

## Case Report

# Healthcare Dynamics at the Hajj: Analysing Qatar's Medical Unit During Mass Gatherings

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## INTRODUCTION

Mass gathering events pose significant healthcare challenges, including the spread of infectious diseases, strain on local medical resources, and the high density of participants. Among such events, the Hajj pilgrimage to Mecca is a prime example, drawing millions annually and necessitating comprehensive healthcare preparation and vigilant disease monitoring. This study delves into the healthcare services provided during the 2023 Qatar Pilgrimage, part of the Qatari Campaign, offering a detailed analysis of medical support during this critical spiritual gathering.

## BACKGROUND AND RATIONALE

The Hajj pilgrimage, known for its dense crowds and rigorous rituals, presents distinct health challenges categorised into communicable and non-communicable diseases. Concerning communicable diseases, the gathering significantly elevates the risk of *N. meningitidis* carriage, leading to meningococcal disease. The dense assembly of pilgrims from various regions also increases the incidence of respiratory tract infections, with conditions like pneumonia necessitating critical care. Furthermore, the environment is conducive to the spread of diarrheal diseases and other emerging infectious diseases, albeit rarer. On the other hand, non-communicable diseases prevalent during the pilgrimage include chronic conditions, notably cardiovascular diseases, which are more common among older participants. The extreme temperatures of the Hajj exacerbate heat-related injuries, posing additional health risks. Moreover, the healthcare infrastructure manages physical injuries from ritual activities and provides ongoing care for the elderly and those with chronic illnesses. This convergence of diverse populations at the Hajj thus creates a complex epidemiological landscape [1-3]. Further emphasising the significance of these health challenges, recent studies have shed light on their direct consequences for pilgrim safety. Cardiovascular complications, heat stroke, and respiratory diseases emerge as the primary

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### Keywords

- Healthcare dynamics; Mass gatherings; Hajj pilgrimage; Qatar Pilgrimage Campaign; Medical unit; Spatial-temporal analysis; Public health; Infectious diseases; Non-communicable diseases; Patient demographics; Clinic utilization; SPSS analysis; Healthcare provisioning; Preventive healthcare; Epidemiological insights; Healthcare management; Temporal patterns; Spatial distribution; Health risks; International healthcare collaboration; Patient care; Healthcare planning

reasons for emergency department visits, underlining their severity and the critical need for immediate medical intervention [2]. These conditions demand urgent care and significantly influence the mortality rate among pilgrims [4]. The pattern of these ailments being recurrent reasons for hospital admissions underscores the urgent requirement for advanced medical preparedness and effective emergency response systems during the Hajj. Addressing these prevalent health risks is crucial in enhancing safety measures and reducing mortality, thereby safeguarding the well-being of the pilgrims.

To manage the unique health challenges of the Hajj effectively, Saudi Arabian health authorities have implemented comprehensive strategies. These include mandatory vaccinations, digital systems for real-time illness tracking, and enhanced healthcare infrastructure. Such proactive measures set a precedent for public health management during large-scale global gatherings. Echoing this commitment to health during the Hajj, Qatar has established a specialised medical unit dedicated to its pilgrims' needs. This initiative reflects a collaborative approach to international healthcare during such significant events. The unit, embodying Qatar's devotion to the well-being of its pilgrims, annually adapts its wide-ranging medical services, guided by a patient-first philosophy. This adaptability ensures the unit's capacity to meet the changing healthcare needs specific to the Hajj. In 2022, Qatar's unit was staffed with a multidisciplinary team of healthcare professionals, including consultants, family physicians, nurses, pharmacists, and specialists in infectious diseases, emergency care, respiratory issues, and Ear, Nose, and Throat (ENT) conditions. This diverse team was adept at providing comprehensive medical care, ranging from routine treatments to complex medical emergencies.

Strategically located at pilgrimage sites, the unit offers timely and adequate medical care. It focuses on preventive healthcare, acute condition management, chronic disease care continuity, and disease surveillance in densely populated areas of the Hajj. This approach ensures high-quality medical care for pilgrims, minimises disruptions to their religious rituals, and reduces the burden on Saudi Arabia's healthcare system during this peak period. By easing the operational load on the host nation's healthcare infrastructure, the unit benefits individual pilgrims and contributes to global healthcare efficiency. While other nations like India, Iran, and Indonesia have reported their medical initiatives for the Hajj, Qatar's unique approach is less documented, presenting an opportunity to broaden the scope of understanding in international health strategies for mass gatherings. This study aims to delve into and bring to light Qatar's distinctive healthcare practices, enriching the global discourse and offering novel perspectives on collaborative health management in large-scale events such as the Hajj. The rationale behind this study is to deepen the understanding of medical needs during the Hajj by analysing contemporary data from Qatar's Medical Unit during the 2022 pilgrimage. This analysis seeks to contribute to a more nuanced and comprehensive understanding of the temporal and spatial healthcare dynamics at play during such massive religious congregations, underscoring the critical role of tailored national health initiatives in the broader context of international healthcare collaboration.

## STUDY OBJECTIVES

This research aims to conduct a comprehensive, data-driven analysis of healthcare demands during the Qatar Pilgrimage Campaign. By examining 415 patient encounters, the study seeks to map out key aspects such as the pilgrims' demographic profiles and clinic attendance patterns. The main objectives are twofold: firstly, to capture a detailed demographic snapshot of the pilgrims from the Qatari contingent, thus providing a clear picture of the patient population served during the pilgrimage, and secondly, to identify and understand both the temporal and spatial patterns in clinic visitations and medical issues encountered. This research addresses a notable gap in current literature, focusing on Qatar's unique contributions to healthcare management during the Hajj.

## STUDY SIGNIFICANCE

The anticipated outcomes of this study are poised to provide pivotal strategic insights for healthcare planning in mass gatherings. These insights are mainly focused on enhancing the efficiency of medical service provision and deepening the understanding of health risks associated with large-scale events. Central to these findings is the potential to inform decisions regarding the optimal placement of clinics and the effective distribution of resources. This knowledge will guide public health interventions in future campaigns and comparable situations. Consequently, it can significantly bolster health management strategies tailored to the unique challenges of managing health care in large-scale gatherings, leading to more effective and efficient health care delivery in these contexts.

## STUDY OVERVIEW

This investigation offers an in-depth review of primary data sourced from the internal archives of the Qatar Pilgrimage Campaign, with a focus on healthcare delivery. Employing robust quantitative methodologies, the study delves into various aspects of the healthcare services provided. These include an analysis of pilgrim demographics, examining the day-to-day variations in clinic visits, and an exploration of the prevalence of a range of health conditions encountered across different medical sites. This thorough examination aims to provide a holistic understanding of the healthcare dynamics during the pilgrimage.

## METHODOLOGY

### Research Design and Data Collection

This study employed a cross-sectional quantitative design, utilising the campaign's centralised database data. This method provided a comprehensive snapshot of demographics, clinic attendance, and diagnoses, essential for analysing healthcare dynamics during the pilgrimage.

### Study Area and Data Analysis

Data were primarily sourced from three clinics within the campaign. We used SPSS for data analysis, conducting descriptive analyses to chart patient demographics and clinic visitation trends. Inferential statistics were also employed to identify patterns in medical care needs across different locations and times.

### Sampling and Demographics

The study analysed all recorded patient encounters ( $n = 415$ ) from officially registered pilgrims. This approach eliminated sampling bias and ensured the representativeness of the findings, with a particular focus on age and gender distribution among the pilgrims.

### Spatial and Temporal Distribution

Patient volume and diagnostic data across the clinics were analysed to discern trends and identify peak periods. This revealed correlations between pilgrimage activities and healthcare utilisation, highlighting the importance of temporal and spatial factors in understanding healthcare service demands.

### Healthcare Provisioning Insights

The combined spatial-temporal analysis yielded strategic insights into medical issues, aiding healthcare planning for the pilgrimage. It highlighted patterns of ailments and their distribution across different clinic locations, underscoring the need for a tailored healthcare approach specific to the pilgrimage's unique conditions.

## RESULTS

### Descriptive Statistics and Contextual Background

The study analysed 415 patient encounters within three

clinics designated for pilgrim care during the Hajj: the 'Mina Clinic', 'Arafat and Muzdalifah Clinics', and the 'Affairs Building'. Patient demographics showed a male majority (64.34% or 267 individuals) compared to females (35.66% or 148 individuals), with an average age of 40 years and a standard deviation of 11.91 years, indicating a broad age range among the patients, who were primarily Qatari nationals, followed by Egyptians, Saudis, and Yemenis. Regarding clinic visits, the 'Mina Clinic' recorded the highest number at 157, with the 'Arafat and Muzdalifah Clinics' and 'Affairs Building' following with 130 and 128 visits, respectively. Medical presentations were predominantly classified under 'Disease' (370 cases), with 'Trauma' and 'Other' being significantly less frequent at 31 and 14 cases, respectively. The most common diagnosis was Upper Respiratory Tract Infection (URTI), with 170 reported cases. The primary intervention was medication dispensation, noted in 273 instances while using the treatment room was documented in 130 cases. Referrals to a medical unit occurred in 11 instances, requiring only one hospitalization (Tables 1,2).

### Temporal Patterns of Clinic Visitation

The 'Arafat and Muzdalifah' Clinics experienced a peak in patient volume on June 28<sup>th</sup> (130 visits), while the 'Mina Clinic' showed an incremental increase in visits, peaking at the end of the month. The 'Affairs Building' exhibited a steady flow of patients initially, with a decrease after June 25<sup>th</sup>.

### Temporal and Spatial Distribution of Medical Issues

The temporal analysis of disease subcategories during the Qatar Pilgrimage Campaign, as illustrated in the line graph, provides a detailed view of the distribution of various health issues over the event's duration. A critical observation from this analysis is the noticeable fluctuations in the number of cases across different diagnosis subcategories on various days, highlighting the dynamic nature of healthcare demands throughout the campaign. Specific health issues, particularly respiratory problems and headaches/body pains, demonstrated a consistent presence, albeit with varying degrees of prevalence. Some subcategories exhibited peaks on specific dates, suggesting correlations with events or activities during the pilgrimage that might have impacted pilgrim health. A notable increase in URTI diagnoses was observed on June 28<sup>th</sup> with 68 cases, alongside other days with heightened occurrences. The spread of URTI diagnoses across the clinics points to a common health concern during the pilgrimage. Headache diagnoses peaked significantly on June 28<sup>th</sup> with 28 cases, with a reduction in the following days, yet a notably high number of cases, 18 and 10, respectively. The pattern of headache diagnoses suggests it is a common issue among pilgrims. Additionally, the analysis recorded instances of heat stroke cases likely associated with environmental conditions on certain days, with 5 out of 6 cases occurring on the 29<sup>th</sup> and the 30<sup>th</sup>. Abdominal pain, nausea and diarrhoea, though common across most days, peaked on the 28<sup>th</sup> with 14 out of 40 cases (Figures 1,2).

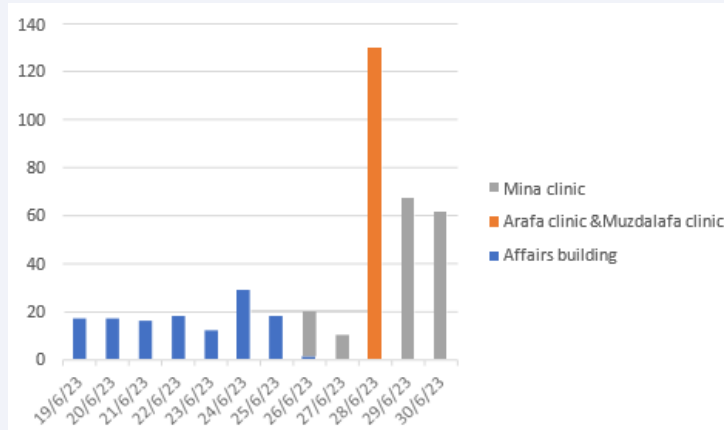
**Table 1:** Dates of Visit

Date of Visit 2	Overall (N = 415)
19-06-2023	17 (4.1%)
20-06-2023	17 (4.1%)
21-06-2023	16 (3.9%)
22-06-2023	18 (4.3%)
23-06-2023	12 (2.9%)
24-06-2023	29 (7.0%)
25-06-2023	18 (4.3%)
26-06-2023	20 (4.8%)
27-06-2023	10 (2.4%)
28-06-2023	130 (31.3%)
29-06-2023	67 (16.1%)
30-06-2023	61 (14.7%)
<b>Sex</b>	
Male	267 (64.3%)
Female	148 (35.7%)
<b>Age</b>	
N-Miss	2
Mean (SD)	39.9 (11.9)
Range	18.0-87.0
<b>Location</b>	
Mina clinic	157 (37.8%)
Arafa clinic & Muzdalafa clinic	130 (31.3%)
Affairs building	128 (30.8%)
<b>Action Taken</b>	
Medication Dispense	273 (65.8%)
Treatment Room	130 (31.3%)
Referral to the medical unit	11 (2.7%)
Referred to Hospital	1 (0.2%)
<b>Category</b>	
Communicable Diseases	199 (48.0%)
Non-Communicable Diseases	215 (51.8%)
Non-Communicable Diseases	1 (0.2%)
<b>Subcategory</b>	
Respiratory	170 (41.0%)
Headache and body pains	88 (21.2%)
Abdominal gastritis, nausea and diarrhoea	40 (9.6%)
Wounds and injuries	25 (6.0%)
Dermatological	23 (5.5%)
Chronic Disease	18 (4.3%)
Heat stroke	6 (1.4%)
Others	45 (10.8%)
<b>Nationality</b>	
Qatari	194 (46.7%)
Egyptian	80 (19.3%)
Yamani	29 (7.0%)
Saudi	26 (6.3%)
Others	86 (20.7%)

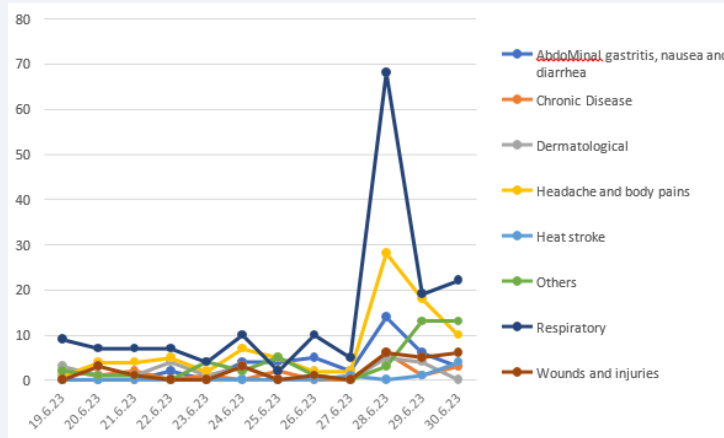
In the spatial analysis of clinic visits during the Qatar Pilgrimage Campaign, significant insights were gleaned regarding the distribution of patients across various healthcare facilities. The Mina Clinic, with 157 visits, stood out as a critical healthcare hub, reflecting substantial healthcare needs in its vicinity. This was closely followed by the combined visits to Arafa and Muzdalafa Clinics, amounting to 130, underscoring their integral role in healthcare provision during the pilgrimage. Similarly, the Affairs Building Clinic, with 128 visits, played a pivotal role in the

**Table 2:** Disease diagnoses

Row Labels	Abdominal gastritis, nausea and diarrhoea	Chronic Disease	Dermatological	Headache and body pains	Heat stroke	Others	Respiratory	Wounds and injuries	Grand Total
Affairs building	11	8	13	28		15	46	7	128
Arafa clinic & Muzdalafa	14	6	5	28		3	68	6	130
Mina clinic	15	4	5	32	6	27	56	12	157
Grand Total	40	18	23	88	6	45	170	25	415



**Figure 1** Record Analysis



**Figure 2** Various health issues over the event's duration

healthcare services landscape; it is essential to note that the total number of visits in the Affairs and Building clinics occurred over nine days compared to 1 and 2 days in the later clinics. A further examination into clinic-site-specific diagnosis trends revealed distinct patterns of health issues. Respiratory, Headache, body aches and abdominal symptoms presentations were spread out across all the clinics. In the Affairs building clinics, it is noted that there was the highest number of dermatological presentations, with 13 out of 23 cases. The Mina Clinic reported all the cases

of heat stroke, with 6 cases underlining the necessity for heat-related illness preparedness. Also, the clinic reported the highest number of wound and injury cases, 12 out of 25.

## DISCUSSION

### Key Results/Findings

The study presented a comprehensive analysis of 415 patient encounters at three clinics during the Hajj pilgrimage, revealing

key findings in patient demographics, clinic utilisation, and medical issues. A male majority (64.34%) was observed, with a broad age range (average 40 years). The 'Mina Clinic' saw the highest number of visits (157), and the most common medical presentation was Upper Respiratory Tract Infection (URTI), constituting 41% of cases. Medication dispensation was the primary intervention.

## DISCUSSION OF RESULTS WITH EXPLANATIONS

**Patient Demographics and Clinic Utilization:** The diverse age range and nationalities suggest that healthcare services should be geared towards a wide demographic. The pattern of diseases encountered during the pilgrimage, predominantly non-communicable (51.8%), followed closely by communicable (48.0%), presents a complex healthcare scenario. The high incidence of Upper Respiratory Tract Infections (URTI), constituting a significant portion of communicable diseases, is a crucial finding. This prevalence points towards environmental factors, such as crowd density and air quality, as potential contributors to respiratory ailments. Additionally, the consistent presence of headaches and body pains, along with gastrointestinal issues like abdominal pain, nausea, and diarrhoea, reflects the physical and environmental stressors pilgrims may encounter. These disease patterns are instrumental in guiding healthcare resource allocation and preventive measures. The high rate of URIs suggests the need for robust respiratory illness management strategies, including public health advisories on preventative measures and adequate medical supplies for respiratory care. The prevalence of headaches and body pains underscores the importance of pain management resources and hydration facilities to address physical exertion and dehydration issues. The gastrointestinal symptoms highlight the necessity for stringent food safety measures and accessible healthcare services for acute abdominal conditions.

The study's spatial and temporal analyses offer pivotal insights into healthcare dynamics during the Hajj pilgrimage, underscoring the need for nuanced healthcare strategies. Spatially, the distinct distribution of patient visits and health issues across the three clinics highlights the heterogeneity of medical needs. The high volume at the 'Mina Clinic' and Arafat Clinic indicates a significant healthcare need in this area, possibly due to its location or facilities offered. The Mina Clinic, with the highest patient volume and specific cases like heat stroke and injuries, suggests a greater demand for emergency and heat-related illness preparedness. In contrast, the Affairs Building's prevalence of dermatological cases indicates environmental or activity-specific factors influencing pilgrim health. Such spatial disparities necessitate tailored healthcare services at each location. Temporally, the study reveals significant day-to-day variations in clinic visitations and health issues. The marked increase in URTI cases and headaches, particularly on June 28th, suggests a correlation with specific pilgrimage activities or environmental changes. The pattern of these health issues, alongside gastrointestinal symptoms and heat stroke cases, highlights the influence of environmental conditions and the

pilgrimage's physical demands on pilgrim health. Understanding these temporal patterns is crucial for healthcare planning, emphasising the need for resource allocation and preventive strategies aligned with anticipated peaks in healthcare demands.

Integrating these spatial and temporal insights, it becomes evident that adequate healthcare provision during the Hajj pilgrimage requires a dynamic approach. This approach should consider the specific healthcare needs of each clinic location and the temporal fluctuations in medical issues. For instance, enhanced emergency care and heat illness prevention measures would be particularly beneficial at the Mina Clinic, while dermatological care might be a focus at the Affairs Building. Similarly, anticipating days with increased respiratory issues and headaches can guide the strategic deployment of medical resources and public health advisories.

## Study Limitations and Strengths

In assessing the limitations and strengths of this study, it becomes evident that while the real-time data collection during the Hajj pilgrimage offers invaluable insights into the dynamic healthcare needs in high-density settings, the scope remains restricted to three clinics over a specific period. This limitation constrains the generalizability of the findings, potentially overlooking broader health trends beyond the observed clinics and times. Additionally, the study's primary focus on immediate medical presentations might miss chronic conditions or longer-term health impacts, a significant consideration in understanding the complete health implications of such a mass gathering. Conversely, the study's strengths lie in its detailed demographic and disease pattern analysis, providing a nuanced understanding of the pilgrim population's healthcare needs. Including spatial and temporal dimensions in the analysis adds a holistic perspective, crucial for planning effective healthcare strategies in similar large-scale events.

## RECOMMENDATIONS

A multifaceted approach can be adopted to optimise healthcare management during the Hajj, focusing on targeted strategies to address specific health concerns and locations. Mobile health units should be deployed with a concentration on Arafat and Mina clinics, areas with the highest demand for medical care. These units, equipped for rapid response, can alleviate the pressure on permanent facilities by providing primary care directly to pilgrims in need, especially in peak times. Additionally, introducing a digital health platform or mobile app for pilgrims is essential. This tool would offer vital health information, such as tips for maintaining good health, reminders for medication and hydration, and first-aid advice. A necessary feature of this platform would be the capability for pilgrims to report health concerns, facilitating early intervention and better management of potential health crises. Pre-Hajj health screenings are another critical component of this strategy. Pilgrims should be encouraged to undergo comprehensive health evaluations before their journey, emphasising managing chronic diseases and

respiratory health. By ensuring effective control of conditions like hypertension and diabetes and advocating for respiratory vaccinations, such as influenza, COVID-19, and pneumonia, the incidence of health complications during the pilgrimage can be significantly reduced.

Environmental control measures must be prioritised in Mina, where most heat strokes were reported. Establishing mist cooling stations, shaded rest areas, and accessible hydration points would be instrumental in preventing heat-related illnesses. Finally, comprehensive health education campaigns are vital. These campaigns should focus on managing and preventing upper respiratory tract infections, heat-related injuries and strokes, and wound care. Educating pilgrims on symptom recognition, preventive measures, and the importance of seeking timely medical care can play a crucial role in enhancing the overall health and safety of the pilgrims. Integrating these strategies will address the specific healthcare needs of pilgrims and ensure a safer, more health-conscious environment during the Hajj, ultimately enhancing the effectiveness and efficiency of the medical services provided.

### Prospective Research Trajectories

The study supports the need for future research to extend these findings, suggesting the inclusion of intervention trials and predictive analytics to enhance healthcare delivery at future mass gatherings. A multidisciplinary research ethos, marrying epidemiological insights with advanced event management

tactics, is essential to cultivate a comprehensive strategy for healthcare provision in mass gatherings. In conclusion, our study provides insights into the healthcare demands and temporal patterns of medical issues during the Hajj pilgrimage. The findings suggest the need for targeted healthcare services addressing the predominant adult demographic, enhanced respiratory infection control, and preventive measures for environmental-induced conditions such as headaches. These insights can inform the allocation of resources and the design of public health interventions for future pilgrimages.

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