

The Influence of Knowledge of Healthcare Workers about Hazards of Heat Exposure and Prevalence of Heat-Related Illnesses among Pilgrims Attending Hospitals and Primary Health Centers in Makkah Saudi Arabia 2023

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Abstract:

Background

Although classic heat exposure and heat stroke is one of the most ancient conditions known to humans, the description of its early clinical manifestations, natural course, and complications remains uncertain. Heat exposure and heat stroke is a life-threatening condition characterized by a rapidly increasing core temperature above 40°C and neurologic alterations, such as delirium, convulsions, or coma, after exposure to extreme environmental heat alone or in combination with intense physical exertion. Heat-related illnesses (HRIs), such as heatstroke (HS) and heat exhaustion (HE), are common complications during Hajj pilgrims. The Saudi Ministry of Health (MOH) developed guidelines on the management of HRIs to ensure the safety of all pilgrims, must be healthcare workers' (HCWs) adherence to the updated national guidelines regarding pre hospital and in-hospital management of HRIs.

Aim of the study: To influence of Knowledge of Healthcare Workers about Hazards of Heat Exposure and Prevalence of Heat-related illnesses among pilgrims attending at hospitals and primary health centers in Makkah at Saudi Arabia 2023.

Methods: Across sectional descriptive study conducted among Healthcare Workers about Hazards of Heat Exposure and Prevalence of Heat-related illnesses among pilgrims attending at hospitals and primary health centers, Makka, June, 2023 to July 2022 Hajj 2023, Our total Sample size of health care workers participants were (200)

Results: the relation of Knowledge of the healthcare workers about hazards of heat exposure and Prevalence of heat-related illnesses among pilgrims regarding the knowledge the most of participants average knowledge were (56.0%) followed by high were (26.0%) but weak were (18.0%) and total were (100.0%) while have a significant relation were P-value <0.001 and X^2 48.16.

Conclusion: Heat Exposure and Heat Illnesses are not common problems among Saudi Arabians. They are, however, of significance in pilgrims from other parts of the world during Haj season, which varies according to the lunar calendar year. In recent years, Haj has coincided with the summer months of July and August. The temperatures during Haj reach an average high of 54°C (130°F).

Keywords: Influence, Knowledge, Healthcare Workers, Hazards, Heat, Exposure, Heat-related, illnesses, pilgrims, hospitals, Primary health centers, Makkah , Saudi Arabia .

Introduction

The World Health Organization (WHO) recognized climate change as one of the top five environmental causes of death worldwide [1]. Extreme weather patterns have resulted in various illnesses and mortalities around the world. Exposure to heat, in particular, is a natural hazard that can affect human health and is significantly linked to the occurrence of heat-related illnesses [2]. A wide range of health conditions may result from heat exposure and heat-related illnesses, from mild symptoms to life-threatening manifestations such as heatstroke (HS), heat exhaustion (heat exposure), and heat cramps [3]

Hajj is the fifth pillar of Islam as it is compulsory for the financially and physically capable Muslims to perform it at least once in the life. Hajj is considered among the big challenges facing Saudi Arabia and the Ministry of Health¹. [4] More than 9 million pilgrims perform rituals every year during the Hajj which is considered a peaceful mass gathering of pilgrims collecting in masses from 200 countries at Mecca, Saudi Arabia. The Hajj comprises "effort-intensive prayers, supplications, and rituals for spiritual edification" 2. Age, urbanization, obesity, comorbidities, lack of adaptive cooling measures, duration of exposure to heat, and relative humidity are individual and environmental risk factors that may increase the frequency and intensity of Exposure to heat [5,6]. Patients with Exposure to heat can present with wide clinical spectrums such as fatigue, vomiting, fainting, hyperthermia, neurological disturbance, circulatory collapse, and multi organ failure [7]. The diagnosis of Exposure to heat is usually based on the history of exposure to a hot environment, clinical symptoms, and signs of dehydration [8].

Heat exposure and heat-related illnesses is endemic during the Hajj pilgrimage to Mecca in the desert climate of Saudi Arabia [9]. Due to strict rituals, pilgrims stay outside the city in the desert within well-defined geographical boundaries, wear comparable clothing, eat similar food, and move together. Therefore, pilgrims receive a comparable dose of heat, experiencing near-experimental conditions of severe heat stress. Furthermore, in Hajj all the conditions are set for early detection of heat exposure and heat-related illnesses. This includes most pilgrims' awareness of the danger of heat exposure and heat-related illnesses and how to recognize its early warning symptoms and signs [10]. In addition, public health protocols are in place for recognition and prompt cooling therapy in field hospitals within walking distance to minimize heat-induced organ damage and maximize the chance of survival. In this, we comprehensively describe the demographics, clinical characteristics, biomarkers, therapy, and outcomes of HS in one of the largest cohorts to date[11].

The Holy City of Makkah is the host of two Islamic rituals, namely Hajj and Umrah. Makkah is located in the western region of the Kingdom of Saudi Arabia (KSA), and it is characterized by a desert climate with extreme heat during the daytime, heat exposure and heat-related illnesses are the leading causes of morbidity and mortality when the pilgrimage season to Makkah enters the hot cycle of the year [12].

The government of Saudi Arabia places the highest priority on the provision of adequate health services, free of charge, to the pilgrims during their stay in the Haj sites (Makkah Al-Mukarramah, Mina, Muzdalifah and Arafat). These services are largely provided by and coordinated through the Ministry of Health (MOH).[13] One of the major breakthroughs for the treatment of heat stroke was the introduction of the Makkah Al-Mukarramah Body Cooling Unit (MMBCU).[14] The MMBCU, placed in operation during the Haj of 1979, is a specially constructed bed that provides rapid cooling and protection of the vital organs of the heat-stroke victim. In recent years, the MMBCU has become the equipment of choice, and specially designed heat stroke centers have been located in the Haj sites. Sixty-four MMBCUs have also been installed in three of the hospitals in and around the Haj.[15]

Literature Review

Higgins et al (2022), report that excessive loss of water, salt, or both may increase the risk of heat illnesses. A previous study reported that on-the-spot oral hydration is an essential step for the patient treatment process [17]. However, starting oral hydration and placing patients in supine positions with elevated hips and legs had the lowest compliance scores. Such low compliance levels could be due to several reasons: the lack of proper knowledge among Healthcare Workers concerning the importance of proper hydration during heat exposure and heat-related illnesses attacks can represent an important reason for this inadequate adherence. Environment-related factors, including the presence of other critically ill patients needing more attention [18,19]

Another study by Fanello et al (2023) reported that elderly are usually at greater risk. That the majority fall into the older age group in their countries of origin . Excess mortality from heat exposure and heat-related illnesses is reported during the pilgrimage and it is possible that such deaths are heat induced. Excessively hot weather may also increase mortality from heat exposure disease. Excess deaths in the KSA from heat exposure and heat-related illnesses in the heat wave years .[20]

In other study reported Othman et al (2023) that Diarrhea and food poisoning Traveller's diarrhea is common during the Hajj especially in the elderly, although few studies have documented its incidence and etiology. The last study was done in 2020 showing that heat exposure and Prevalence of heat illnesses was the third most common cause for hospitalization during Hajj, also in elderly, Cholera and heat exposure and Prevalence of heat illnesses an acute bacterial enteric disease caused by *Vibrio cholera* accounted for several outbreaks after the Hajj [21]

Heat exposure and heat-related illnesses regularly reported during the Hajj pilgrimage, resulting in significant morbidity and mortality among pilgrims [22].

Another study (23) found that important factor increasing the risk of heat illnesses among the pilgrims is the high prevalence of chronic disabling diseases. Especially notable among these is diabetes mellitus. In 70% there was an abnormally high blood sugar level while only 30% of those patients with high blood sugar had sugar in their urine. In the majority there was no previous history of diabetes. Diabetics were the least likely to respond to cooling and all deaths were among these patients. The relationship between heat stress and high blood sugar needs further investigation.[23]

Although the primary management lines for heat exposure and heat-related illnesses are simple and imply mainly proper cooling and hydration, improper management of heat exposure and heat-related illnesses can lead to devastating consequence such as heat exposure and heat-related illnesses, multi organ failure, and death [23]. In the case of heat exposure and heat-related illnesses, moving the patient to a cooler environment such as a shaded area or an air-conditioned car, coupled with lightening the patient's clothing, would be the first step of patient treatment [24]

Quandt et al(2020) report, moving patients to cooler places was the only management step with an above average adherence from HCWs, to most patients since it is the easiest and fastest step. Compliance with lightening up clothes was average due to the nature of clothes male pilgrims wear (Ihram), which are two loose pieces of cloth worn during the rituals.[25]

On the other hand, previous studies highlighted the importance of initiating external cooling on-site and continuing cooling during transportation to medical facilities. Continuous cooling significantly improves the outcome of heat exposure and heat-related illnesses management in the pre-hospital setting [26]

Other study showed average compliance in the overall pre-hospital cooling process. There was a below-average adherence to both immediate and continued cooling; however, HCWs adhered to the immediate transfer and cooling methods. This variation in compliance to pre-hospital cooling could reflect the need for more healthcare training about the importance of cooling. Factors like the distance to the heat exposure and heat-related illnesses unit, transportation availability, access to cooling tools, and overcrowded environment may affect the proper adherence to the cooling process [27].

Rationale:

A review of the literature shows that our knowledge of the epidemiology of heat exposure and Prevalence of heat-related illnesses on a global and regional level is still lacking, great importance and unique for the study of heat illness is the start of the hot cycle of the Makkah Pilgrimage which will continue for the next 15-16 years. Approximately two million people, the majority of whom are at great risk, will be exposed to the extremes of hot weather in May-September. Thousands of heat stroke cases are expected to occur. In this paper the conditions prevailing during the annual Makkah Pilgrimage are described as well as a review of the epidemiological and clinical findings observed by the author during the pilgrimages of 2022 /2023 when a lot of cases of Heat Stroke were seen and treated respectively, the influence of Knowledge of Healthcare Workers about Hazards of Heat Exposure and Prevalence of Heat-related illnesses among pilgrims very important for the Saudi MOH to develop further recommendations and actions..

Aim of the study: To assessment the influence of Knowledge of Healthcare Workers about Hazards of Heat Exposure and Prevalence of Heat-related illnesses among pilgrims attending hospitals and primary health centers, Makkah, Saudi Arabia 2023.

Objectives:

To assessment the influence of Knowledge of Healthcare Workers about Hazards of Heat Exposure and Prevalence of Heat-related illnesses among pilgrims attending at hospitals and primary health centers, Makkah Al-Mokarrama, Saudi Arabia 2023

To assess the Knowledge of the Healthcare Workers about Hazards of Heat Exposure and Prevalence of Heat-related illnesses among pilgrims attending at hospitals and primary health centers, Makkah Al-Mokarrama, Saudi Arabia 2023

Methodology:

Study design:

This study is a cross-sectional study design was used in carrying out of this study.

Study Area

The study has been carried out in the city of Makkah. Makkah is the holiest spot on Earth. It is the birthplace of the Prophet Mohammad and the principal place of the pilgrims to perform Umrah and Hajj. It is located in the western area in Kingdom of Saudi Arabia and called the Holy Capital. Contains a population around 2.580 million. This study was conducted to pilgrims who resident in Makkah city during, during Jun 2023 to July 2023 Hajj 2023 , the Saudi government provides free health services during Hajj rituals through hospitals and primary health centers (PHCs), including seasonal health facilities during the pilgrimage . Health care workers included in our survey were male and female (<30years of age to >50) health care workers who Workers who deal with pilgrims diagnosed with heat Exposure and heat Illnesses attending at Health care Center and hospitals during the study period. Data were collected for the (200) ' attending at hospitals and Health care Center. A team of two was deployed at hospitals and Health care Center to collect data through a pathway checklist questionnaire. We excluded workers below 18 years, Health care workers , and patients who were not diagnosed with heat exposure and heat illnesses, the study has been conduct on a convenience sample of 200 workers' residents in Makkah city matching the inclusion criteria and exclusion..

Selection criteria:

This difference translates into biological, socioeconomic and lifestyle differences

Inclusion criteria:

Health care worker who agree to participate in the study
Work in hajj at Makkah city .
Able and willing to participate in the study.
participate diagnosed with heat exposure and heat illnesses

3.3.3Exclusion criteria:

Health care worker outside Makkah city .
Health care worker that refusing to participant

The sample size

The sample size has been calculated by applying Raosoft sample size calculator based on (The margin of error: 5%, Confidence level: 95%, and the response distribution was considered to be 20%) accordingly to sample size from hajj pilgrims by the required sample size; (200). (Male and female) and adding 10 more to decrease margin of error. After adding 5% oversampling, the minimum calculated sample has been 200. Computer generated simple random sampling technique was used to select the study participants. Data collection was done by the researcher during the 2023

Data collection tools of the study:

To collect data knowledge structured questionnaire was used. It was developed by the researcher after reviewing of current national and international related literature. It composed of questions. This included the following parts:

Part one: biosocial demographic characteristics: as name, pilgrim number, age, sex, phone number, leader name, frequency of hajj, years of education, area of residence, and presence of chronic diseases as diabetic mellitus.

Part two: this part including questions to assess the Knowledge of Healthcare Workers about Hazards of Heat Exposure and Prevalence of Heat-related illnesses among pilgrims and line of treatment .

Following a short briefing about the study, informed consent will obtain from each participant who agreed to join the survey. Ethics approval will obtain from hospitals and primary health centers research center. The study tool was developed by the researcher and checked for validity and reliability using Cronbasha's alpha ($r=0.76$). Pilot study was done on 10 HCWs Hajj to check and ensure the clarity, applicability and feasibility of tools. HCWs completed the surveys themselves; however, research team members helped those who were unable to complete the questionnaires themselves.

Data entry and analysis:

The Statistical Package for Social Sciences (SPSS) software version 24.0 has be used for data entry and analysis. Descriptive statistics (e.g., number, percentage) and analytic statistics using Chi-Square tests (χ^2) to test for the association and the difference between two categorical variables were applied. A p-value ≤ 0.05 will be considered statistically significant

Pilot study

A pilot study has be conducted from Healthcare Workers in hospitals and primary health centers the same sector due to the similarity to the target group using the same questionnaire to test the methodology of the study. As a feedback, the questionnaire will be clear and no defect has be detected in the methodology

Ethical considerations

Permission from the Makkah joint program Family Medicine program has be obtained. Permission from the Directorate of hajj, verbal consents from all participants in the questionnaire were obtained. All information was kept confidential, and a result has be submitted to the department as feedback .

8. Budget: Self-funded

Results :

Table 1: distribution of participants according to socio demographic characteristics (Age, Gender, Nationality, qualification, Job title, and experience)

	N	%
Age		
<30	44	22
30-40.	56	28
40-50.	64	32
>50	36	18
Gender		
Male	136	68
Female	64	32

Nationality		
Saudi	154	77
Non-Saudi	46	23
Your qualification is		
Diploma	36	18
Bachelor	56	28
Resident	42	21
Specialist	24	12
Master	20	10
Consultant	22	11
Job title		
Doctor	64	32
Nurse	94	47
Administrative	42	21
Years of experience		
<5	42	21
5-10.	76	38
10-15.	50	25
>15.	32	16

Regarding socio demographic characteristics, this table shows that the highest proportion of participants age 40-50 years (32.0%) and 30-40 years of age (28.0%), while <30 years were (22.0%), regarding the gender the majority of participant male were (68.0%), but female were (32.0%) , regarding nationality the majority of participant Saudi were (77.0%) but non- Saudi were (23.0%), regarding the qualification is the majority of participant bachelor were (28.0%) but Resident were (21.0%), while diploma were (18.0%), regarding the Job title the majority of participant nurse were (47.0%) but doctor were (32.0%), while Administrative were (21.0%), regarding the years of experience the majority of participant from 5-10 were (38.0%), while from 10-15 were (25.0%) but <5 were (21.0%).

Table 2: distribution of the participants' knowledge about the heat exposure and heat stroke cases .

	N	%
Heat exposure and heat stroke cases Management		
Basic Case Management	30	15
Advanced Case Management	22	11
All of them	126	63

Do not know	22	11
How heat exposure and heat stroke cases Management		
Patient moved to a cooler place	22	11
Patient placed in supine position and elevate legs and hips	24	12
Patient clothes lightened up	10	5
Patient started oral hydration	18	9
Patient moved to a cooler place	12	6
All of them	110	55
Do not know	4	2
If advanced how case management		
Intravenous fluid given when patient nauseated	32	16
Cooling and transferring the patient to health facility	22	11
If no improvement of signs and symptoms, other diagnosis considered	30	15
All of them	110	55
Do not know	6	3
Heat stroke pre-primary health care management guidelines compliance scores		
BSI * considered	24	12
Any medication given pre-primary health care	36	18
Full pre-primary health care report taken	26	13
All of them	110	55
Do not know	4	2
To recognition of heat exposure and heat stroke / Case management		
Responsiveness assessed	52	26
All vital signs documented	44	22
All of them	96	48
Do not know	8	4
Stabilize ABC		
Airway stabilized	18	9
Breathing stabilized	30	15
Circulation stabilized	16	8
All of them	120	60
Do not know	16	8

Cooling		
Started immediately on the scene	12	6
Ice packs/chemical ice packs, fanning, wet sheets to the skin were applied	38	19
Cooling continued on the way to the heatstroke unit	16	8
Patient transferred immediately to the heatstroke unit	18	9
All of them	106	53
Do not know	10	5

Regarding knowledge about the heat exposure and heat stroke cases, the table shows regarding heat exposure and heat stroke cases management the majority of participant answer all of them were (63.0%), but Basic Case Management were (15.0%), while Advanced Case Management and do not know respectively were (11.0%), regarding how heat exposure and heat stroke cases Management the majority of participant answer all of them were (55.0%), but Patient placed in supine position and elevate legs and hips were (12.0%), while Patient moved to a cooler place were (11.0%), regarding If advanced how case management the majority of participant answer all of them were (55.0%), but Intravenous fluid given when patient nauseated were (16.0%), while If no improvement of signs and symptoms, other diagnosis considered were (15.0%), regarding heat stroke pre-primary health care management guidelines compliance scores the majority of participant answer all of them were (55.0%), but Any medication given pre-primary health care were (18.0%), while Full pre-primary health care report taken were (13.0%), regarding the recognition of heat exposure and heat stroke / Case management the majority of participant answer all of them were (48.0%), but Responsiveness assessed were (26.0%), while All vital signs documented were (22.0%), regarding the Stabilize ABC the majority of participant answer all of them were (60.0%), but breathing stabilized were (15.0%), while Airway stabilized were (9.0%), but the circulation stabilized were (8.0%), regarding Cooling the majority of participant answer all of them were (53.0%), but Ice packs/chemical ice packs, fanning, wet sheets to the skin were applied were (19.0%), while Patient transferred immediately to the heatstroke unit were (9.0%), but Cooling continued on the way to the heatstroke unit were (8.0%)

Table 3: distribution of the participants' general knowledge about heat exposure and heat stroke pre-primary health care management guidelines compliance scores .

Heat exposure and heat stroke in-primary health care management guidelines compliance	N	%
In-primary Considerations		
Adhered to appropriate PPEs	34	17
Did not give antipyretics	4	2
Full pre-primary report taken	26	13
All of them	124	62
Do not know	12	6

Diagnosis confirmation with rectal thermometer/ Case Management		
A. Cooling		
Cooling continued	22	11
Skin and rectal temperature continuously monitored	26	13
Skin temperature maintained > 30 C	16	8
Cooling stopped when rectal temperature is 39 C	18	9
All of them	102	51
Do not know	16	8
B. Stabilize ABC		
Airway stabilized	18	9
Breathing stabilized : administer oxygen to keep oxygen saturation (SaO ₂) > 94	14	7
All of them	152	76
Do not know	16	8
Special considerations		
Rhabdomyolysis diagnosed	22	11
Volume expanded by giving more fluids	24	12
Intravenous furosemide, mannitol, and sodium bicarbonate were given	64	32
All of them	66	33
Do not know	24	12
Potassium and calcium were monitored		
Yes	156	78
No	24	12
Do not know	20	10
If hyperkalaemia, the patient was treated		
Yes	144	72
No	24	12
Do not know	32	16
In case of seizure/shivering, benzodiazepines given		
Yes	150	75
No	44	22
Do not know	6	3
In case of multiple organ system dysfunction, supportive therapy given		

Yes	162	81
No	22	11
Do not know	16	8

Regarding Heat exposure and heat stroke in-primary health care management guidelines compliance, the table shows regarding In-primary Considerations the majority of participant answer all of them were (62.0%), but adhered to appropriate PPEs were (17.0%), while full pre-primary report taken were (13.0%), regarding Diagnosis confirmation with rectal thermometer/ Case Management regarding the A. cooling the majority of participant answer all of them were (51.0%), but Skin and rectal temperature continuously monitored were (13.0%), while Cooling stopped when rectal temperature is 39 C were (9.0%), followed by Skin temperature maintained > 30 C and do not know respectively were (8.0%), regarding B. Stabilize ABC the majority of participant answer all of them were (76.0%), but Airway stabilized were (9.0%), while do not know were (8.0%), followed by breathing stabilized : administer oxygen to keep oxygen saturation (SaO2) > 94 were(7.0%), regarding Special considerations the majority of participant answer all of them were (33.0%), but intravenous furosemide, mannitol, and sodium bicarbonate were given were (32.0%), while volume expanded by giving more fluids were (12.0%), followed by do not know were (12.0%) while Rhabdomyolysis diagnosed were (11.%), regarding the Potassium and calcium were monitored the majority of participant answer Yes were (78.0%), but No were (12.0%) followed by do not know were (10.0%), regarding the hyperkalemia, the patient was treated the majority of participant answer Yes were (72.0%), but do not know were (16.0%), while No were (12.0%), regarding case of seizure/shivering, benzodiazepines given the majority of participant answer Yes were (75.0%), but No were (22.0%), while do not know were (3.0%), regarding case of multiple organ system dysfunction, supportive therapy given the majority of participant answer Yes were(81.0%) but No were (11.0%) while do not know were (8.0%),

Table 4 Distribution of the relation of Knowledge of the healthcare workers about hazards of heat exposure and Prevalence of heat-related illnesses among pilgrims

		Knowledge	
		N	%
Weak		36	18
Average		112	56
High		52	26
Total		200	100
Chi-square	X²	48.16	
	P-value	<0.001*	

Table 4 show Distribution of the relation of Knowledge of the healthcare workers about hazards of heat exposure and Prevalence of heat-related illnesses among pilgrims regarding the

knowledge the most of participants average knowledge were (56.0%) followed by high were (26.0%) but weak were (18.0%) and total were (100.0%) while have a significant relation were P-value <0.001 and X^2 48.16.

Figure 1 Distribution of the relation of Knowledge of the healthcare workers about hazards of heat exposure and Prevalence of heat-related illnesses among pilgrims

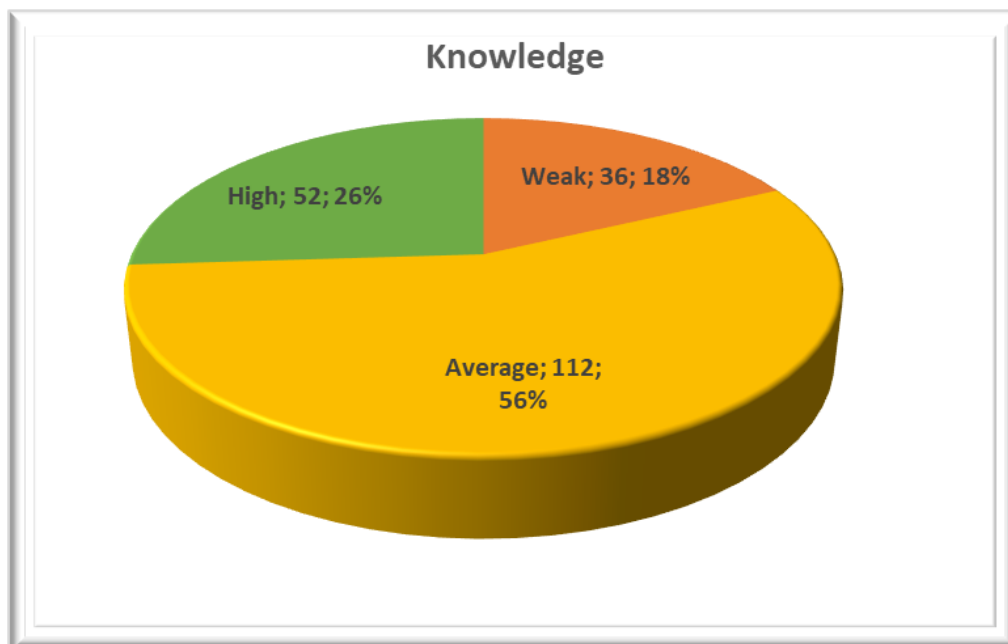


Table 5 Distribution of the relation of Knowledge of the healthcare workers about hazards of heat exposure and Prevalence of heat-related illnesses and demographic data .

		Total		Weak		Average		High		Chi-square	
		N	%	N	%	N	%	N	%	X ²	P-value
Age	<30	44	22%	1	52.78%	2	19.64%	3	5.77%	48.925	<0.001*
	30-40.	56	28%	1	38.89%	3	29.46%	9	17.31%		
	40-50.	64	32%	2	5.56%	4	35.71%	2	42.31%		
	>50	36	18%	1	2.78%	1	15.18%	1	34.62%		
Gender	Male	13	68%	2	58.33%	7	66.96%	4	76.92%	3.504	0.173
	Female	64	32%	1	41.67%	3	33.04%	1	23.08%		
Nationality	Saudi	15	77%	3	88.89%	8	71.43%	4	80.77%	5.253	0.0723

	Non-Saudi	46	23 %	4	11.11 %	3 2	28.57 %	1 0	19.23 %		
Your qualification is	Diploma	36	18 %	1 2	33.33 %	2 0	17.86 %	4	7.69%	46.366	<0.001 *
	Bachelor	56	28 %	1 5	41.67 %	3 2	28.57 %	9	17.31 %		
	Resident	42	21 %	3	8.33%	2 8	25.00 %	1 1	21.15 %		
	Specialist	24	12 %	2	5.56%	1 9	16.96 %	3	5.77%		
	Master	20	10 %	2	5.56%	5	4.46%	1 3	25.00 %		
	Consultant	22	11 %	2	5.56%	8	7.14%	1 2	23.08 %		
Job title	Doctor	64	32 %	5	13.89 %	2 2	19.64 %	3 7	71.15 %	114.18 3	<0.001 *
	Nurse	94	47 %	5	13.89 %	7 6	67.86 %	1 3	25.00 %		
	Administrative	42	21 %	2 6	72.22 %	1 4	12.50 %	2	3.85%		
Years of experience	<5	42	21 %	2 6	72.22 %	1 4	12.50 %	2	3.85%	134.31 4	<0.001 *
	5-10.	76	38 %	7	19.44 %	6 2	55.36 %	7	13.46 %		
	10-15.	50	25 %	2	5.56%	3 1	27.68 %	1 7	32.69 %		
	>15.	32	16 %	1	2.78%	5	4.46%	2 6	50.00 %		

Table (5) show relation of Knowledge of the healthcare workers about hazards of heat exposure and Prevalence of heat-related illnesses and demographic data regarding the age the majority of participant in knowledge weak score in age <30 years were (52.78%), while average score were (19.64%) from total were (22.0%) followed by 30-40 year the participant in weak score (38.89%) while total were (28.0%) followed by 40-50 years were (42.31%) in score high from total were (32.0%) while a significant relation were P-value=0.001, and X^2 (48.925), regarding the gender the majority of participant from male knowledge high score were (76.92%), while average score were (66.96%) followed by the participant in weak score (58.33%) while total were (68.0%), regarding the female the majority of participant were (41.67%) in score weak followed by average were (33.04%) from total were (32.0%) while no significant relation were P-value=0.173, and X^2 (3.504), regarding the nationality the majority of participant Saudi the knowledge weak score were

(88.89%), while high score were (80.77%) followed by the participant in average score (71.43%) from total were (77.0%), regarding the non- Saudi the majority of participant were (28.57%) in score average followed by high were (19.23%) from total were (23.0%) while no significant relation were P-value=0.0723, and X^2 (5.253),

regarding the qualification is the majority of participant bachelor the knowledge weak score were (41.67%), while average score were (28.57%) from total were (28.0%), regarding the diploma knowledge weak score were (33.33%), while average score were (17.86%) from total were (18.0%), regarding the master knowledge high score were (25.00%), while average score were (4.46%) from total were (10.0%), regarding the Consultant knowledge high score were (23.08%), while average score were (7.14%) from total were (11.0%), while a significant relation were P-value=0.001, and X^2 (46.366), regarding the Job title is the majority of participant nurse the knowledge average score were (67.86%), while high score were (25.00%) from total were (47.0%), regarding the doctor knowledge high score were (71.15%), while average score were (19.64%) from total were (32.0%), regarding the Administrative knowledge weak score were (72.22%),while average score were (12.50%) from total were (21.0%), while a significant relation were P-value=0.001, and X^2 (114.183), regarding the Years of experience the majority of participant from 5-10 the knowledge average score were (55.36%), while weak score were (19.44%) from total were (38.0%), regarding the <5 knowledge weak score were (72.22%), while average score were (12.50%) from total were (21.0%), regarding from 10-15 knowledge high score were (32.69%),while average score were (27.68%) from total were (25.0%), regarding from >15 knowledge high score were (50.0%),while average score were (4.46%) from total were (16.0%), while a significant relation were P-value=0.001, and X^2 (134.314)

Figure 2 distribution of the relation of Knowledge of the healthcare workers about hazards of heat exposure and Prevalence of heat-related illnesses and qualification

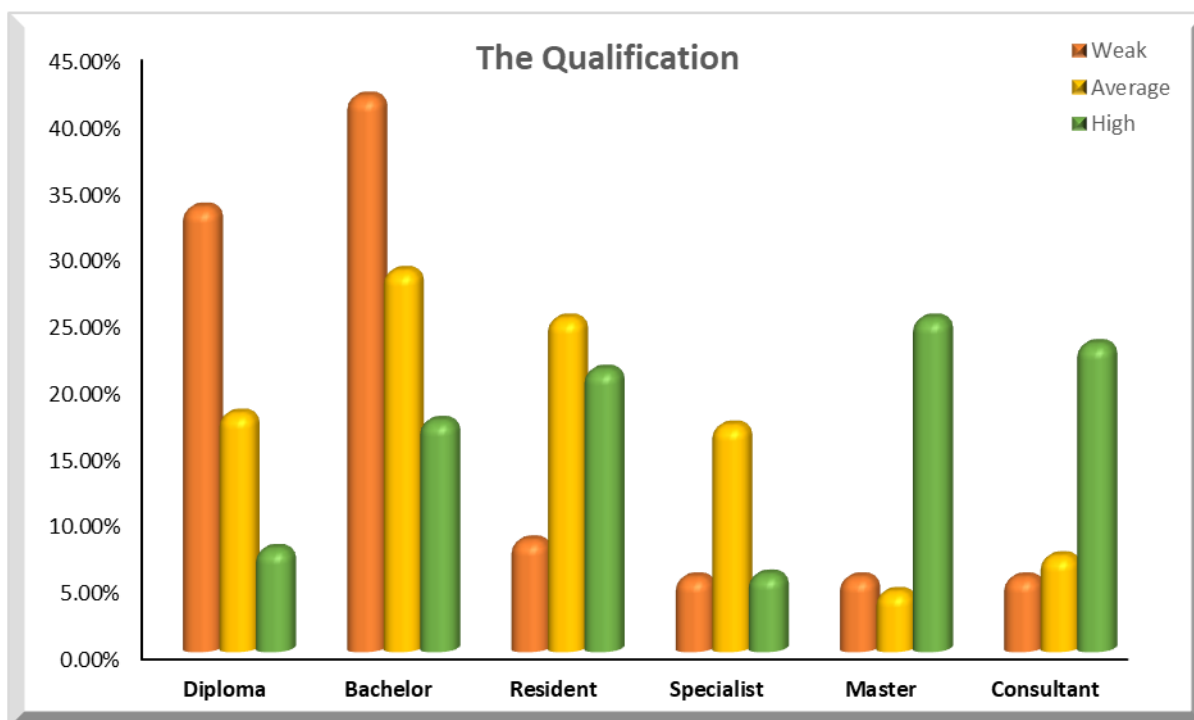


Figure 3 distribution of the relation of Knowledge of the healthcare workers about hazards of heat exposure and Prevalence of heat-related illnesses and age

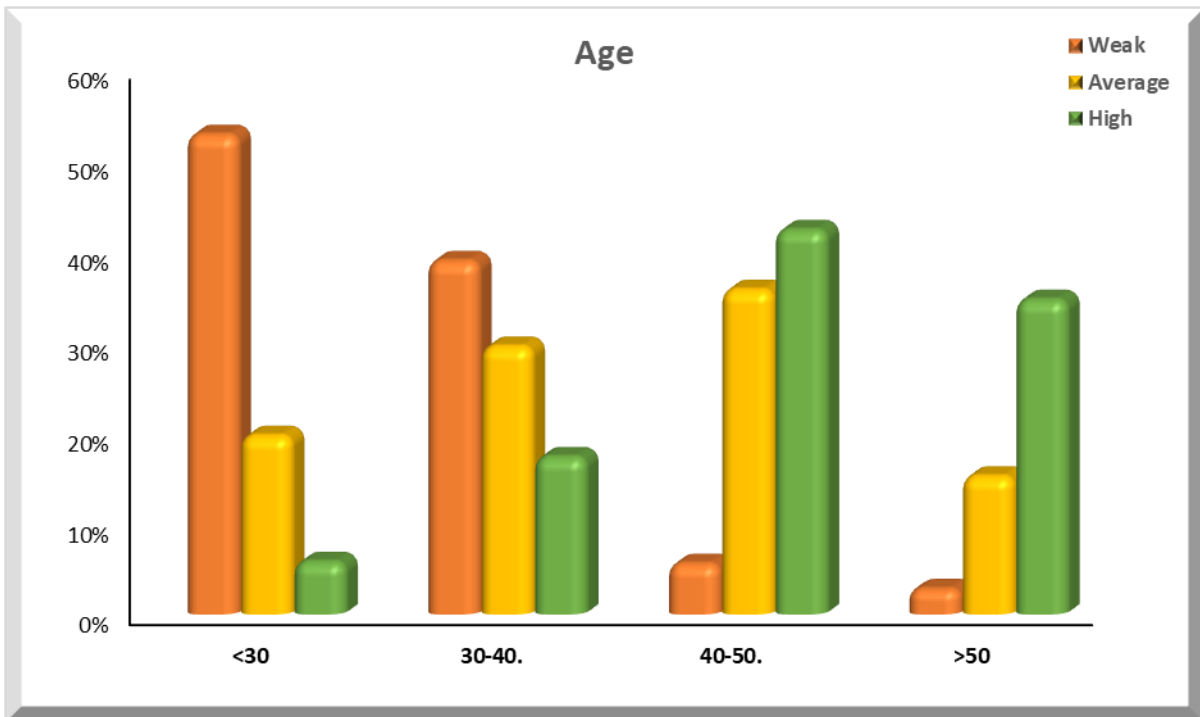


Figure 4 distribution of the relation of Knowledge of the healthcare workers about hazards of heat exposure and Prevalence of heat-related illnesses and years' experience.

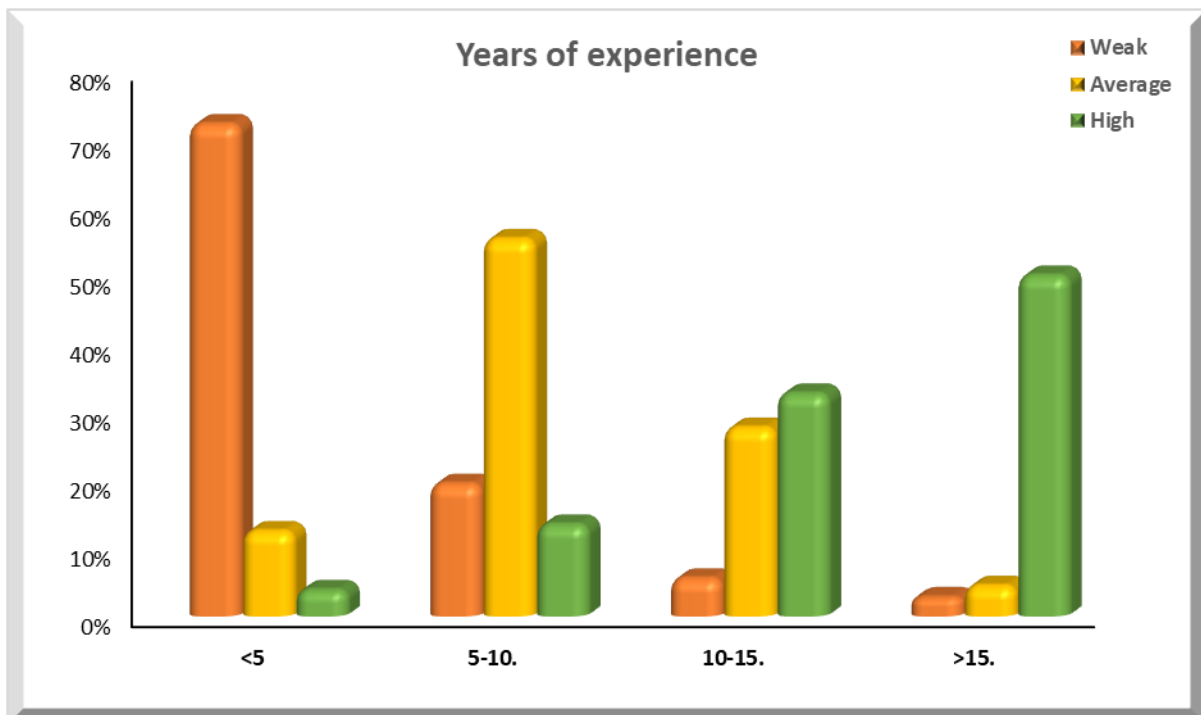
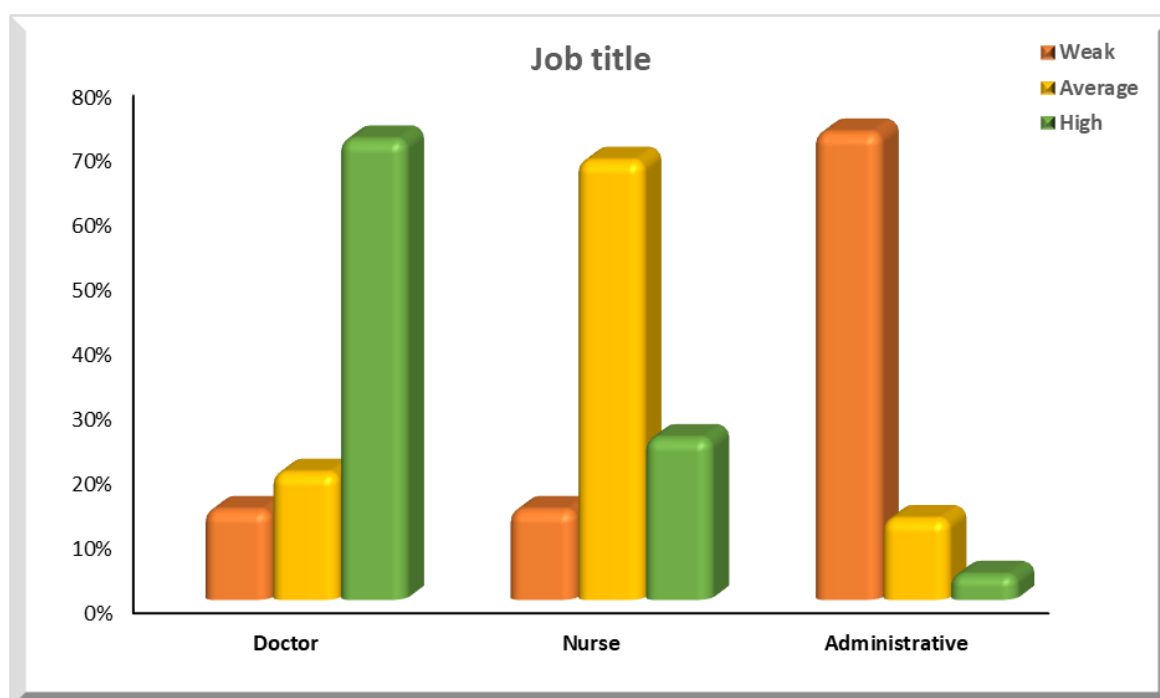


Figure 5 distribution of the relation of Knowledge of the healthcare workers about hazards of heat exposure and Prevalence of heat-related illnesses and job title



Discussion:

Heat exposure and heat-related illnesses are regularly reported during the Hajj pilgrimage, resulting in significant morbidity and mortality among pilgrims [21]. Adequate primary health centers, pre-hospital and hospital management is the cornerstone to ensure optimal outcomes in patients with heat exposure and heat-related illnesses. [23] Saudi MOH developed guidelines for the Knowledge of Healthcare Workers about hazards of heat exposure and heat-related illnesses among pilgrims attending at hospitals and primary health centers during Hajj season[22]. Nonetheless, HCWs can find it challenging to adhere to all of instructions, especially during mass gathering events such as the Hajj rituals. Very important the Healthcare Workers' compliance with this Knowledge to apply the necessary changes, which would improve the quality of health services and protect the pilgrims. [19] the aim of this study influence of Knowledge of Healthcare Workers about Hazards of Heat Exposure and Prevalence of Heat-related illnesses among pilgrims attending at hospitals and primary health centers in Makkah at Saudi Arabia 2023. The study showed socio demographic characteristics highest participants age 40-50 years (32.0%), the gender the majority male were (68.0%), regarding nationality the majority Saudi were (77.0%), the qualification is the majority bachelor were (28.0%), the Job title the majority nurse were (47.0%) but doctor were (32.0%), years of experience the majority from 5-10 were (38.0%)(See table1)

On the other hand, regarding the knowledge about the heat exposure and heat stroke cases found excessive loss of water, salt, or both may increase the risk of heat illnesses. A previous study reported that on-the-spot oral hydration is an essential step for the patient treatment process [28]. Results similar our study, starting oral hydration and placing patients in supine positions with elevated hips and legs had the lowest compliance scores. Such low compliance levels could be due to several reasons: the lack of proper knowledge among Healthcare Workers concerning the importance of proper hydration during heat exposure and heat-related illnesses attacks can represent

an important reason for this inadequate adherence. Environment-related factors, including the presence of other critically ill patients needing more attention [29], diversity of cultures, and different languages could have made it more difficult for Healthcare Workers to precisely follow all the the knowledge. Other patient-specific factors include the stable general condition of most patients or improvement after initial management steps. These factors could also be the reason for the below-average adherence to advanced case management of heat-related illnesses, including transferring patients to health facilities and considering other diagnoses in cases not improving. We also observed incomplete data documentation in the adherence to intravenous (IV) fluid administration in nauseated patients.[30] (See table2) On the contrary, other study found that [18] higher compliance scores were recorded in the pre- and in-hospital management of heat exposure and heat-related illnesses. Better awareness of medical staff to the serious risks and rapid complications of heat exposure could be a reason for this difference in compliance. [22] The average compliance to pre-hospital considerations reflected the fair knowledge of Healthcare Workers of the proper preparation and relevant history taking for patients with heat exposure and heat-related illnesses. One of the positive outcomes of this study was the high levels of recognition and adherence to the assessment of cases with heat exposure and heat-related illnesses. All healthcare professionals should direct all their efforts to stabilize the patient's airway, breathing, and circulation (ABC) before proceeding to more specific cooling therapy[18]. When assessing medical staff's adherence to the ABC stabilizing guidelines, Healthcare Workers showed high adherence to the guidelines, where high percent of the eligible cases were adequately stabilized. Even after hospital admission, staff showed outstanding compliance levels to airway stabilization and maintaining oxygen saturation above [31]. This relatively high adherence could result from the adequate training and readiness of medical staff for emergency scenarios related to heat exposure and heat-related illnesses. (See table 3)

In the current study, regarding the age the majority of participant in knowledge weak score in age <30 years were (52.78%), while average from total were (22.0%) while a significant relation were P-value=0.001, and X² (48.925), regarding the qualification is the majority of participant bachelor the knowledge weak score were (41.67%), while a significant relation were P-value=0.001, and X² (46.366), regarding the Job title is the majority of participant nurse the knowledge average score were (67.86%), were P-value=0.001, and X² (114.183) (See table 5, Figure 3,4,5)

Conclusion

Although authorities of the government of Saudi Arabia are working on research and forming interdisciplinary teams to prevent health problems during the Hajj, the mortality rate from hazards of heat exposure's high and the majority of the patients had hazards of heat exposure and Heat Illnesses, must be planned that more emphasis will be placed on educating the pilgrims about prevention of heat exhaustion prior to their arrival in the Kingdom. It is also hoped that with the improvement in the services and immediate availability of first aid in the Haj sites will witness better and safer Haj seasons in the future

Reference:

1. Trushna, T., & Tiwari, R. R. (2022). Establishing the National Institute for Research in Environmental Health, India. *Bulletin of the World Health Organization*, 100(4), 281.
2. Beechinor, R. J., Overberg, A., Brown, C. S., Cummins, S., & Mordino, J. (2022). Climate change is here: What will the profession of pharmacy do about it?. *American Journal of Health-System Pharmacy*, 79(16), 1393-1396.

3. Leal Filho, W., Ternova, L., Parasnis, S. A., Kovaleva, M., & Nagy, G. J. (2022). Climate change and zoonoses: a review of concepts, definitions, and bibliometrics. *International Journal of Environmental Research and Public Health*, 19(2), 893.
4. Patz, J. A., Campbell-Lendrum, D., Holloway, T., & Foley, J. A. (2005). Impact of regional climate change on human health. *Nature*, 438(7066), 310-317.
5. Haghani, M., Coughlan, M., Crabb, B., Dierickx, A., Feliciani, C., van Gelder, R., ... & Wilson, A. (2023). Contemporary Challenges in Crowd Safety Research and Practice, and a Roadmap for the Future: the Swiss Cheese Model of Crowd Safety and the Need for a Vision Zero Target.
6. Singh, K. (2023). *Syncretic Shrines and Pilgrimages: Dynamics of Indian Nationalism*. Taylor & Francis.
7. Lipman, G. S., Gaudio, F. G., Eifling, K. P., Ellis, M. A., Otten, E. M., & Grissom, C. K. (2019). Wilderness medical society clinical practice guidelines for the prevention and treatment of heat illness: 2019 update. *Wilderness & environmental medicine*, 30(4), S33-S46.
8. Gauer, R. L., & Meyers, B. K. (2019). Heat-related illnesses. *American family physician*, 99(8), 482-489.
9. Yezli, S., Yassin, Y., Ghallab, S., Abdullah, M., Abuyassin, B., Vishwakarma, R., & Bouchama, A. (2023). Classic heat stroke in a desert climate: a systematic review of 2,632 cases. *Journal of internal medicine*.
10. Alqahtani, J. S. (2023, January). Healthcare Research in Mass Religious Gatherings and Emergency Management: A Comprehensive Narrative Review. In *Healthcare* (Vol. 11, No. 2, p. 244). Multidisciplinary Digital Publishing Institute.
11. Almuzaini, Y., Alburayh, M., Alahmari, A., Alamri, F., Sabbagh, A. Y., Alsalamah, M., & Khan, A. (2022). Mitigation strategies for heat-related illness during mass gatherings: Hajj experience. *Frontiers in public health*, 10, 957576.
12. Arafat, M. (2022). Transculturality and the Hajj: diasporas as mediators of cross-cultural encounters. *Journal of Ethnic and Migration Studies*, 1-18.
13. Khadijah, U. L. S., Novianti, E., & Anwar, R. (2022). Social Media In The Marketing Of Religious Tourism: The Case Of Umrah And Hajj Services. *Sosiohumaniora*, 24(1).
14. Jamil, J., & Rahim, Z. A. (2022). Islamic hospitality philosophy, Islamophobia host-guest relationships, traveler psychographic and archetype in the Muslims world. *University of South Florida (USF) M3 Publishing*, 16(9781955833080), 25.
15. Hassan, T. H., Abdou, A. H., Abdelmoaty, M. A., Nor-El-Deen, M., & Salem, A. E. (2022). The impact of religious tourists' satisfaction with Hajj services on their experience at the sacred places in Saudi Arabia. *Geo J. Tour. Geosites*, 43, 1013-1101.
16. Litwiller, B., & Barnes, A. N. (2022). Risk Factors for Emergency Medical Care or Hospitalization Due to Heat-Related Illness or Injury: A Systematic Review. *Florida Public Health Review*, 19(1), 12.
17. Higgins, T., Arastu, A. S., & Auerbach, P. S. (2022). *Medicine for the Outdoors E-Book: The Essential Guide to First Aid and Medical Emergencies*. Elsevier Health Sciences.
18. Lipman, G. S., Gaudio, F. G., Eifling, K. P., Ellis, M. A., Otten, E. M., & Grissom, C. K. (2019). Wilderness medical society clinical practice guidelines for the prevention and treatment of heat illness: 2019 update. *Wilderness & environmental medicine*, 30(4), S33-S46.
19. Dow, J., Giesbrecht, G. G., Danzl, D. F., Brugger, H., Sagalyn, E. B., Walpoth, B., ... & Grissom, C. K. (2019). Wilderness medical society clinical practice guidelines for the out-of-

- hospital evaluation and treatment of accidental hypothermia: 2019 update. *Wilderness & environmental medicine*, 30(4), S47-S69.
20. Fancello, V., Hatzopoulos, S., Santopietro, G., Fancello, G., Palma, S., Skarżyński, P. H., ... & Ciorba, A. (2023). Vertigo in the Elderly: A Systematic Literature Review. *Journal of Clinical Medicine*, 12(6), 2182.
 21. Othman, J. (2023). Determining the Knowledge about Hazards of Heat Exposure and Prevalence of Heat Illnesses among Elderly and pregnant pilgrims attending primary health care Center, Makkah Al-Mokarrama, Saudi Arabia. *Annals of the Romanian Society for Cell Biology*, 27(01), 199-215.
 22. Abdelmoety, D. A., El-Bakri, N. K., Almowalld, W. O., Turkistani, Z. A., Bugis, B. H., Baseif, E. A., ... & Abu-Shaheen, A. (2018). Characteristics of heat illness during Hajj: a cross-sectional study. *BioMed Research International*, 2018.
 23. Esmaeilzadeh, A., Maleki, A. J., Moradi, A., Siahmansouri, A., Yavari, M. J., Karami, P., & Elahi, R. (2022). Major severe acute respiratory coronavirus-2 (SARS-CoV-2) vaccine-associated adverse effects; benefits outweigh the risks. *Expert Review of Vaccines*, 21(10), 1377-1394.
 24. Hanna, E. G., & Tait, P. W. (2015). Limitations to thermoregulation and acclimatization challenge human adaptation to global warming. *International journal of environmental research and public health*, 12(7), 8034-8074.
 25. Quandt, S. A., & Arnold, T. J. (2020). The health of children in the Latinx farmworker community in the eastern United States. *Latinx farmworkers in the Eastern United States: Health, safety, and justice*, 163-195.
 26. Rammah, A., Whitworth, K. W., Han, I., Chan, W., Hess, J. W., & Symanski, E. (2019). Temperature, placental abruption and stillbirth. *Environment international*, 131, 105067
 27. Basu, R., Sarovar, V., & Malig, B. J. (2016). Association between high ambient temperature and risk of stillbirth in California. *American journal of epidemiology*, 183(10), 894-901
 28. Romanovsky, A. A. (2018). *Thermoregulation Part I: From Basic Neuroscience to Clinical Neurology*. Elsevier.
 29. Fischer, F., Lange, K., Klose, K., Greiner, W., & Kraemer, A. (2016, June). Barriers and strategies in guideline implementation—a scoping review. In *Healthcare* (Vol. 4, No. 3, p. 36). MDPI.
 30. Basch, E., Dueck, A. C., Rogak, L. J., Minasian, L. M., Kelly, W. K., O'Mara, A. M., ... & Schrag, D. (2017). Feasibility assessment of patient reporting of symptomatic adverse events in multicenter cancer clinical trials. *JAMA oncology*, 3(8), 1043-1050.
 31. Cardoso, F., Senkus, E., Costa, A., Papadopoulos, E., Aapro, M., André, F., ... & Winer, E. P. (2018). 4th ESO–ESMO international consensus guidelines for advanced breast cancer (ABC 4). *Annals of Oncology*, 29(8), 1634-1657.