcare facilities.

Results: Of the 274 transferred patients, 36.1% were older adults (>60 years), 55.8% were men, 59.9% were Asian, and 36.4% were African. The primary diagnoses were cardiovascular diseases (26.7%), fractures (16.1%), respiratory diseases (15.3%), gastrointestinal diseases (12.8%), skin infections (10.3%), metabolic diseases (4.7%), neurological or psychiatric diseases (4.7%), and urogenital diseases (3.6%). Older adults comprised 50.0% of those with respiratory diseases, 46.2% of those with metabolic diseases, 37.1% of those with gastrointestinal diseases, 34.1% of those with fractures, 32.9% of those with cardiovascular diseases, and 30% of those with urogenital diseases.

Conclusions: Cardiovascular, respiratory, metabolic, and gastrointestinal diseases, as well as fractures, contributed to most of the transferred medical conditions transported in the medical convoy in Makkah during the 2019 Hajj season. Older adults were more than a third of the transferred patients.

Keywords: Hajj, mass gatherings, healthcare, EMS, convoy.

Introduction

To fulfill patients' wishes to complete Hajj rituals, assure their safety, and provide the best evidence-based practice available, the Ministry of Health in Saudi Arabia annually organizes a medical convoy to transfer admitted pilgrims from hospitals and cities to Arafat. This allows the completion of Hajj pillars while providing optimal health care [1]. The Hajj, the annual Islamic pilgrimage to Makkah, is Islam's fifth and final pillar. It is one of the largest mass gatherings in the world, with millions of Muslims from different countries converging in one place (2.4 million pilgrims from 196 countries). With so many people in close proximity, the risk of infectious disease spread is high [2]. In addition, the physical demands of the Hajj, such as walking long distances and exposure to extreme heat, can pose health risks [3,4].

One of the most significant health risks during the Hajj is the potential spread of respiratory diseases, such as influenza and pneumonia. Congested environments and

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close contact with other pilgrims can facilitate the spread of these diseases [5–8]. In addition, the risk of heat-related illnesses, such as heat exhaustion and heatstroke, is high due to the extreme temperatures in the region [9–11]. Another major health concern during the Hajj is the risk of food- and water-borne diseases. Pilgrims are also at risk of injuries and fractures, particularly during the stoning ritual in Mina, where crowds can become chaotic and accidents may occur [9,10].

For socioeconomic reasons, older adults represent a significant proportion of pilgrims. They are vulnerable to developing complications from chronic medical conditions. Among these, cardiovascular diseases are the major cause of mortality among pilgrims [12].

Although most medical conditions can be treated on the spot at healthcare facilities across different sites where the Hajj rituals are held, others require admitting the pilgrim. To complete their rituals, many are transferred by the medical convoy in well-equipped, highly organized ambulances from various sites to Arafat. This convoy includes a specialized medical team consisting of doctors, nurses, and paramedics, in addition to five standby ambulances, an intensive-care ambulance, an integrated oxygen cabin, a mobile first-aid workshop, and a bus for transporting patient companions. This study aimed to describe the medical conditions of patients transferred to perform the Hajj pillars in Makkah during the 2019 Hajj season.

Methods

This descriptive cross-sectional study included patients transferred from Makkah hospitals by the medical convoy to Arafat during the 2019 Hajj season. The medical convoy is a unique service provided by Saudi Arabia to patients. This service uses specification guides with inclusion criteria for patients' safety and continuous healthcare services (Box 1). Patients' data were extracted via a standardized electronic evaluation form used to collect data from the pilgrims by trained healthcare workers from the medical convoy. This form included data about age, gender, nationality, primary diagnosis, and comorbidities. The treating physicians made the primary diagnoses in the secondary or tertiary healthcare facilities where the patients were admitted.

The study inclusion criteria were all pilgrims admitted to Makkah hospitals. The exclusion criteria were intubated patients, clinically unstable patients who scored 7 or more based on the National Early Warning Score, patients using more than one inotrope medication, and patients needing isolation or contact precautions.

Quantitative data were presented as median and interquartile range. Categorical data were presented as frequency and percentage and analyzed using the Chi-square test or Fisher's exact test when appropriate. A two-tailed p-value of <0.05 was considered statistically significant. Odds ratios with 95% confidence intervals (CIs) were calculated to identify the predictive factors associated with comorbidities. The statistical analysis used SPSS version 28 (IBM Company, Armonk, NY).

***Box 1.** Summary of medical instructions to patients transferred by medical convoy*

- The transfer procedure will be explained to the patient or family (informed consent).
- Pretransfer assessment will be done by the inpatient admitting team.
- Patients will be assessed and prepared for transport.
- The medical team for each transferred patient includes EMS, nurse, and physician.
- The transport physician will take an appropriate handover from the admitting service physician.
- The accompanying personnel depends on the nature of the underlying illness, comorbidities, level of dependency, and risk of deterioration during transfers:
  - Intensivists
  - Emergency specialists.
- Vital signs and mental status will be assessed and recorded as indicated by the patient's condition during transportation.
- Ongoing reassessment will occur throughout transport.
- Any significant changes in the patient's condition during transport must be reported to the transport medical director. This includes but is not limited to:
  - Deviation from the patient's normal vital signs
  - Signs of respiratory distress
  - Mental status changes
  - Cardiac dysrhythmias.
- Bedside assessment with the transferring nurse or RT will include:
  - Assessment of IV site
  - Patency of line
  - Confirmation of IV fluid rates
  - Confirmation of correct medication, dose, and infusion rate
  - Inspection of IV site during transfer for signs of infiltration.

***Table 1.** Demographic data of patients (n = 274).*

	N	%
Age (years)		
≤40	32	11.7
41–50	42	15.3
51–60	101	36.9
>60	99	36.1
Median (interquartile range)	60 (50–66)	
Gender		
Male	153	55.8
Female	121	44.2
Nationality		
African	63	23.0
Asian	152	55.5
Middle Eastern	50	18.2
Others	9	3.3

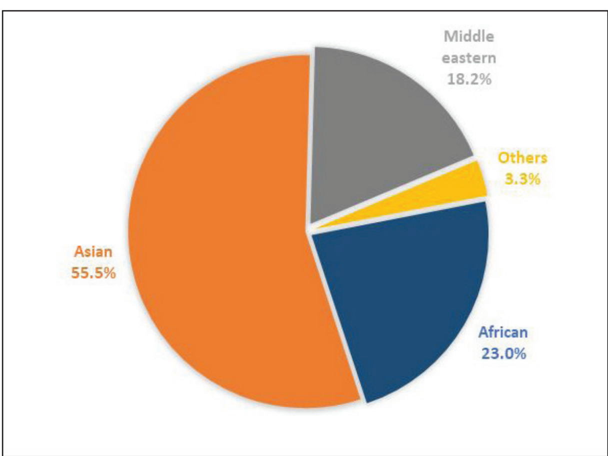

***Figure 1.** Nationality of patients.*

Results

This study included 274 transferred patients during the 2019 Hajj season, with a slight male predominance (55.8%), as shown in Table 1. More than one third of patients (36.1%) were over the age of 60 years. Figure 1 illustrates the most prevalent nationalities among the studied patients were Asian (55.5%), followed by African (23%) and Middle Eastern (18.2%).

Table 2 and Figure 2 show that the most frequent primary diagnoses among the studied patients were cardiovascular diseases (26.3%), respiratory diseases (18.2%), fractures (15.7%), and gastrointestinal diseases (14.6%).

As presented in Table 3, more than half of the patients (57.7%) had comorbidities. These were diabetes mellitus in approximately one third of all patients (32.5%), hypertension in 25.5%, congestive heart failure in 4.4%, chronic renal failure in 2.6%, cerebral vascular accident and chronic obstructive pulmonary disease in 2.2% each, and chronic kidney disease and asthma in 1.8% each.

Table 2. *Diagnosis at admission (n = 274).*

Diagnosis	*N*	%
Cardiovascular diseases	72	26.3
Respiratory diseases	50	18.2
Fractures	43	15.7
Gastrointestinal diseases	40	14.6
Skin and subcutaneous tissue diseases	18	6.6
Neurological diseases	13	4.7
Mental disorders	10	3.6
Endocrine and metabolic diseases	7	2.6
Genitourinary diseases	6	2.2
Unspecified symptoms and signs	6	2.2
Infectious diseases	3	1.1
Hematological diseases	3	1.1
Malignant neoplasms	3	1.1

Table 3. *Comorbidities of patients (n = 274).*

Comorbidities	*N*	%
No	116	42.3
Yes	158	57.7
DM	89	32.5
HTN	70	25.5
CHF	12	4.4
CRF	7	2.6
CVA	6	2.2
COPD	6	2.2
CKD	5	1.8
Asthma	5	1.8
Schizophrenia	4	1.5
Cardiomyopathy	2	0.7
Bipolar disorder	2	0.7
IHD	1	0.4
Oral neoplasm	1	0.4
Metabolic disorder, unspecified	1	0.4
Renal transplant	1	0.4
Anemia	1	0.4
SVT	1	0.4
Thyroid disease	1	0.4
Sickle cell disease	1	0.4

DM: Diabetes mellitus, HTN: Hypertension, CHF: Congestive heart failure, CRF: Chronic renal failure (dependent on dialysis), CVA: Cerebral vascular accident, COPD: Chronic obstructive pulmonary disease, CKD: Chronic kidney disease, IHD: Ischemic heart disease, SVT: Supraventricular tachycardia.

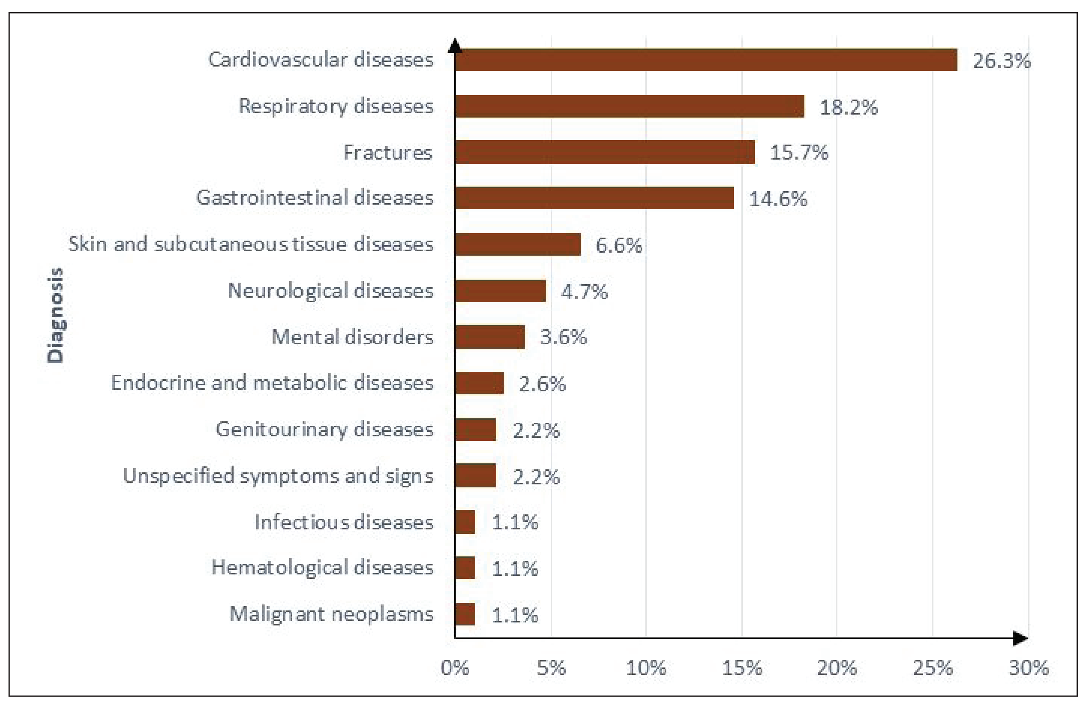

Figure 2. *Diagnoses of patients at admission.*

Table 4. *Association between patient age and comorbidities.*

	Age (years)		*p* value	OR (95% CI)
	≤60 (*n* = 175)	>60[#] (*n* = 99)		
No	69 (39.4%)	47 (47.5%)	0.195	1.39 (0.84 to 2.28)
Yes	106 (60.6%)	52 (52.5%)		
DM	61 (34.9%)	28 (28.3%)	0.264	1.36 (0.79 to 2.32)
HTN	44 (25.1%)	26 (26.3%)	0.838	0.94 (0.54 to 1.66)
CHF	7 (4%)	5 (5.1%)	0.762	0.78 (0.24 to 2.54)
CRF	3 (1.7%)	4 (4%)	0.258	0.414 (0.09 to 1.89)
CVA	5 (2.9%)	1 (1%)	0.423	2.88 (0.33 to 25.03)
COPD	3 (1.7%)	3 (3%)	0.671	0.56 (0.11 to 2.82)
CKD	4 (2.3%)	1 (1%)	0.657	2.29 (0.25 to 20.8)
Asthma	3 (1.7%)	2 (2%)	>0.999	0.85 (0.14 to 5.15)
Schizophrenia	4 (2.3%)	0 (0%)	0.3	5.22 (0.28 to 98)
Cardiomyopathy	2 (1.1%)	0 (0%)	0.537	2.87 (0.14 to 60.33)
Bipolar disorder	2 (1.1%)	0 (0%)	0.537	2.87 (0.14 to 60.33)
IHD	0 (0%)	1 (1%)	0.361	0.19 (0.01 to 4.64)
Oral neoplasm	1 (0.6%)	0 (0%)	>0.999	1.71 (0.07 to 42.39)
Metabolic disorder, unspecified	0 (0%)	1 (1%)	0.361	0.19 (0.01 to 4.64)
Renal transplant	1 (0.6%)	0 (0%)	>0.999	1.71 (0.07 to 42.39)
Anemia	1 (0.6%)	0 (0%)	>0.999	1.71 (0.07 to 42.39)
SVT	0 (0%)	1 (1%)	0.361	0.19 (0.01 to 4.64)
Thyroid disease	0 (0%)	1 (1%)	0.361	0.19 (0.01 to 4.64)
Sickle cell disease	1 (0.6%)	0 (0%)	>0.999	1.71 (0.07 to 42.39)

[#]Reference category, OR: Odds ratio, CI: Confidence interval, Statistical significance at $p < 0.05$.

DM: Diabetes mellitus, HTN: Hypertension, CHF: Congestive heart failure, CRF: Chronic renal failure (dependent on dialysis), CVA: Cerebral vascular accident, COPD: Chronic obstructive pulmonary disease, CKD: Chronic kidney disease, IHD: Ischemic heart disease, SVT: Supraventricular tachycardia.

No statistically significant association existed between the age of the studied patients and any comorbidities, as shown in Table 4 and Figure 3.

Table 5 shows that the prevalence of diabetes mellitus was significantly lower in male patients compared to female patients (26.8% *vs.* 39.7%, $p = 0.024$), with significantly lower odds (OR = 0.56, 95% CI: 0.33 to 0.93). In contrast, male patients had significantly higher rates than female patients of chronic obstructive pulmonary disease (3.9% *vs.* 0%, $p = 0.036$).

Discussion

Transferring hospitalized pilgrims who need specialized care has long been challenging (13). The medical convoy is a new experience all around the world that allows hospitalized patients to attend mass gathering events at a specific time. It allows hospital services outside the hospital for up to 24 hours.

This cross-sectional study described the patients transferred by the medical convoy in well-equipped ambulances to complete their Hajj rituals in Arafat during the 2019 Hajj season [13,14]. Cardiovascular, respiratory, metabolic, and gastrointestinal diseases and fractures represented the most-transferred medical conditions. In addition, over one third of the transferred patients were older than 60 years, highlighting the importance of specialized geriatric care. The most prevalent nationalities among the studied patients were Asian (55%), followed by African (23%) and Middle Eastern (18%).

Previous studies have reported various communicable and non-communicable diseases related to mass gathering events. For example, respiratory illnesses are common during such events due to the proximity of people and the large crowds [15]. Infectious agents such as influenza, coronavirus, and other respiratory viruses can quickly spread from person to person [16]. In addition, gastrointestinal infections such as those causing diarrhea and vomiting are common during mass gatherings due to contaminated food or water or poor hygiene practices [17,18]. Furthermore, skin infections such as impetigo and fungal infections can be spread during the Hajj due to crowded conditions and poor hygiene [9,19–22].

Previous studies have not specified the medical conditions of patients transported in the medical convoy. This study illustrates the conditions of patients who were successfully transferred and stayed for hours in well-equipped health beds, helping similar future medical journeys in mass gathering events. The most common primary diagnoses were cardiovascular disease (26.3%), respiratory disease (18.2%), fractures (15.7%), and gastrointestinal disease (14.6%).

The combination of high temperatures and strenuous physical activity experienced during the Hajj rituals can result in heat exhaustion and dehydration, particularly among older persons, individuals with chronic diseases, and vulnerable individuals [23]. Various measures have been implemented to reduce the risk of cardiovascular diseases among Hajj pilgrims, including providing medical screening and health education before and during the pilgrimage and promoting physical fitness and a healthy lifestyle [24]. Accidents and fractures are also common during mass gathering events [25]. Fractures in older adults from minor injuries or falls indicate a high probability of osteoporosis [26,27]. Hip and vertebral compression fractures are commonly related to osteoporosis [28,29]. In addition, Hajj rituals involve extended periods of standing, walking, and physical exertion, which can lead to musculoskeletal injuries such as strains, sprains, and fractures. Early detection and management can reduce the risk of osteoporotic-related fractures [30] and mitigate the socioeconomic effects of long-term disability [31].

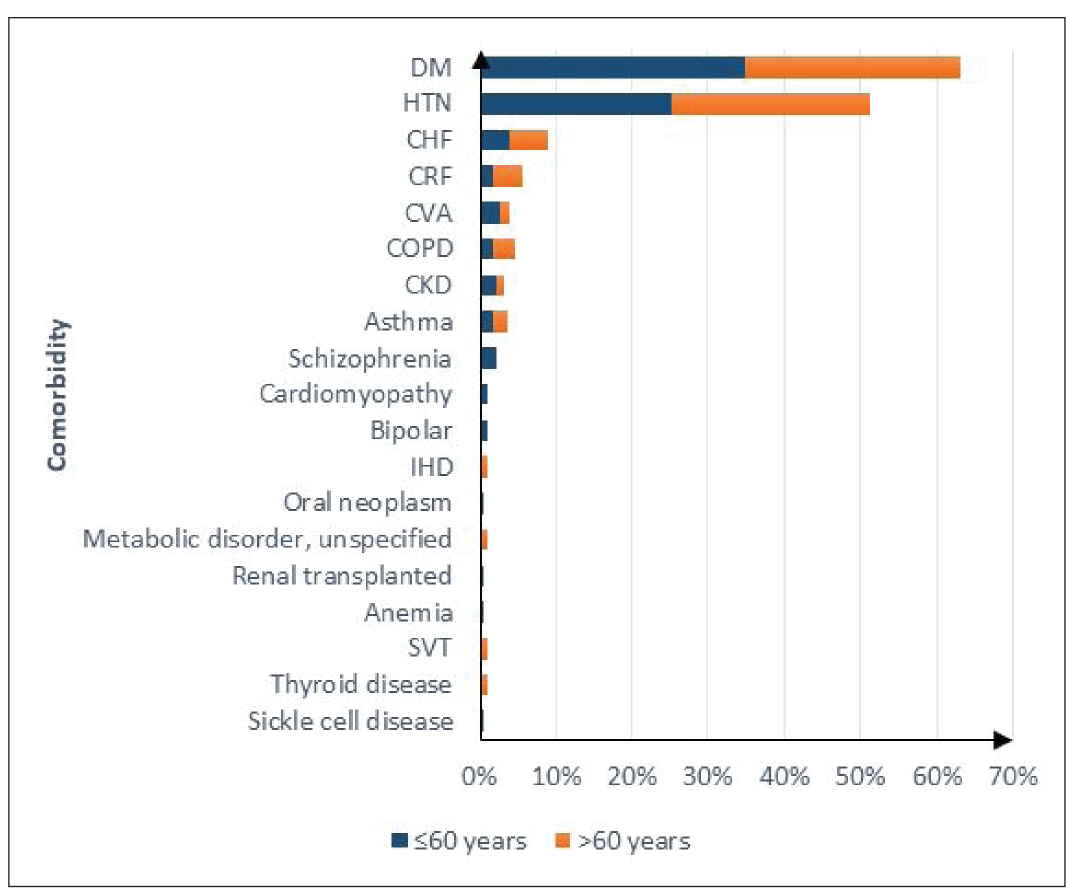

Figure 3. *Comorbidities according to age.*

Table 5. *Association between gender and comorbidities.*

	Gender		*p*-value	OR (95% CI)
	Male (n = 153)	Female[#] (n = 121)		
No	71 (46.4%)	45 (37.2%)	0.125	0.68 (0.42 to 1.11)
Yes	82 (53.6%)	76 (62.8%)		
DM	41 (26.8%)	48 (39.7%)	0.024	0.56 (0.33 to 0.93)
HTN	38 (24.8%)	32 (26.4%)	0.762	0.92 (0.53 to 1.59)
CHF	9 (5.9%)	3 (2.5%)	0.172	2.46 (0.65 to 9.29)
CRF	4 (2.6%)	3 (2.5%)	>0.999	1.06 (0.23 to 4.81)
CVA	4 (2.6%)	2 (1.7%)	0.697	1.6 (0.29 to 8.87)
COPD	6 (3.9%)	0 (0%)	0.036	10.71 (0.6 to 192.01)
CKD	1 (0.7%)	4 (3.3%)	0.174	0.19 (0.02 to 1.74)
Asthma	4 (2.6%)	1 (0.8%)	0.338	3.22 (0.36 to 29.2)
Schizophrenia	2 (1.3%)	2 (1.7%)	>0.999	0.79 (0.11 to 5.68)
Cardiomyopathy	0 (0%)	2 (1.7%)	0.194	0.16 (0.01 to 3.27)
Bipolar disorder	0 (0%)	2 (1.7%)	0.194	0.16 (0.01 to 3.27)
IHD	0 (0%)	1 (0.8%)	0.442	0.26 (0.01 to 6.48)
Oral neoplasm	1 (0.7%)	0 (0%)	>0.999	2.39 (0.1 to 59.2)
Metabolic disorder, unspecified	1 (0.7%)	0 (0%)	>0.999	2.39 (0.1 to 59.2)
Renal transplant	0 (0%)	1 (0.8%)	0.442	0.26 (0.01 to 6.48)
Anemia	0 (0%)	1 (0.8%)	0.442	0.26 (0.01 to 6.48)
SVT	1 (0.7%)	0 (0%)	>0.999	2.39 (0.1 to 59.2)
Thyroid disease	0 (0%)	1 (0.8%)	0.442	0.26 (0.01 to 6.48)
Sickle cell disease	1 (0.7%)	0 (0%)	>0.999	2.39 (0.1 to 59.2)

[#]Reference category, OR: Odds ratio, CI: Confidence interval, Statistical significance at $p < 0.05$.

DM: Diabetes mellitus, HTN: Hypertension, CHF: Congestive heart failure, CRF: Chronic renal failure (dependent on dialysis), CVA: Cerebral vascular accident, COPD: Chronic obstructive pulmonary disease, CKD: Chronic kidney disease, IHD: Ischemic heart disease, SVT: Supraventricular tachycardia.

Over a third of the transferred patients were older adults above 60 years old, with a male predominance of 55.8%. Older adults are considered among the most vulnerable populations during the Hajj. Since the Hajj rituals in 2019 took place in August, when temperatures in Makkah soared above 40°C, older adults were at higher risk of major heat-related illnesses due to age-related changes in the body's ability to regulate temperature. They are also at a higher risk of cardiovascular diseases, especially during physical exertion and stress. In addition, the Hajj attracts pilgrims from worldwide, increasing the risk of exposure to infectious diseases such as upper and lower respiratory tract infections [32]. Older adults are at a higher risk of developing complications from respiratory infections [33]. They are also more susceptible to dehydration due to decreased thirst sensation and kidney function [34]. Inadequate hydration can lead to cardiovascular and renal diseases [35,36]. In this study, more than half of the patients had comorbidities, including diabetes mellitus in approximately one third of patients, followed by hypertension in 25.5% and congestive heart failure in 4.4%.

Mass gatherings can be a physically and emotionally challenging experience: some people may feel overwhelmed by the crowds and unfamiliar surroundings. In addition, the stress of the pilgrimage can exacerbate existing mental health conditions [9,37]. Thus, older adults must consult their healthcare providers before embarking on the Hajj and take appropriate precautions to minimize the risk of health complications.

This study has some limitations to be considered. At first, we had no data about other sociodemographic characteristics that might have affected the incidence of certain diseases. In addition, the data about comorbidities was patient-reported, making them vulnerable to report and recall bias.

In conclusion, the medical convoy experience has demonstrated that diseases can be effectively mitigated through early prevention measures. Cardiovascular, respiratory, metabolic, and gastrointestinal diseases and fractures contributed to most of the medical conditions carried by the medical convoy in Makkah. Older adults represented more than a third of the transferred patients. Our findings highlight the need for medical screening of chronic diseases before the Hajj, especially among older adults. Risk factor prevention and early drug intervention for complications of diseases such as osteoporosis, diabetes, and hypertension can contribute to reducing the number of cases. Further studies on hypertension, osteoporotic-related fractures, and diabetes control should consider mass gatherings attended by older adults and address early detection and management. Future research on medical convoys should include studies of a new clinical score to follow up patients for longer periods.

List of Abbreviations

CKD	chronic kidney disease
Copd	chronic obstructive pulmonary disease
CVA	cerebrovascular vascular accident
DM	diabetes mellitus
HTN	hypertension
IHD	ischemic heart dsease
SVT	supre ventricular tachycardia

Conflict of interest

No conflict of interest to declare.

Funding

No funding sources to declare.

Consent to Participate

Consent was taken verbally.

Ethical Approval

The Institutional Review Board of the Minister of Health in Saudi Arabia approved the study protocol.

Data availability

Available upon reasonable request.

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