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Original Article

Risk Factors and Distribution of Infectious Diseases among the Older Adults on a Pilgrimage to Arba'een Mass Gathering

Hosein Azizi[1*], Behrouz Naghili[2,3], Pirhossein Kolivand[2,3], Fariba Abbasi[1], Shahriyar Ghanbarzadeh Javid[1], Elham Davtalab Esmaeili[4], Ehsan Sarbazi[5]

[1]Women's Reproductive Health Research Center, Tabriz University of Medical Sciences, Tabriz Iran
[2]Research Center for Health Management in Mass Gathering Red Crescent Society of the Islamic Republic of Iran, Tehran, Iran
[3]Research Center for Emergency and Disaster Resilience Red Crescent Society of the Islamic Republic of Iran, Tehran, Iran
[4]Research Center of Psychiatry and Behavioral Sciences, Tabriz University of Medical Sciences, Tabriz, Iran
[5]Road Traffic Injury Research Center, Tabriz University of Medical Sciences, Tabriz, Iran

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***Corresponding Author:**
Hosein Azizi,
Emails: aziziepid@gmail.com, h.azizi@tbzmed.ac.ir

Abstract

Objectives: To determine the syndromic symptoms associated with infectious diseases in the older adults attending the Arba'een pilgrimage mass gathering.

Design: A cross-sectional study.

Setting(s): Outpatient clinics during the Arba'een pilgrimage

Participants: A total of 200 subjects were randomly chosen among the older adults attending outpatient clinics during the Arba'een pilgrimage in Iraq in 2022.

Outcome measures: The syndromic symptoms of infectious diseases, including acute fever and rash, influenza-like syndrome, severe acute respiratory syndrome (SARS), food poisoning, acute diarrhea, bloody diarrhea, and chronic cough were evaluated using a valid checklist provided by the Center for Disease Control and Prevention (CDC) and the Ministry of Health (Iran). Multiple logistic regression analysis was carried out to estimate the crude and adjusted odds ratios (AORs) with 95% confidence intervals.

Results: The mean age of the participants was 68.3 years, with nearly 60% of the participants being men. Among 72 (29.4%) mask users, 71% changed masks in less than 8 hours. The most common syndromic symptom was flu-like illness (42%). In the final analysis, not using a mask (AOR = 1.5, 1.1 – 4.7), diabetes (AOR = 3.01, 1.4 – 7.7), and smoking (AOR = 1.75, 1.02 – 3.8) increased the risk of the flu-like syndrome and severe respiratory disease symptoms.

Conclusions: Flu and respiratory illnesses are common among the aging population attending Arba'een mass gatherings. To prevent potential outbreaks, it is necessary to perform a differential diagnosis of respiratory diseases such as influenza and coronavirus disease 2019 (COVID-19).

Keywords: Arba'een pilgrimage, Epidemic, Infectious diseases, Older adults, Epidemiology

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Introduction

The global movement of individuals has been facilitated by increased accessibility of air and land transportation, making it easier for infectious diseases to spread.[1] Antigenic drift and modifications have increased the dissemination of microorganisms, specifically viruses and infectious diseases.[2] Human societies have been confronted with significant novel challenges due to the continuous evolution of viruses such as the coronavirus disease 2019 (COVID-19). Long-term damage can be induced by highly contagious and lethal diseases during an epidemic.[3]

Common infectious diseases can affect travelers as they are susceptible to a range of diseases, and the infected travelers can cause outbreaks in their country and among those they interact with.[4] The reemergence of certain diseases posed significant challenges to health and disease management systems in eradicating these illnesses due to increased travel activities.[5]

Many Islamic countries have a mass gathering religious event known as Arbaʾeen, occurring on the 40th day after Ashura. Karbala city in Iraq is the destination for over 17 million pilgrims from Islamic countries, including Iran, Pakistan, Turkey, Afghanistan, Azerbaijan, Lebanon, Kuwait, Bahrain, and Saudi Arabia.[6]

Therefore, mass gatherings are place where elderly people

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are particularly vulnerable. The aging population was found to be at heightened risk for COVID-19 morbidity and mortality based on meta-analysis and epidemiological evidence.[7,8] To prevent and treat infectious diseases, it is crucial to manage pilgrims as failure to do so could lead to irrevocable consequences and the risk of an infectious disease epidemic.[6,9] The health of Arba'een pilgrims is being threatened, and disease outbreaks are a serious concern, as highlighted in the annual Hajj pilgrimage and previous studies.[10-13]

The experience of disease control centers in Iran suggests that general or ordinary care involves setting up mechanisms to gather and analyze data, draw conclusions, and take corrective measures. Iran's disease-focused surveillance has invested a significant amount of effort in providing definitive diagnoses of infectious diseases caused by microbes and viruses. However, the current surveillance fails to address the delay between the disease onset (outbreak) and its treatment (timely response).[14] The three stages of diagnosis (possible, suspected, and definite) for infectious diseases make epidemics and outbreaks a significant challenge. Highlighting the importance of promptly establishing a definite diagnosis is crucial for successful containment. The low self-limiting nature of certain diseases can make it challenging to interfere during the peak spread of an epidemic, depending on the disease agent's characteristics and type.[15,16]

Implementing a syndromic surveillance system as a new approach in the healthcare system has mitigated geographical barriers and facilitated accurate diagnoses.[17] The implementation of this new method will enable healthcare providers to reach more patients by taking into account their disease symptoms. Practical interventions can be implemented to mitigate alarm and decrease mortality rates, creating a condition that accelerates epidemic control. In the Islamic Republic of Iran, syndromic care is an invaluable tool that has been successfully implemented nationwide .[18,19]

Previous research has highlighted the use of a syndromic surveillance system tailored to specific situations such as large gatherings during the Arba'een pilgrimage.[20] The scarcity of time and laboratory resources along the pilgrimage route is the main reason for this approach. The prompt and early detection of diseases can be facilitated by using this system, which can aid to prevent epidemics. The current study aimed to assess the symptoms related to infectious diseases among elderly individuals during their pilgrimage to the Arba'een mass gathering in 2022.

Methods

Study Design and Setting

A descriptive study was conducted to survey the frequency of infectious disease syndromes and the use of masks among elderly people attending Arba'een pilgrimages in 2022. The study population consisted of all aging people who attended outpatient clinics along the path Najaf-Karbala route during the Arba'een pilgrimages in Iraq. The study involved a random sample of 200 elderly participants, assuming a prevalence (P) of 0.5 for infectious diseases among outpatient pilgrims referred to clinics, based on a pilot study (since no prior studies assessed infectious disease in aging Arba'een pilgrims using syndromic surveillance). The study considered a margin of error (d) of 0.15 * *P*, a 95% confidence level, and a 10% allowance for non-responses or incomplete responses.

The aging people (60 years and over) attending outpatient clinics along the Najaf- Karbala route were chosen through systematic sampling using outpatients clinic lists. Upon forming the research team at these outpatient clinics, baseline characteristics of the participants and symptoms related to various infectious illness syndromes were recorded among clinic visitors. Outpatients were assessed using a checklist that consisted of two parts. The first section included demographic and baseline data, containing a list of various underlying diseases (self-reported by participants), and information on mask usage (e.g., wearing and changing routines). The second section covered all symptoms indicating infectious diseases based on the syndromic symptoms defined by the Centers for Disease Control and Prevention (CDC) and the Ministry of Health (Iran).[14,19]

Assessing Syndromic Symptoms in Patients Referred to the Outpatient Clinics

Definition of the Syndromic Surveillance System

Syndromic surveillance is the process of collecting, analyzing, and disseminating information about a health event. This information is used by health policymakers to create, implement, and assess health programs and related activities.

The focus of the syndromic surveillance system is on the patient's main complaint rather than a diagnosis based on their symptoms. In other words, the relevant authorities are informed when patients with specific symptoms seek medical attention.[21,22]

A syndrome is a set of clinical signs and symptoms that can indicate the presence of one or more illnesses or health problems. The term 'syndrome' refers to clinical manifestations that occur before a disease can be formally diagnosed. A disease is a pathological condition that disrupts the normal functioning of the human body and has been formally diagnosed.[23] A syndrome can manifest as symptoms of various distinct diseases. Nevertheless, paraclinical and laboratory methods are typically used for disease confirmation and differential diagnosis. Symptom therapy is used for managing syndromes, but the underlying cause of the condition is also addressed when managing diseases.

Evaluated Syndromes

1. Acute Fever and Rash (Maculopapular and Mon-maculopapular)

This syndrome is marked by a fever of more than 38 degrees Celsius (oral) with at least one of the following

diffuse symptoms: small and non-skin-colored spots (macular), usually diffused, small, prominent, and non-skin-colored seeds (papule), usually diffused. The most significant differential diagnoses include poisoning by chemical, bacterial, viral, fungal, and parasitic agents, heavy metals, toxins, alcohol, and brucellosis.[24]

2. Influenza-like Syndrome

This syndrome is characterized by fever and cough within the past week. The most significant differential diagnoses include influenza, parainfluenza, whooping cough, COVID-19, and severe acute respiratory syndrome (SARS).[24]

3. Severe Acute Respiratory Syndrome

This syndrome involves the onset of fever and cough within the previous week, accompanied by at least one of the following symptoms: respiratory symptoms (tachypnea or rapid breathing, depression of the intercostal muscles during breathing, noisy breathing, bloody sputum), cardiovascular symptoms (chest pain, a severe drop in blood pressure, and rhythm disorder), nervous system symptoms (decreased level of consciousness and convulsions). The most crucial differential diagnoses include influenza, COVID-19, and tuberculosis.[24]

4. Food Poisoning Syndrome

This syndrome is characterized by the manifestation of at least one of the following symptoms: nausea and vomiting following the ingestion of food or liquid and abdominal discomfort (heartburn) after eating or drinking. The most important differential diagnoses include poisoning by chemical, bacterial, viral, fungal, and parasitic agents, heavy metals, toxins, alcohol, and brucellosis are the most important differential diagnoses.[24]

5. Acute Diarrhea Syndrome

This condition occurs when an individual experiences the passage of loose stools at least three times within 24 hours, possibly 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.[24]

6. Bloody Diarrhea Syndrome

It is characterized by the presence of bright blood in the stool, potentially accompanied by symptoms such as nausea, vomiting, or abdominal pain. The differential diagnoses include shigellosis, amoebiasis, salmonellosis, heavy metals, anthrax, and other forms of cholera.[24]

7. Chronic Cough Syndrome

This syndrome is marked by a persistent cough lasting two weeks or more, usually accompanied by sputum. The most important differential diagnosis of chronic cough is tuberculosis.[24]

Statistical Analysis

SPSS software (version 21.0, Chicago, IL, USA) was used for data analysis. Skewness and kurtosis tests were used to examine the non-normality of the data. The chi-square (χ^2) test was used to examine categorical variables when the expected value of the cell was 5 or more in at least 80% of the cells, and no cell had an expected value of less than one. An independent t-test was conducted for quantitative variables when normal distribution and homogeneity of variance were met. Furthermore, multiple logistic regression analysis was carried out to estimate crude odds ratios and adjusted odds ratios (AORs) of symptoms and risk factors for respiratory syndrome and flu-like symptoms. All tests were considered statistically significant at a level of less than 5%.

Results

A total of 200 older adult outpatients of the Arba'een pilgrimage, with a mean age of 68.3 years (range: 60-81), participated in the study. Approximately 60% of the participants were male. The prevalence of high blood pressure and diabetes mellitus (DM) was 58.8% and 35.3%, respectively. Concerning the proportion of other self-reported underlying diseases, 29% of participants reported smoking, 7% had fatty liver, and 12% had psychiatric illnesses (Table 1).

Table 2 shows the proportion of mask use among Arba'een marching pilgrims who visited outpatient clinics. Only 29.4% used a mask, and the majority of mask wearers (71%) replaced their masks in less than 8 hours.

Table 3 demonstrates the prevalence of infectious disease syndromes among aging people outpatients referred to outpatient clinics during the Arba'een pilgrimage in 2022. Flu-like illnesses (42%) and acute non-bloody diarrhea

Table 1. Baseline Characteristics of the Aging Arba'een Pilgrims Referred to Outpatient Clinics

Variable		Frequency (N = 200)	Percent
Age	Mean ± standard deviation	68.3 ± 6.2	Range: 60-81
Gender	Female	82	41
	Male	118	59
Marital status	Single	12	5
	Married	106	53
	Widow or widower	82	42
History of diabetes	No	129	64.7
	Yes	71	35.3
History of blood pressure	No	82	41.2
	Yes	118	58.8
Taking psychiatric drugs	No	176	88.2
	Yes	24	11.8
Fatty liver	No	186	93
	Yes	14	7
Smoking	No	141	70.6
	Yes	59	29.4

(32%) were the most common illnesses, while bloody diarrhea (1.5%), acute fever, and rash were less common.

Table 4 demonstrates a significant association between not wearing a mask, DM, and smoking and the incidence of flu-like syndrome and severe respiratory disease; however, hypertension/high blood pressure did not show a significant correlation.

Table 5 presents the results of a multiple logistic regression analysis for flu-like syndromes, severe respiratory disease, and crude ORs and AORs. After adjusting for age, gender, fatty liver, and blood pressure, DM (AOR = 3.01, 1.4–7.7), not using a mask (AOR = 1.5, 1.2–4.7), and smoking (AOR = 1.75, 1.02–3.8) increased the risk of developing flu-like symptoms and severe respiratory disease in the elderly pilgrims. Conversely, using and replacing a face mask in less than 8 hours (AOR = 0.25, 0.1–0.84) significantly lowered the risk of developing the disease.

Discussion

The Arba'een pilgrimage is a religious gathering for many Muslims, particularly those from Iran annually. The Arba'een walk in Iraq is estimated to attract 17-21 million participants, making it one of the largest annual mass gatherings worldwide.[25] Karbala, a city in central Iraq, is the destination of participants who walk from cities across Iraq and neighboring countries. The event commemorates the return of Hussein Ibn Ali's family to the city 40 days after the massacre of Hussein and his relatives and companions in 680 AD. This annual event known as Arba'een occurs on the 20th day of Safar, the second month of the Islamic lunar calendar. The use of the lunar calendar means that the Arba'een event takes place in different seasons throughout the year, hence potentially affecting the type of pathogens and their transmission.[26]

The annual participation rate of pilgrims (walkers) in this journey exhibits a consistent upward trend. This survey aimed to investigate the distribution of syndromic symptoms related to infectious diseases and the factors associated with them and measure the frequency of mask usage among elderly visiting outpatient clinics along the Arba'een pilgrimage route. This study is among the first of a limited number of research endeavors performed among Arba'een pilgrims. Given the significant flow of Arba'een pilgrims and the annual gathering of millions for this religious ceremony, preventing any potential epidemic must be prioritized. Syndromic symptoms are the primary symptoms related to specific diseases, each with its own set of symptoms. Recognizing and reporting cases exhibiting these specific symptoms, irrespective of their diagnosis, allows preventive and treatment measures

Table 2. Mask Wearing Based on Gender in the Elderly People Referred to Outpatient Clinics During Arba'een Pilgrimages

Variable		Frequency (N = 200)	Percent
Wearing a mask	Yes	72	29.4
	No	128	70.6
Users swap masks daily (n = 24)	Less than 8 hours	51	71
	Over 8 hours	21	29

Table 3. Prevalence of Infectious Illness Syndromes in Arba'een Pilgrims Referred to Outpatient Clinics in 2022

Syndrome		Total (N = 200)	Percent
Syndrome related to infectious diseases	Asymptomatic	0	0.0
	Influenza-like illness	84	42.0
	Severe respiratory illness	12	6
	Acute watery diarrhea (non-bloody)	64	32
	bloody diarrhea	3	1.5
	Food poisoning	10	5
	Acute fever and rash	5	2.4
	Chronic cough	22	11

Table 4. 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 = 200)	*P* Value
		Yes (n = 84)	No (n = 116)		
Gender	Female	42	60	102	0.133
	Male	43	56	89	
Diabetes	No	32	55	87	0.026
	yes	52	61	0.113	
Wearing a mask	No	33	86	119	0.043
	yes	51	30	81	
Fatty liver	No	68	102	170	0.192
	yes	16	14	30	
Blood pressure	No	65	47	112	0.087
	yes	19	69	88	
Smoking	No	56	88	144	0.033
	yes	28	28	56	

Table 5. Crude and Adjusted ORs of Risk of Influenza-like Illness and Severe Respiratory Syndrome in Arba'een Marchers in 2022 Using Multiple Logistic Regression

Variables	Crude ORs and 95% CI	Adjusted ORs* and 95% CI
Not wearing a mask	2.55 (1.3–7.4)	1.50 (1.2–4.7)
P value	0.043	0.023
Changing the mask (less than 8 hours)	0.83 (0.26–2.6)	0.25 (0.1–0.84)
P value	0.150	0.031
Smoking	2.5 (1.2–6.5)	1.75 (1.02–3.8)
P value	0.033	0.031
DM	2.2 (1.2–5.8)	3.01 (1.4–7.7)
P value	0.033	0.021

Note. OR: Odds ratio; CI: Confidence interval; DM: Diabetes mellitus.
*Adjusted for age, gender, fatty liver, and blood pressure.

by higher authorities across all levels of society until a definite diagnosis is established.[27]

The early prediction of outbreak size, speed, intensity, and pattern can be aided by identifying and documenting syndromic symptoms among Arba'een pilgrims.[25] This can facilitate timely and effective disease prevention and control management, which in turn leads to decreased costs within the healthcare system. Furthermore, it improves the ease and adaptability of categorizing signs and symptoms, along with prompt notification and swift execution of interdepartmental collaboration in healthcare.[28-30]

According to the current investigation, flu-like syndrome and respiratory illnesses were the most frequently reported syndromes (42%) among patients. Based on the survey and the recorded infectious disease surveillance system of the 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 these cases required more than two days of hospitalization due to the severity of respiratory illness, and 106 cases died between the October and December 2019.[6] The same findings and risks of respiratory diseases were highlighted for Haj mass gatherings by Mahdi et al.[12]

Given the potential transmission of respiratory diseases through airborne particles, environmental factors, and person-to-person contact in large gatherings such as Arba'een, it is crucial to prioritize understanding transmission methods and prevention strategies. However, our research indicated that only 29.4% of participants used masks, with over 70% changing their masks once every 8 hours. As a result, the findings of this study suggest that mask use is notably low during large gatherings such as Arba'een. The same concerns are also highlighted during other mass gatherings such as Hajj.[13]

The COVID-19 pandemic has highlighted the importance of mask usage,[31,32] practicing proper physical distancing, and avoiding contact between individuals displaying suspicious symptoms and vulnerable populations, including children, pregnant women, the older adults, and those with other diseases. These actions are crucial in mitigating the potential risks to human life.[33,34]

Our study results indicated the highest proportion of respiratory disease symptoms among individuals who smoke. Healthcare systems must prioritize the proper management of smokers and those with underlying medical conditions.[35]

The effective management of preparations for the Arba'een pilgrimage mass gathering can prevent diseases and other outbreaks. Conducting a comprehensive evaluation of syndromic symptoms and a systematic classification of symptoms can significantly improve the efficiency of diagnosing an illness and initiating therapy.[9]

Limitations and Strengths

The syndromic approach employed in the current study is considered a significant strength. Due to the overwhelming number of participants and outpatients, laboratory diagnosis facilities could not be utilized during the Arba'een pilgrimage. Therefore, recognizing and categorizing diseases based on symptoms can result in cost savings and the diagnosis of outbreaks in the case of unusually observing high rates of disease.[36,37]

Conclusions

Elderly pilgrims exhibited a significant prevalence of influenza-like syndromes and severe respiratory diseases. As a result, it is essential to conduct a comprehensive differential diagnosis, including influenza and COVID-19, to prevent any potential epidemic during the Arba'een pilgrimage. Furthermore, the participants' use and regular replacement of face masks were reported to be shockingly low. The probability of respiratory symptoms progressing is higher when mask usage is not adhered to or smoking is involved. In contrast, timely mask replacement was found to decrease the likelihood of these symptoms.

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Author contributions

Conceptualization: Hosein Azizi, Behrouz Naghili.
Data curation: Fariba Abbasi, Hosein Azizi, Elham Davtalab Esmaeili, Pirhossein Kolivand, Shahriyar Ghanbarzadeh Javid.
Formal analysis: Hosein Azizi, Elham Davtalab Esmaeili.
Funding acquisition: Hosein Azizi, Behrouz Naghili.
Investigation: Hosein Azizi, Pirhossein Kolivand, Ehsan Sarbazi, Shahriyar Ghanbarzadeh Javid.
Methodology: Hosein Azizi, Elham Davtalab Esmaeili, Ehsan Sarbazi.
Project administration: Hosein Azizi
Resources: Hosein Azizi, Pirhossein Kolivand.
Software: Hosein Azizi.
Supervision: Hosein Azizi, Behrouz Naghili.
Validation: Hosein Azizi.
Visualization: Hosein Azizi, Shahriyar Ghanbarzadeh Javid, Fariba Abbasi.
Writing–original draft: Hosein Azizi.
Writing–review & editing: Behrouz Naghili, Elham Davtalab

Esmaeili, Fariba Abbasi, Pirhossein Kolivand, Shahriyar Ghanbarzadeh Javid, Ehsan Sarbazi.

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Data availability statement
The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethical approval
The study was approved by the Ethics Committee of the Iranian Red Crescent Society under code IR.RCS.REC.1401.007. Verbal informed consents were obtained from all participants before the survey.

Conflict of interests
The authors declare that there is no conflict of interests.

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