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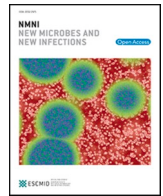
Original Article

Prevalence of and risk factors for infectious disease syndromic symptoms among pilgrimage to Arba'een mass gathering religious in 2023

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ABSTRACT

Background: There is a growing participation of Shia Muslims, in the Arba'een pilgrimage every year. It is imperative to conduct a comprehensive study on the transmission of diseases among Arba'een pilgrims in order to identify and promptly respond to potential epidemics effectively. We aimed to assess the syndromic symptoms associated with infectious diseases and the prevalence of mask usage among patients visiting outpatient clinics during the Arba'een pilgrimage in Ira, in 2023.
Methods: In this descriptive-analytical study, 300 outpatients who sought medical care at outpatient clinics during the Arba'een pilgrimage were randomly selected. The study data and infectious disease syndromic symptoms were assessed using trained healthcare professionals. A multiple logistic regression analysis was carried out to estimate the crude and Adjusted odds ratios (AORs) of symptoms and risk factors associated with respiratory syndrome and flu-like symptoms with 95 % confidence intervals.
Results: The mean age of the participants was 39 years and 61 % of those were male. Out of 72 (24 %) of mask users, 41.6 % had changed masks in less than 8 h. The most common syndromic symptoms was Flu-like illness (53 %). In the final analysis, not wearing a mask AOR = 1.40 (1.1–9.8) and smoking AOR = 3.25 (1.1–9.5) both elevated the risk of the flu-like syndrome and severe respiratory disease symptoms.
Conclusions: Pilgrims are especially vulnerable to the flu and other respiratory illnesses. Therefore, performing a differential diagnosis in these people, including flu and COVID-19, is essential to prevent an outbreak during the Arba'een pilgrimage.

1. Introduction

The increased accessibility of air and land transportation has contributed to the global movement of individuals, thereby facilitating the transmission of infectious diseases [1]. The acceleration of the dissemination of microorganisms, particularly viruses, and infectious diseases, has been facilitated by antigenic drift and modifications [2]. The ongoing progression of viruses, such as the 2019 Coronavirus, has presented substantial novel challenges to human societies. In an epidemic, highly contagious and lethal diseases can result in lasting damage [3].

Travelers are susceptible to a range of diseases, including prevalent

infectious diseases. Additionally, infected travelers can be a source of an epidemic in their country of origin and among individuals they come into contact with [4]. The rise in these travel activities has resulted in the reemergence of certain diseases, posing substantial challenges to the endeavors of health and disease management systems in eradicating these illnesses [5].

Arba'een; the 40th day; is a mass gathering religious event observed in many Islamic countries. More than 17 million pilgrims from Islamic countries such as Iran, Pakistan, Turkey, Afghanistan, Azerbaijan, Lebanon, Kuwait, Bahrain, Saudi Arabia travel to Karbala city in Iraq [6]. Arba'een commemorates the return of Hussein ibn Ali's family to Karbala. This marks the 40th day after the massacre of the grandson of

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Prophet Muhammad, his relatives, and companions. Millions of pilgrims and residents, predominantly Shia Muslims, honor this day by walking from cities across Iraq and Iran towards the shrine of Imam Hussein in Karbala, located 100 km southeast of Baghdad and 80 km from Najaf [7–10].

Many Muslims, mainly from Iran, partake in the Arba'een pilgrimage as a mass gathering religious every year. Managing pilgrims is crucial to preventing and treating infectious diseases, and failure to do so may result in irrevocable consequences and the risk of an infectious disease epidemic [6,11]. There is a serious concern and threat for health of Arba'een pilgrimages and the risk of disease outbreaks, which has been emphasized in previous studies and other mass gathering such as annual Haj (an annual Islamic pilgrimage) [12–15].

General or ordinary care, as demonstrated by Iran's experience with disease treatment, disease surveillance entails establishing mechanisms for gathering and analyzing data to draw conclusions and take corrective measures. Iran's disease-focused surveillance has invested considerable effort into the possibility of providing conclusive diagnoses of infectious diseases caused by microbes and viruses. The delay between the onset of disease (outbreak) and its treatment (prompt response) is and will continue to be one of the shortcomings of the existing surveillance [16]. Epidemics and outbreaks pose significant challenges, particularly when considering the three stages of diagnosis (possible, suspected, and definite) for infectious diseases. It is crucial to emphasize that successful containment relies heavily on promptly establishing a definite diagnosis. Interfering during the peak spread of an epidemic can be challenging due to the potential self-limiting nature of certain diseases, which varies depending on the characteristics and type of the disease agent [17,18].

Implementing the **syndromic surveillance system** as a novel approach in the healthcare system has effectively mitigated the geographical barriers and facilitated accurate diagnoses [19]. By implementing this new method, it will be possible to reach a more significant number of patients by considering their disease symptoms. Implementing practical interventions to mitigate alarm and decrease patient mortality rates can create an environment that accelerates epidemic control. Syndromic care is an invaluable tool presently being implemented in the Islamic Republic of Iran and has been successfully implemented nationwide [20,21].

Therefore, previous findings highlighted to implement of a syndromic surveillance system tailored to specific situations [22], such as the large gathering during the Arba'een pilgrimage. The reason for this is the constrained availability of time and laboratory resources along the pilgrimage route. Such a system can aid in the prompt and early case detection of diseases, thereby preventing the occurrence of epidemics. The objective of the current study was to assess the syndromic symptoms associated with infectious diseases and the prevalence of mask usage among patients seeking care at outpatient clinics during the Arba'een pilgrimage in 2022.

2. Methods

2.1. Study design and setting

This descriptive-analytical study aimed to assess the frequency of infectious disease syndromes and the use of masks in Arba'een pilgrimages in 2023. The target population comprised of 300 randomly chosen Arba'een pilgrim outpatients.

Based on a pilot study, the prevalence of respiratory infections was 40 % among outpatients pilgrims referred to clinics. Considering Confidence Interval (CI) 95 %, an estimated error of d = 0.15p, and 10 % compensate due to non-responses or poor responses, the sample size was determined to be 300 participants.

Upon forming the research team at the outpatient clinic, participants were selected through systematic sampling from the list of outpatients visiting the clinics. The baseline characteristics of the participants and symptoms related to any infectious disease syndromes were assessed among clinic visitors by trained health professionals working within the health system. A two-part checklist was utilized for the assessment of outpatients. The initial section included demographic and baseline information, a record of different pre-existing medical conditions (as reported by the individuals), underlying diseases, and details regarding mask usage (including mask wearing and changing schedules). Underlying diseases were assessed based on self-report and having a medical record or taking medication. The subsequent section encompassed all symptomatic indications of infectious diseases based on syndromic symptoms defined by Center for Disease Control and Prevention, Ministry of Health (Iran) [16,21]. Face-to-face interviews using trained health professionals were used to obtain the valid data. The interviews lasted at least 20 min and were conducted after the outpatient visits in the clinics.

2.2. Assessing syndromic symptoms in patients referred to the outpatient clinic

2.2.1. Definition of the syndromic surveillance system

A syndromic surveillance system collects, analyzes, and disseminates information about a health event. Health policymakers use this information to design, implement and evaluate health programs and related activities.

The syndromic surveillance system centers on the patient's chief complaint. Information is gathered about patients instead of making a diagnosis based on their presentation of symptoms. In other words, when patients with specific symptoms seek medical attention, the appropriate authorities are notified. Health, prevention, and treatment measures are implemented on all levels of society, including screening, paying particular attention to high-risk individuals, administering treatment or vaccination, and possibly even quarantining the affected population until a definitive diagnosis is made [23,24].

A syndrome is a collection of clinical manifestations and symptoms that may suggest the presence of one or more diseases or health disorders. In essence, the term "syndrome" pertains to the clinical manifestations that occur prior to the diagnosis of diseases. On the contrary, a disease is a formally diagnosed pathological condition or a disruption in the normal functioning of the human body [25].

A syndrome can manifest as a symptom of various distinct diseases. However, disease confirmation and differential diagnosis are typically conducted through paraclinical and laboratory methods. The approach to managing syndromes involves symptom therapy while managing diseases entails addressing the underlying cause of the condition in addition to symptom therapy.

2.3. Evaluated syndromes

Acute fever and rash (maculopapular and non-maculopapular): fever of more than 38° oral with at least one of the following diffuse symptoms: 1) small spots and not the same color as the skin (macular), usually diffused 2) small and prominent seeds, not the same color as the skin (papule), usually diffused. The most important differential diagnoses: are poisoning with chemical, bacterial, viral, fungal, parasitic agents, heavy metals, toxins, alcohol, and brucellosis [26].

Influenza-like syndrome: fever with a cough that has occurred in the last week. Influenza, parainfluenza, whooping cough, COVID-19, and SARS are among the most important differential diagnoses [26].

Severe acute respiratory syndrome (SARS): the onset of fever and cough within the previous week with at least one of the following symptoms in the respiratory system (Tachypnea or rapid breathing, depression of the intercostal muscles during breathing, noisy breathing, bloody sputum); in the cardiovascular system (chest pain, severe drop in blood pressure, rhythm disorder); In the nervous system (decreased level of consciousness, convulsions). Influenza, COVID-19, and tuberculosis are among the most crucial differential diagnoses [26].

Food poisoning syndrome: the manifestation of at least one of the

following symptoms: 1) Nausea and vomiting following ingestion of food or liquid. 2) Abdominal discomfort (heartburn) after eating or drinking. Poisoning with chemical, bacterial, viral, fungal, and parasitic agents and poisoning with heavy metals, toxins, alcohol, and brucellosis are the most important differential diagnoses [26].

Acute diarrhea syndrome: the condition where an individual experiences the passage of loose stools at least three times within 24 h. Additionally, this syndrome may be accompanied by symptoms such as nausea, vomiting, and abdominal pain. The primary differential diagnoses of diarrhea encompass microbial, viral, and parasitic etiologies, such as cholera, brucellosis, and chemical factors [26].

Bloody diarrhea syndrome: it is characterized by the presence of bright blood in the stool, accompanied by potential symptoms such as nausea, vomiting, or abdominal pain. The differential diagnoses of utmost significance encompass shigellosis, amoebiasis, salmonellosis, heavy metals, anthrax, and other forms of cholera [26].

Chronic cough syndrome: persistent cough for two weeks or more, usually accompanied by sputum. The most important differential diagnosis of chronic cough is tuberculosis [26].

2.4. Statistical analysis

For data analysis, STATA (version 14) was carried out. The skewness and kurtosis tests were used to examine the non-normality of the data. Frequency, average, median values, and standard deviations were used for descriptive statistics. The Chi-square test evaluated the association between syndromic respiratory and flu-like symptoms and the frequency of classified and qualitative factors. Quantitative variables, such as age, were compared using the independent *t*-test. The crude and adjusted odds ratio of symptoms and risk factors for respiratory syndrome and flu-like symptoms were estimated using multiple logistic regression and a 95 % confidence intervals. For modeling, all independent variables were initially evaluated through simple logistic regression. Subsequently, variables with a p-value below 0.2 underwent further analysis via multiple logistic regression employing the *Enter* method. The Hosmer and Lemeshow statistic was utilized to assess data congruence and the model's goodness of fit. All tests were considered statistically significant at a level lower than 5 %.

3. Results

A total of 300 outpatients attending clinics along the Arba'een pilgrimage route were included in this study. The average age of the patients was 39 years, ranging from 2 years to 81 years. The majority of participants (61 %) were male, while 55 % were reported to be married. A total of 26 % and 22 % of the outpatients had a history of high blood pressure and smoking. Regarding other self-reported underlying diseases, 13 % reported having diabetes, 9 % indicated having fatty liver, and 6 % reported having psychiatric disorders (Table 1).

Table 2 indicates the prevalence of mask use among Arba'een marching patients who visited outpatient clinics. Only 24 % had used a mask. 41.6 percent of mask wearers replaced their masks in less than 8 h.

Table 3 indicates the incidence of communicable disease syndromes among outpatients referred to outpatient clinics during the Arba'een pilgrimage in 2022. The most common were flu-like illness (53 %) and acute non-bloody diarrhea (31 %). Table 3 also shows the frequency and percentage of various syndromes.

Table 4 demonstrates a significant correlation between not wearing a mask and smoking and the incidence of the flu-like syndrome and severe respiratory disease. This significant correlation was not observed in other patients with background diseases.

Table 5 shows the results of a multiple logistic regression analysis of flu-like syndrome symptoms and severe respiratory disease and the crude and adjusted odds ratios. After adjusting for age, gender, fatty liver, blood pressure, and diabetes, not using a mask AOR = 1.40 (1.1–9.8) and smoking AOR = 3.25 (1.1–9.5) increased the risk of

Table 1
Demographic features and underlying disease history in Arba'een pilgrims referred to outpatient clinics in 2023.

Variable		Frequency (N = 300)	Percentage (%)
Age	Mean ± standard deviation	38.9 ± 19.9	Minimum: 2 Maximum: 81
Sex	Female	117	39
	Male	183	61
Marital status	Single	111	37
	Married	165	55
	Widow or widower	24	8
History of diabetes	No	261	87
	Yes	39	13
History of blood pressure	No	222	74
	Yes	78	26
Taking psychiatric drugs	No	282	94
	Yes	18	6
Fatty Liver	No	273	91
	Yes	27	9
Smoking	No	234	78
	Yes	66	22

Table 2
Mask wearing by gender in patients referred to outpatient clinics during Arba'een pilgrimages in 2023.

Variable		Frequency (N = 300)	Percentage (%)
Wearing a mask	Yes	72	24
	No	228	76
Users swap masks daily (n=24)	Less than 8 h	125	41.6
	Over 8 h	175	58.3

Table 3
Prevalence of infectious illness syndromes in Arba'een pilgrims referred to outpatient clinics in 2023.

Syndrome		Sex		Total (n = 300)	Percentage (%)
		Female	Male		
Syndrome related to infectious diseases	Asymptomatic	10	2	12	4.0
	Influenza-like illness (ILI)	66	92	158	52.7
	Severe respiratory illness (SARI)	1	5	6	2.0
	Acute watery diarrhea (non-bloody)	32	60	92	30.7
	bloody diarrhea	1	3	4	1.3
	Food poisoning	4	6	10	3.3
	Acute fever and rash	4	4	8	2.7
	Chronic cough	4	8	12	4.0

developing flu-like symptoms and severe respiratory disease. On the other hand, using and replacing a face mask in fewer than 8 h AOR = 0.18 (0.08–0.81) significantly lowered the risk of developing the disease.

4. Discussion

The current study aimed to determine the prevalence of syndromic symptoms associated with communicable diseases and the factors influencing them and assess the frequency of mask usage among outpatients visiting outpatient clinics along the Arba'een pilgrimage route. This study represents a limited number of research endeavors conducted

Table 4

The relationship between influenza-like sickness and severe respiratory disease with mask use, underlying illnesses, and other risk factors.

Variable		influenza-like sickness and severe respiratory disease		Total (n = 300)	P-value
		Yes (n = 82)	No (n = 68)		
Sex	Female	64	60	124	0.133
	Male	98	76	174	
Diabetes	No	132	130	262	0.826
	yes	22	18	40	
Wearing a mask	No	105	123	228	0.046
	yes	48	24	72	
Fatty liver	No	132	142	274	0.092
	yes	20	6	26	
Blood pressure	No	108	114	222	0.427
	yes	46	32	78	
Smoking	No	108	126	234	0.068
	yes	44	22	66	

Table 5

The crude and adjusted odds ratios (ORs) of the risk of influenza-like illness and severe respiratory syndrome in Arba'een marchers in 2023 using multiple logistic regression.

Variables	Crude ORs and 95 % CI	Adjusted ORs[a] and 95 % CI
Not wearing a mask	2.34 (0.90–6.12)	1.40 (1.1–9.8)
P-value	0.083	0.023
Changing the mask (less than 8 h)	0.83 (0.26–2.6)	0.18 (0.08–0.81)
P-value	0.450	0.033
smoking	2.5 (0.92–6.8)	3.25 (1.1–9.5)
P-value	0.073	0.031

[a] Adjusted for age, gender, fatty liver, blood pressure, and diabetes.

among Arba'een pilgrims. Given the significant influx of Arba'een pilgrims and the annual congregation of millions for this religious ceremony, it is imperative to prioritize the prevention of any potential epidemic. Syndromic symptoms encompass primary symptoms associated with specific diseases, with each syndrome exhibiting distinct symptoms. Observing and reporting patients exhibiting specific symptoms, irrespective of their diagnosis, allows for implementing preventive and treatment measures by higher authorities across all levels of society until a conclusive diagnosis is established [27].

Hence, identifying and documenting syndromic symptoms among Arba'een pilgrims can serve as a valuable tool for early prediction of outbreak size, speed, intensity, and pattern. Additionally, it can facilitate prompt and efficient disease prevention and control management, ultimately leading to reduced costs within the healthcare system. Additionally, it will enhance simplicity and flexibility in categorizing signs and symptoms, accompanied by prompt notification and swift execution of interdepartmental collaboration within the healthcare sector [28–30].

The present study observed that flu-like syndrome and respiratory diseases were the most frequently reported syndromes among the patients, accounting for 53 % of cases. Based on survey and recorded infectious disease surveillance system of Ministry of Health and Medical Education of Iran, after Arba'een pilgrims returned from Iraq, 8333 cases went to medical centers due to respiratory problems, half of whom required >2 days of hospitalization due to the severity of respiratory illness and 106 of whom deceased between the beginning of October 2019 and December 2019 [6]. The same findings and risk of respiratory diseases were highlighted for Haj mass gatherings by Hashemi et al. [14].

Given the potential for respiratory diseases to be transmitted through airborne particles, environmental factors, and person-to-person contact,

it is imperative to prioritize understanding transmission methods and prevention strategies in large gatherings like Arba'een. However, our study revealed that 24 % of the participants had utilized a mask. Of those, 42.4 % replaced their masks every 8 h. Consequently, the findings of this study indicate a notably low percentage of mask usage during large gatherings, such as Arba'een. Furthermore, most participants (58.2 %) reported wearing the same mask for over 8 h before replacing it. The same concerns were highlighted in other mass gathering such as Hajj [15].

The COVID-19 pandemic has highlighted the importance of usage and wearing masks [31–33], practicing proper physical distancing, and avoiding contact between individuals displaying suspicious symptoms and vulnerable populations, including children, pregnant women, elderly, and aggravation of other diseases. These actions are crucial in mitigating the potential risks to human life [34].

Based on the results of our study, it was observed that individuals who partake in smoking demonstrated the highest prevalence of symptoms related to respiratory disease syndrome. Therefore, healthcare systems must prioritize properly managing individuals who engage in smoking and those with underlying medical conditions [35].

Effective management of preparations for mass gathering of the Arba'een pilgrimage can contribute to the prevention of diseases and other outbreaks. The efficiency of diagnosing an illness and initiating therapy can be significantly improved by conducting a comprehensive evaluation of syndromic symptoms through the systematic classification and early detection of symptoms [11].

4.1. Limitations and strengths

The syndromic approach taken in the present study is a strength. There were no laboratory or para-clinical diagnostic facilities available for the final confirmation of the disease in outpatient clinic during the Arba'een pilgrimage, and there was an overwhelming number of participants and outpatients in the clinics. Consequently, identifying and classifying diseases based on symptoms can lead to cost savings and facilitate the diagnosis of outbreaks if unusually high disease rates are observed [36,37].

5. Conclusion

The study findings indicated that there is a significant prevalence of influenza-like syndrome and severe respiratory diseases among pilgrims. As a result, it is imperative to conduct a comprehensive differential diagnosis, including influenza and COVID-19, to prevent any potential epidemic during the Arba'een pilgrimage [38,39].

Additionally, it was observed that the participants' utilization and regular replacement of face masks were alarmingly low. This lack of adherence to mask usage and smoking increases the likelihood of developing respiratory symptoms syndrome. Conversely, the timely replacement of masks has been shown to reduce the risk of such symptoms.

Funding

Ethical approval

The study was approved by ethics committee under code IR.RCS. REC.1401.007 by Iranian Red Crescent Society. Verbal inform consents were obtained from all participants before the survey.

Availability of data and materials

The datasets generated and/or analysed during the current study are

available from the corresponding author on reasonable request.

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