RESEARCH ARTICLE

Epidemiology of accident and safety concern during arba'een Karbala pilgrimage of 2024: An observational analysis

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Abstract

Objective: To analyse the distribution and characteristics of accidents during the Arba'een pilgrimage.

Method: The retrospective, descriptive study was conducted at the Ministry of Health, Baghdad and Karbala and comprised data from July 26 to August 26, 2024 related to accidents during the Arba'een pilgrimage in Karbala, Iraq. The data was obtained from health directorates across Iraq. The incidents were categorised by type, health department, and pilgrim nationality (Iraqi or foreign). The distribution of injuries and fatalities was assessed. Data was analysed using SPSS version 26.

Results: Of the 728 injuries recorded, 681(93.54%) involved Iraqi nationals and 47(6.46%) involved foreign pilgrims (p=0.0051). Of the 19 fatalities reported, Iraqi pilgrims accounted for 12(63.2%) and foreign pilgrims 7(36.8%) (p=0.00018). Falls, fractures, and road traffic accidents were the most common injury types. High-risk regions, such as Karbala and Najaf, received significant resource allocation, including medical personnel and emergency response services.

Conclusions: Different types of injuries and fatalities during the Arba'een pilgrim mostly affected Iraqis, and the most common type of incidents was road traffic accidents.

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Introduction

The Arba'een pilgrimage, a profound annual event in honour of Imam Hussein, draws millions of devotees from Iraq and beyond, gathering in Karbala to commemorate the end of the 40-day mourning period for the martyrdom of Imam Hussein. This journey, often conducted on foot over significant distances, is marked by an unparalleled sense of unity and faith among the participants. However, the scale of the pilgrimage also presents a unique set of challenges for public safety and health services, given the sheer volume of attendees and the intensity of the event. Recent years have seen a notable rise in various incidents affecting the pilgrims, including road traffic accidents (RTAs), food poisoning, falls, crowd crushes, and cases of drowning. Understanding the causes and patterns of these incidents is essential for improving preventive measures and ensuring the safety of the pilgrims.[1,2]

The overwhelming number of pilgrims travelling by road, often on foot or via overloaded vehicles, has significantly increased the risk of traffic-related incidents. Limited infrastructure, high traffic density, and insufficient road safety measures in certain areas contribute to frequent accidents, ranging from minor collisions to severe crashes resulting in significant injuries or fatalities. Although various governmental and non-governmental organisations (NGOs) have implemented traffic management strategies during Arba'een, challenges persist, emphasising the need for a robust, scalable safety framework to address traffic congestion and minimise road hazards.[1]

Providing food for millions of people involves massive logistical operations, with meals often prepared by volunteers under challenging conditions. Inadequate sanitation, exposure to high temperatures, and improper food handling can lead to foodborne illnesses among the pilgrims. Poisoning cases, while preventable, remain a common health issue, further straining medical resources during the pilgrimage. Effective food safety protocols, continuous education for volunteers, and regular inspections could help reduce the incidence of food poisoning and enhance the overall health security for the attendees.[3]

The pilgrimage route encompasses uneven terrain, crowded walkways, and temporary accommodations that lack standard safety features, increasing the risk of slips, falls and related injuries. Fatigue experienced by pilgrims travelling long distances on foot adds to their vulnerability. While minor falls are common, severe cases involving fractures or head injuries are also reported every year.

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Improving pathway conditions and implementing temporary safety barriers could provide immediate safety benefits.[4]

One of the most concerning hazards during the Arba'een pilgrimage is the risk of stampedes, often caused by sudden surges in crowd density, or bottlenecks in restricted areas. The immense crowds and emotional intensity associated with the pilgrimage can lead to panic, resulting in crowd crushes that pose serious threats to life and safety. Past incidents have highlighted the need for advanced crowd management strategies, including controlled access points, timely dissemination of information to the crowd, and improved training for security personnel on crowd psychology and safety protocols.[2,4]

Another significant hazard, albeit less frequent, involves the risk of drowning as pilgrims cross rivers or attempt to have a bath in nearby water sources. Some pilgrim routes require the crossing of water bodies where inadequate safety measures may expose participants to drowning risks. Identifying high-risk areas and establishing clearly marked and monitored crossing points could reduce these incidents.[5,6]

The current study was planned to analyse the distribution and characteristics of accidents during the Arba'een pilgramage.

Materials and Methods

The retrospective, descriptive study was conducted at at the Ministry of Health, Baghdad and Karbala and comprised data from July 26 to August 26, 2024, related to accidents during the Arba'een pilgrimage in Karbala, Iraq.

Data was collected from the Operations and Emergency Medical Services Department under the Ministry of Health, Iraq. The collected data encompassed all RTAs reported from various health departments across Iraqi governorates during the Arba'een period in 2024. The dataset included information on the number of injuries and fatalities, distinguishing between Iraqi and non-Iraqi victims. The data was subjected to injury and fatality classification, and the incidents were categorised according to the number of injuries and fatalities to Iraqi nationals or foreigners. The data was also segmented governorate-wise, allowing for geographical analysis of accident frequency and severity.

Data was analysed using SPSS version 26. Data was expressed as frequencies and percentages.

Results

Of the 635 total cases including injuries and fatalities, males were the majority 341(53.7%). The highest number of injuries occurred in Najaf 114(18%) and Diwaniya 80(12.66%) regions, while Diyala reported the lowest 6 (1%) (Table 1).

Of the 616 (97%) injuries, 577 involved Iraqi nationals and 39 involved foreign pilgrims (p=0.0051). Of the 19 fatalities reported, Iraqi pilgrims accounted for 12(63.2%) and foreign pilgrims 7(36.8%.) (*p*=0.00018) (Table 2). The distribution of fatalities and injuries were recorded to be highest in the Najaf governorate (Figure 1).

The types of incidents varied across regions, with Najaf reporting the highest number of poisoning and asphyxiation cases, while Dhi Qar and Diwaniya saw the highest rates of falls and fractures, contributing

Table-1: Region-wide distribution of injuries during Arb'aeen pilgrimage in 2024.

Health Department	Iraqi Injuries	Foreign Injuries	Total n (%)
Karbala	52	1	53 (8.60)
Najaf	102	9	111 (18.00)
Diwaniya	74	4	78 (12.66)
Dhi Qar	58	4	62 (10.06)
Wasit	58	3	61 (9.90)
Basra	36	10	46 (7.46)
Diyala	6	0	6 (1.00)
Muthanna	16	0	16 (2.59)
Maysan	28	2	30 (4.87)
Salahuddin	30	3	33 (5.30)
Babil	33	0	33 (5.35)
Rusafa	32	0	32 (5.19)
Karkh	32	0	32 (5.19)
Nineveh	20	3	23 (3.73)
Total	577	39	616 (100)

There was a statistically significant difference in the distribution of injuries between Iraqi and foreign pilgrims across the health departments (*p*=0.0051, DF=13).

Table-2: Distribution of injuries and fatalities during the Arba'een pilgrimage in 2024.

Category	Iraqi	Foreign	Total
	n (%)	n (%)	n (%)
Injuries	577 (97.96)	39 (84.78)	616 (97.0)
Fatalities	12 (2.04)	7 (15.21)	19 (3.0)
Total	589 (92.76)	46 (7.24)	635 (100)

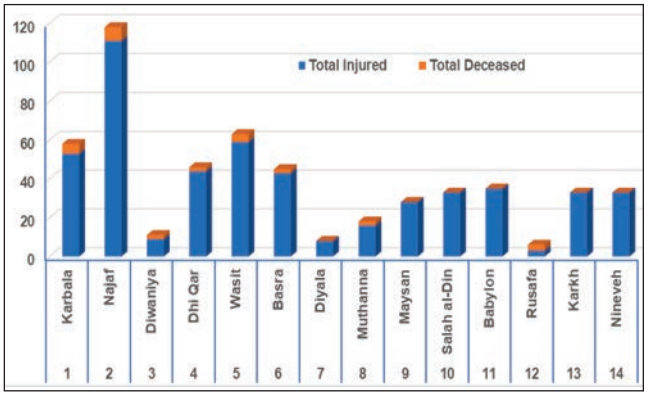

Figure-1: Distribution of vehicle accident injuries and deceased in various health directorates during the Arba'een.

Table-3: Distribution of the healthcare indicators according to the healthcare directorate.

District	No. of Emergency Cases	No. of Ambulances Deployed	Medical Evacuations	Total Referrals to Hospitals	Total Local Patients	Number of Medical Personnel	Total Medical Services Provided	Total Water Distributed	Total Food Distributed
Directorate	0	3	80	26,613	14888	0	371,403	1,997,420	13,494
Rusafa	25	4	22	17,400	56	4	105,585	479,290	1,592
Karbala	51	185	130	24,630	131724	3	371,403	1,997,420	13,944
Najaf	63	69	114	43,367	6617	0	127,4316	5,446	114
Babylon	0	0	0	11,541	72	0	725,717	2,039	99
Baghdad	25	4	22	17,400	56	4	105,585	479,290	1,592
Maysan	6	86	0	91,780	44	0	25,7536	1,029	83
Basra	2	0	5	4,519	4	0	33,822	67	58
Salahuddin	0	3	16	2,878	16	2	16,449	6,448	40
Anbar	0	0	12	12,301	11	0	83	6,448	40

Road Accidents Across Districts: Chi-square statistic: 1,986.13, DF = 9, p-value: 0.001 (statistically significant difference in road accidents across districts). Medical Evacuations Across Districts: Chi-square statistic: 239.79, *p*-value: $1.43\times10^{-461.43}$statistically significant difference in medical evacuations across districts; Ambulances Deployed vs. Medical Services Provided: Correlation coefficient: 0.29, *p*-value: 0.41 (no statistically significant correlation). Emergency Cases vs. Hospital Referrals: Correlation coefficient: 0.20, *p*-value: 0.59 (no statistically significant correlation).

significantly to the overall injury burden. RTAs were a leading cause of injuries, with significant variability observed across districts, totalling 635 across all the governorates (p=0.001). Although 185 ambulances were deployed in Karbala to manage emergencies, no significant correlation was observed between the number of ambulances and the volume of medical services provided (p=0.41).

Emergency cases totalled 257,015, with 26,613 medical evacuations and 14,888 hospital referrals reported. Muthanna recorded the highest patient load relative to its available resources, indicating potential resource gaps. Resource distribution across regions was uneven, with Karbala providing 1,997,420 units of water (200ml plastic water bottles) and 13,944 food distributions (plastic container for food), compared to significantly lower figures in Diyala and Anbar districts (Table 3).

Discussion

The findings from the Arba'een pilgrimage of 2024 indicated that injuries and fatalities were primarily concentrated in regions with high pilgrim densities, notably Najaf and Karbala. The significant difference in injury distribution between Iraqi and foreign pilgrims highlighted the need for tailored interventions, particularly for foreign pilgrims who may face language barriers, unfamiliar environments, and limited access to medical care.[7] The presence of fatalities among foreign pilgrims further emphasised the need for targetted support, such as on-site medical personnel and mobile health units, which was in line with earlier studies.[2,7]

The data also exposed environmental hazards, including inadequate ventilation and poor hygiene in densely populated areas, suggesting that controlled crowd flow and improved ventilation should be prioritised.[3,8] The high incidence of RTAs, reflected in the frequent deployment of emergency services, highlighted transportation infrastructure challenges.[9] Concentrated deployment of ambulances in Karbala and Najaf demonstrated responsiveness, but the need for hospital referrals and medical evacuations indicated the severity of these injuries. Designating specific lanes for emergency vehicles and optimising traffic management could reduce the incidence of RTAs and enhance emergency response efficiency.[3,9]

Resource distribution was another key aspect of the pilgrimage's health response. Disparities in resource allocation across regions suggested the need for a comprehensive review of distribution systems to ensure equitable access.[9,10]

The Arba'een pilgrimage presents unique healthcare challenges due to the sheer scale of participation and the diversity of incidents.[11] Health facilities along pilgrimage routes are critical in managing the surge of patients and providing timely medical care for a wide array of emergencies.[7,9] The current study highlighted the importance of pre-emptive resource allocation and rapid deployment of medical personnel, ambulances and essential supplies. Comparative analyses with other mass gatherings, such as the Hajj pilgrimage, indicate similar patterns of injuries and health risks, although the distinctive challenges faced by foreign pilgrims during Arba'een offer new avenues for research and intervention.[12-14] Tailored support systems based on cultural and logistical needs could significantly enhance health outcomes for this group.[15]

Addressing the disparities between Iraqi and foreign pilgrims along with better resource optimisation may pave the way towards ensuring the safety and wellbeing of all Arba'een pilgrims.[13-16]

The current study has limitations as the relied on reported incidents from health departments, which may not have

captured all accidents, especially minor injuries that were not formally documented. Additionally, the scope of the study was limited to incidents involving RTAs, excluding statistical data for other critical incidents, such as poisoning, stampedes, falls and fractures, due to data unavailability. The study did not include the nationalities of the pilgrims, number of pilgrims per region or age group, making it hard to assess the actual risk. Besides, the study did not control for confounding factors, such as weather conditions, road characteristics and the time of day. Addressing these gaps in future research would provide a more complete understanding of the health and safety challenges faced during the Arba'een pilgrimage.

It is crucial to adopt a data-driven approach to enhance safety measures and resource allocation. Future efforts should focus on establishing preventive strategies, improving emergency response infrastructure, and reinforcing the medical capacity of health departments serving high-risk areas.

Conclusions

There were several critical areas that were identified for intervention, including enhanced medical support for foreign pilgrims, targetted resource distribution, and improved crowd and traffic management.

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Author Contribution:

FAB, AASA, SYN & ISKMA: Concept, design, data acquisition, analysis, interpretation, drafting, revision, final approval and agreement to be accountable for all aspects of the work.