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## ***The Disaster Preparedness among Health Care Workers in Holy Mosques at Makkah and Madinah, Saudi Arabia***

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### **ABSTRACT**

Saudi Arabia is annually receiving the largest mass gathering in the world, who come to perform Hajj or Umrah within a confined time and place. To assess preparedness for disasters at three health institutes in Holy mosques from the perspectives of the health workers. A cross-sectional study design, 314 health workers were selected randomly from Makkah health center (n=151), Madinah health center (n=68), and Al Ansar hospital (n=95) who responded to questionnaire adopted to assess preparedness for disaster. A significantly greater percentage of workers in Makkah center (79.5%) indicated that there is a disaster plan, comparable to those in Al Ansar hospital (61.1%) or Madinah health center (60.3%) ( $p<0.05$ ). Also, a significantly higher proportion of the health workers in Makkah center (78.1%) agreed that they are adequately prepared to deal with the sudden influx of a large number of patients if compared to those in Madinah HC (55.9%) or those in Al Ansar hospital (52.6%) ( $p<0.05$ ). A significantly higher percentage of the workers in the Makkah center (79.5%) compared to those in Al Ansar hospital (57.9%) and Madinah health center (61.8%) indicated that there is regular execution of disaster drills  $p<0.05$ . Makkah center is more adequately prepared to deal with disasters than the Madinah health center and Al Ansar hospital. Deliberate efforts are needed to enhance the disaster preparedness of the Madinah center and Al Ansar hospital to cope with the projected progressive increment in the number of pilgrims soon.

**Key words:** *Disaster preparedness, Mass gathering, Healthcare workers, Risk measurement*

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### **INTRODUCTION**

Umrah and Hajj seasons are considered one of the largest, most culturally and geographically diverse mass gatherings in the world. The mass migration during the Umrah and Hajj is unparalleled in scale, and pilgrims face numerous health hazards [1]. The extreme congestion of people and vehicles during this time amplifies health risks making them more vulnerable to crises and disasters and causing many challenges to face the healthcare providers in Makkah and Madinah. Several Muslims from different countries attempt to visit the Holy Mosques in Makkah and Madinah to do prayers and Umrah [1, 2]. This escorts an increasing number of visitors nearly 2 million people in a particular month. Together with this, the visitors when they do simple practicalities, like when to do physical prayers, could result in deep unfavorable effects which could tire out obtainable resources [3]. The World Health Organization is defined disaster as “an occurrence disrupting the normal conditions of existence and causing a level of suffering that exceeds the capacity of adjustment of the affected community” [4]. In contrast, the United Nations (UN) defines a disaster as a serious disruption of the functioning of a society causing widespread human, material, and/or environmental losses that exceed the ability of the affected society to cope using only its resources [5]. The disaster planning process involves four phases, namely mitigation, preparedness,

response, and recovery [6]. So disaster preparedness is known to be “the measures that ensure the organized mobilization of personnel, funds, equipment, and supplies within a safe environment for effective relief “[4].

Disaster preparedness, together with risk measurement and multidisciplinary administration strategies at all technique levels, is crucial to the delivery of effective and efficient responses to the health requirements of a disaster-stricken populace [7]. In the meantime, emergency preparedness demotes the preparedness pyramid that finds infrastructure, planning, knowledge and capacities, and training as the major factors for sustaining a high level of preparedness [8].

To develop and modify breathing disaster preparedness plans and policies, it is of critical significance to investigate the current disaster preparedness plans among health care providers in both holy mosques in Makkah and Madinah. To understand the current status of healthcare workers' preparedness in the two holy mosques. Hereby, the main research question can be stated: Are the healthcare workers who are working at the two holy mosques during Hajj and Umrah Seasons, prepared to deal with disasters? In the current study, I will assess the knowledge and attitude among healthcare workers in the two Holy Mosques regarding their level of disaster preparedness. Also, I will compare the level of knowledge and attitude in regard to disaster preparedness between healthcare workers in both Holy Mosques of Makkah and Madinah.

## MATERIALS AND METHODS

A Cross-sectional design was used throughout the study. The population of the study included all healthcare workers who were working in the health center in Makkah, Madinah health center, and Al Ansar hospital in Madinah. The total population obtained from MOH data is around 250 healthcare workers in Makkah. In addition to around 550 healthcare workers in Madinah. The sample was estimated using Epi Info™ version 7, putting into consideration the prevalence of the study problem around 50%, and the value of 0.05 as an acceptable limit of precision. At 95% confidence interval (CI) limits, with a target population equal to 800 health workers in both places (550 in Madinah and 250 in Makkah); the estimated sample size is 260. The sample was divided proportionally into the two places, using the following equation:

$s = S * ni/N$ , where “s” stands for the designated proportionate sample size, “S” for the total sample size, “N” for the total number of population, and “ni” for the number of population in each group. Accordingly, the sample size assigned to Madinah equals 179 personnel and 81 for Makkah. The sample in each location was also divided proportionately according to the job of the respondents either physician (Group1) or other health workers (Group 2).

The designated sample size was selected from the two cities by proportionate stratified sampling technique, where each of the two holy places was considered as a stratum, and from each stratum, systematic random sampling was adopted using the list of all employees as the matrix for selection; based on the estimated sample size, the systematic order of selection was every thirds employee; taking into consideration that the first number was selected as a simple random number between 1 and 3. A self-administered validated modifiable questionnaire was used in the previous study (The Disaster Preparedness among Physicians Working at Mina-Aljamarat Medical Centers during Hajj Season). This modifiable questionnaire includes the following variables such as demographics (age, gender, etc) and knowledge (existence of disaster plan, S.A.L.T Triage, and existence of command). More variables were added/modified accordingly. Self-administered questionnaires were distributed to all study populations and collected by investigators on the same day. Descriptive analysis is displayed in the form of frequency distribution for categorical variables. For significance determination, the Chi-Square test was used. P-value < 0.05 is considered as indication for significance. A pilot study was carried out according to the suggested methodology to test study feasibility and test questionnaire validity. The selected health care center as a pilot was chosen randomly and was excluded from the main study afterward.

## RESULTS AND DISCUSSION

**Table 1** shows that males constituted almost one-half of the workers in Makkah center (50.3%) and Madinah health center (55.9%) and almost two-thirds (64.2%) of those in Ansar hospital. A significantly higher percentage of middle-aged workers (30-<50 years) was observed in workers in Makkah center (47.7%) than those in Ansar hospital (38.9%) and Madinah health center (45.6%)  $p < 0.05$ . Similarly, a significantly higher percentage of the workers in Makkah center is working in the same center for <1 year (12.6%) than those in Ansar hospital (5.3%) and the Madinah health center (7.4%)  $p < 0.05$ .

Also, while the percentage of registered nurses was proportionally highest in Makkah center (33.1%), the specialists were proportionally highest in Ansar hospital (24.2%), these differences are statistically significant  $p < 0.05$ . Only 4% of the workers in the Makkah center have a postgraduate degree compared to 14% in Ansar hospital and 15.6% in the Madinah health center  $P < 0.05$ . A significantly higher percentage of the workers in Makkah center (82.8%) indicated that they had attended training courses about disaster/emergencies than those in Ansar hospital (61.1%) and the Madinah health center (69.1%).

**Table 1.** Characteristics of the study group according to the place of work.

Characteristics	Place of work						X <sup>2</sup>	p
	Makkah center N=151		Ansar hospital N=95		Madinah HC N=68			
	No.	%	No.	%	No	%		
<b>Gender</b>								
Male	76	50.3%	61	64.2%	38	55.9%	4.554	0.103
Female	75	49.7%	34	35.8%	30	44.1%		
<b>Age</b>								
<30 years	55	36.4%	27	28.4%	25	36.8%	10.508	0.033*
30-<50 years	72	47.7%	37	38.9%	31	45.6%		
≥50 years	24	15.9%	31	32.6%	12	17.6%		
<b>Years working in current place</b>								
<1 year	19	12.6%	5	5.3%	5	7.4%	14.346	0.026*
1-5 years	72	47.7%	39	41.1%	26	38.2%		
5-10 years	41	27.2%	23	24.2%	21	30.9%		
10+ years	19	12.6%	28	29.5%	16	23.5%		
<b>Current position</b>								
Medical officer	36	23.8%	31	32.6%	33	48.5%	50.029	<0.001*
Registered nurse	50	33.1%	11	11.6%	8	11.8%		
Pharmacist	8	5.3%	7	7.4%	10	14.7%		
Laboratory scientist	9	6.0%	12	12.6%	2	2.9%		
Enrolled nurse	18	11.9%	3	3.2%	4	5.9%		
Specialist	23	15.2%	23	24.2%	6	8.8%		
Administrative	7	4.6%	8	8.4%	5	7.4%		
<b>Education level</b>								
Bachelor	89	58.9%	67	72.0%	43	67.2%	25.272	<0.001*
Diploma	56	37.1%	13	14.0%	11	17.2%		
Postgraduate	6	4.0%	13	14.0%	10	15.6%		
<b>Attended disaster/emergency training course</b>								
Yes	125	82.8%	58	61.1%	47	69.1%	14.806	0.001*
No	26	17.2%	37	38.9%	21	30.9%		

\* Statistically significant

**Table 2** shows the overwhelming majority of the health care workers reported that they are aware of the role of the work site during disasters and emergencies, with no statistically significant difference between those working in Makkah health center (86.8%), Al Ansar hospital (83.2%) and Madinah health center (75%)  $p > 0.05$ . Meanwhile, it was observed that a significantly greater percentage of those who are working in Makkah center (79.5%) knew that their center has a disaster plan, comparable to those in Al Ansar hospital (61.1%) or Madinah health center (60.3%)  $p < 0.05$ . Accordingly, a significantly higher percentage of those who are working in Makkah HC denoted that they are familiar with the disaster plan (78.8%) if compared to those in Al Ansar hospital (57.9%) or Madinah HC (66.2%). Nevertheless, only about one-half or less of the participants in Makkah HC (40.4%), Al Ansar (45.3%) and Madinah HC (54.4%) pointed out that they are aware of the major components that must be included in the disaster plan, with no significant difference.

**Table 2.** Awareness of the health workers about disaster plans according to their site of work.

	Place of work						X <sup>2</sup>	p
	Makkah center N=151		Ansar hospital N=95		Madinah HC N=68			
	No.	%	No.	%	No	%		
<b>Awareness about the role during disaster</b>								
Yes	131	86.8%	79	83.2%	51	75.0%	4.618	0.099
No	20	13.2%	16	16.8%	17	25.0%		
<b>There is a disaster plan</b>								
Yes	120	79.5%	58	61.1%	41	60.3%	29.935	<0.001*
No	7	4.6%	7	7.4%	16	23.5%		
Do not know	24	15.9%	30	31.6%	11	16.2%		
<b>Are you familiar with the disaster plan</b>								
Yes	119	78.8%	55	57.9%	45	66.2%	12.610	0.002*
No	32	21.2%	40	42.1%	23	33.8%		
<b>Awareness about the major components that must be included in the plan</b>								
Yes	61	40.4%	43	45.3%	37	54.4%	3.729	0.155
No	90	59.6%	52	54.7%	31	45.6%		

\* Statistically significant, p-value&lt;0.05

When the health workers were asked to rate their level of knowledge about the management of the sudden influx of a large number of patients, **Table 3** shows that about one-third of those in Makkah (31.8%), Al Ansar hospital (30.5%) and Madinah HC (38.2%) rated the level of knowledge as excellent, and few minorities who rated it as poor, with no difference between the three groups. A significantly higher percentage of the workers in Makkah HC (83.4%) compared to those in Madinah HC (54.4%) disagree that they need to know about the disaster plan  $p < 0.05$ . **Table 3** demonstrates also, that most of the health workers disagreed that only doctors and nurses need to know about disaster plans (68.2% in Makkah center, 81.1% in Al Ansar hospital, and 61.8% in Madinah HC), and also those who disagreed that only administrative staff and heads of departments need to know about the disaster plan (58.3% in Makkah center, 75.8% in Al Ansar hospital and 64.7% in Madinah HC), with no significant difference between the opinion of the workers in the three sites  $p > 0.05$ .

**Table 3.** Self-rated level of knowledge of the health workers about the mass influx of patients and needs for training.

	Place of work						X <sup>2</sup>	p
	Makkah center N=151		Ansar hospital N=95		Madinah HC N=68			
	No.	%	No.	%	No	%		
<b>Self-rated level of knowledge about management of the sudden mass influx of patients</b>								
Excellent	48	31.8%	29	30.5%	26	38.2%	10.604	0.101
Good	74	49.0%	34	35.8%	22	32.4%		
Fair	22	14.6%	26	27.4%	15	22.1%		
Poor	7	4.6%	6	6.3%	5	7.4%		
<b>Do not need to know about disasters and disaster plan</b>								
Agree	7	4.6%	13	13.7%	13	19.1%	25.141	<0.001*
Not sure	18	11.9%	9	9.5%	18	26.5%		
Disagree	126	83.4%	73	76.8%	37	54.4%		

Only doctors and nurses need to know about disaster plans								
Agree	22	14.6%	9	9.5%	14	20.6%	8.521	0.074
Not sure	26	17.2%	9	9.5%	12	17.6%		
Disagree	103	68.2%	77	81.1%	42	61.8%		
Only administrative staff and heads of departments need to know about disaster plans								
Agree	34	22.5%	11	11.6%	14	20.6%	8.293	0.081
Not sure	29	19.2%	12	12.6%	10	14.7%		
Disagree	88	58.3%	72	75.8%	44	64.7%		

\* Statistically significant

**Table 4** demonstrates that a significantly higher proportion of the health workers in Makkah center (78.1%) agreed that they are adequately prepared to deal with the sudden influx of a large number of patients if compared to those in Madinah HC (55.9%) or those in Al Ansar hospital (52.6%)  $p < 0.05$ . Almost two-thirds of the health workers in Makkah center (66.9%), Al Ansar hospital (62.1%), and Madinah HC (66.2%) agreed that there is adequate staff to manage the large influx of patients, with no significant difference between the three groups  $p > 0.05$ . Regarding the availability of protective personal equipment, the great majority of the health workers in Makkah center (85.4%) agreed about the ability of the center to provide adequate equipment for the staff, compared to 70.5% of those in Al Ansar hospital and 60.3% of those in Madinah HC, this difference is statistically significant  $p < 0.05$ .

Also, **Table 4** shows that significantly higher proportions of health workers in Makkah center (85.4%) and Al Ansar hospital (83.2%) compared to those in Madinah HC (72.1%) agreed that there is a need for a specific plan to manage the sudden influx of a large number of patients  $p < 0.05$ . Similar findings were observed for their agreement about the statement that they should conduct regular drills on how to manage disasters with the sudden mass influx of patients, which were significantly higher proportions in Makkah center (89.4%) and Al Ansar hospital (85.3%) if compared to those in Madinah HC (72.1%), agreed about it  $p < 0.05$ . The need for the health care workers to be trained in such situations where significantly higher proportions in Makkah center (92.7%) and Al Ansar hospital (84.2%) if compared to those in Madinah HC (79.4%) agreed about it  $p < 0.05$ . Notably, the results showed that almost double the health workers in Madinah HC (41.2%) than those in Makkah center (21.2%) agreed that their work site is unlikely to be affected by disasters, this difference is statistically significant  $p < 0.05$ .

**Table 4.** Agreement of the health workers about items reflecting preparedness and the need for adequate preparedness for the sudden influx of a large number of patients.

Preparedness for the sudden influx of a large number of patients	Place of work						X <sup>2</sup>	p
	Makkah center N=151		Ansar hospital N=95		Madinah HC N=68			
	No.	%	No.	%	No.	%		
Items Reflecting Preparedness								
The site is adequately prepared to deal with the sudden influx of patients								
Agree	118	78.1%	50	52.6%	38	55.9%	22.181	<0.001*
Not sure	31	20.5%	38	40.0%	25	36.8%		
Disagree	2	1.3%	7	7.4%	5	7.4%		
There is adequate staff to manage the sudden influx of a large number of patients								
Agree	101	66.9%	59	62.1%	45	66.2%	0.771	0.942
Not sure	35	23.2%	25	26.3%	17	25.0%		
Disagree	15	9.9%	11	11.6%	6	8.8%		

<b>The institute is able to provide adequate personal protective equipment for the staff</b>								
Agree	129	85.4%	67	70.5%	41	60.3%	25.840	<0.001*
Not sure	21	13.9%	22	23.2%	17	25.0%		
Disagree	1	0.7%	6	6.3%	10	14.7%		
<b>Need For Adequate Preparedness</b>								
<b>The institute should have a plan to manage the sudden mass influx of patients</b>								
Agree	129	85.4%	79	83.2%	49	72.1%	18.372	0.001*
Not sure	20	13.2%	15	15.8%	11	16.2%		
Disagree	2	1.3%	1	1.1%	8	11.8%		
<b>There must be regular drills on how to manage disasters with a sudden mass influx of patients</b>								
Agree	135	89.4%	81	85.3%	49	72.1%	14.568	0.006*
Not sure	15	9.9%	9	9.5%	13	19.1%		
Disagree	1	0.7%	5	5.3%	6	8.8%		
<b>Workers need training on a sudden mass influx of patients</b>								
Agree	140	92.7%	80	84.2%	54	79.4%	8.605	0.014*
Not sure	11	7.3%	15	15.8%	14	20.6%		
<b>The site is unlikely to be affected by disaster</b>								
Agree	32	21.2%	30	31.6%	28	41.2%	15.580	0.004*
Not sure	41	27.2%	34	35.8%	18	26.5%		
Disagree	78	51.7%	31	32.6%	22	32.4%		

\* Statistically significant

**Table 5** illustrates that a significantly higher percentage of the health workers in Makkah center (84.8%) compared to those in Al Ansar hospital (72.6%) and Madinah HC (73.5%) indicated that they are willing to work even if there is a risk of contracting the infectious disease  $p < 0.05$ . As the overwhelming majority of those who are working in Makkah centers (91.4%) and those in Al Ansar hospital (85.3%) compared to 63.2% in Madinah HC accept that the risk of getting the infection is a part of their job. As well as a greater proportion of those in the Makkah center (86.8%) than those in Al Ansar hospital (62.1%) and Madinah HC (63.2%) expressed that they feel confident that they will get the adequate personal protective measure to reduce the risk of infection  $p < 0.05$ . Similarly, significantly higher percentages of those in the Makkah center (88.7%) than those in Al Ansar hospital (73.7%) and Madinah HC (33.8%) expressed that they feel confident that their work will take care of them if they contract the disease  $p < 0.05$ .

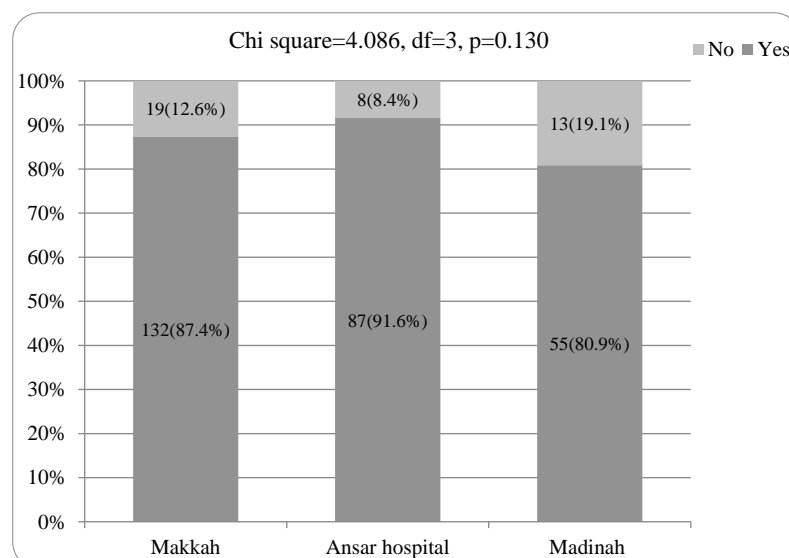
**Table 5.** Willingness of the workers to report for duty during infectious disease disasters.

	<b>Place of work</b>						$X^2$	<b>p</b>
	<b>Makkah center</b>		<b>Ansar hospital</b>		<b>Madinah HC</b>			
	<b>No.</b>	<b>%</b>	<b>No.</b>	<b>%</b>	<b>No.</b>	<b>%</b>		
<b>Willing to work even if the risk of contracting the disease.</b>								
Agree	128	84.8%	69	72.6%	50	73.5%	10.432	0.034*
Not sure	13	8.6%	16	16.8%	15	22.1%		
Disagree	10	6.6%	10	10.5%	3	4.4%		
<b>Accept that risk is part of my job</b>								
Agree	138	91.4%	81	85.3%	43	63.2%	27.518	<0.001*
Not sure	8	5.3%	10	10.5%	16	23.5%		
Disagree	5	3.3%	4	4.2%	9	13.2%		

Confident that the center will offer adequate protective measures								
Agree	131	86.8%	59	62.1%	43	63.2%	23.965	<0.001*
Not sure	20	13.2%	36	37.9%	25	36.8%		
Confident that the center will take care if I contract a disease								
Agree	134	88.7%	70	73.7%	23	33.8%	98.883	<0.001*
Not sure	17	11.3%	21	22.1%	21	30.9%		
Disagree	0	0.0%	4	4.2%	24	35.3%		
Afraid if do not come to work will lose job								
Agree	30	19.9%	43	45.3%	31	45.6%	27.547	<0.001*
Not sure	36	23.8%	20	21.1%	18	26.5%		
Disagree	85	56.3%	32	33.7%	19	27.9%		
I will not report for duty because I am afraid of falling ill								
Agree	7	4.6%	21	22.1%	16	23.5%	33.458	<0.001*
Not sure	30	19.9%	24	25.3%	24	35.3%		
Disagree	114	75.5%	50	52.6%	28	41.2%		
I will not report for being afraid of spreading the disease to family and friends								
Agree	10	6.6%	25	26.3%	25	36.8%	81.489	<0.001*
Not sure	28	18.5%	19	20.0%	35	51.5%		
Disagree	113	74.8%	51	53.7%	8	11.8%		

\* Statistically significant

On the other hand, a significantly lower percentage of the health workers in Makkah center (19.9%) than those in Al Ansar hospital (45.3%) and Madinah HC (45.6%) expressed that they would share in caring for infectious disasters just because being afraid that not sharing will result in losing their job  $p < 0.05$ . Also, significantly lower percentages of those in Makkah center (4.6%) than those in Al Ansar hospital (22.1%) and Madinah center (23.5%) agreed that they would not report for duty in cases of infectious disaster for being afraid to fall ill  $p < 0.05$ . The same was also observed for not reporting for duty for fear to spread the disease to their family and friends, where only 6.6% of those in Makkah center agreed about it compared to 26.3% in Al Ansar hospital and 36.8% in Madinah HC (36.8%)  $p < 0.05$ . On the same line, the majority of the Makkah center (87.4%), Al Ansar hospital (91.6%), and Madinah health center (80.9%) expressed that they are willing to come to the center when there is a large number of casualties, with no statistically significant difference (**Figure 1**).



**Figure 1.** Willingness to come to Haram HC when there is a large number of casualties

**Table 6** demonstrates that a significantly higher proportion of the workers in the Makkah center indicated that they were involved in rescuing victims of natural disasters (57%) compared to those in Al Ansar hospital (14.7%) and Madinah health center (13.2%)  $p < 0.05$ . However, while none of the workers in Makkah and Madinah centers were involved in rescuing victims of traffic disasters, almost one-half of those in Al Ansar hospital (49%) were involved  $p < 0.05$ . Also, a significantly higher proportion of those in Al Ansar hospital (26.3%) than those in Makkah center (14.6%) and Madinah center (13.2%) were involved in rescuing victims of collapse and run-over disasters  $p < 0.05$ .

**Table 6.** Involvement in rescuing victims of disasters and Disaster preparedness practices at Haram Health Centers according to the place of work.

Types of disasters	Place of work						X <sup>2</sup>	p
	Makkah center N=151		Ansar hospital N=95		Madinah HC N=68			
	No.	%	No.	%	No	%		
<b>Natural disasters</b>								
Yes	86	57.0%	14	14.7%	9	13.2%	63.525	<0.001*
No	65	43.0%	81	85.3%	59	86.8%		
<b>Traffic disasters</b>								
Yes	0	0.0%	47	49.0%	0	0.0%	104.511	<0.001*
No	151	100%	48	51.0%	68	100%		
<b>Disease epidemics</b>								
Yes	80	53.0%	51	53.7%	38	55.9%	0.160	0.923
No	71	47.0%	44	46.3%	30	44.1%		
<b>Fire</b>								
Yes	48	31.8%	32	33.7%	16	23.5%	2.128	0.345
No	103	68.2%	63	66.3%	52	76.5%		
<b>Chemical spills</b>								
Yes	9	6.0%	7	7.4%	6	8.8%	0.617	0.734
No	142	94.0%	88	92.6%	62	91.2%		
<b>Collapse/run over</b>								
Yes	22	14.6%	25	26.3%	9	13.2%	6.743	0.034*
No	129	85.4%	70	73.7%	59	86.8%		
Disaster preparedness practices at Haram Health Centers								
<b>Conducting disaster drills</b>								
Yes	120	79.5%	55	57.9%	42	61.8%	24.956	<0.001*
No	5	3.3%	9	9.5%	13	19.1%		
Do not know	26	17.2%	31	32.6%	13	19.1%		
<b>Conducting training workshops about disaster</b>								
Yes	117	77.5%	48	50.5%	44	64.7%	35.711	<0.001*
No	7	4.6%	5	5.3%	12	17.6%		
Do not know	27	17.9%	42	44.2%	12	17.6%		
<b>Sharing in reviewing the disaster plan</b>								
Yes	105	69.5%	34	35.8%	36	52.9%	27.192	<0.001*
No	46	30.5%	61	64.2%	32	47.1%		
<b>The staff knows what to do when there is a disaster</b>								
Yes	136	90.7%	57	66.3%	39	65.0%	37.802	<0.001*
No	12	8.0%	13	15.1%	16	26.7%		
Do not know	2	1.3%	16	18.6%	5	8.3%		

\* Statistically significant



In the same context, **Table 6** shows that a significantly lower percentage of the workers in Al Ansar hospital (57.9%) compared to those in the Makkah center (79.5%) and Madinah health center indicated that there is regular execution of disaster drills  $p < 0.05$ . Also, a significantly higher proportion of those in Makkah center (77.5%) than those in Madinah health center (64.7%) and Al Ansar hospital (50.5%) reported that the center is conducting training workshops about disasters for the workers  $p < 0.05$ . And a greater percentage of those in Makkah center (69.5%) than those in Al Ansar hospital (35.8%) and Madinah center (52.9%) addressed that they shared in reviewing the disaster plan  $p < 0.05$ . Eventually, while the overwhelming majority of the workers in Makkah center (90.7%) expressed that the staff know what to do when there is a disaster, significantly lower percentages indicated the same either in Al Ansar hospital (66.3%) or Madinah health center (65%)  $p < 0.05$ .

Disaster preparedness is considered the key success factor for effective practices during disaster management [9]. The current study aimed at assessing the preparedness of three health institutes involved in providing health care for those who are coming to Saudi Arabia for both Hajj and Umrah. It is well known that the Hajj pilgrimage is the largest mass gathering in the world held on a recurrent annual basis [10, 11]. Almost 3-4 million pilgrims perform their rituals within extensively restricted space and time, eventually, the event has witnessed several catastrophic disasters in the past [12]. The significance of the current study comes from the concern of the Saudi government in its "vision 2030" to reach several 15 million Muslims per year to perform Umrah satisfactorily, which necessitates preparedness of the health institutes at holy cities for these events [13].

The results showed that the overwhelming majority of the healthcare workers reported that they are aware of the role of the work site during disasters and emergencies. However, no statistically significant difference between those working at Makkah health center (86.8%), Al Ansar hospital (83.2%), and Madinah health center (75%), which reflects the efforts of the ministry of health in Saudi Arabia regarding updating of the health workers in holy cities about guidelines of dealing with different forms of disasters [11, 14, 15].

The majority of the health workers agreed that all the health workers need to know about disaster plans, which fulfill the recommendations for preparedness for disasters, and that collaborative multidisciplinary administration strategies at all levels in the health institute are crucial to the delivery of effective and efficient responses to the health requirements of disaster [16]. A significantly higher proportion of the health workers in Makkah center (78.1%) agreed that they are adequately prepared to deal with a sudden influx of a large number of patients if compared to those in Madinah HC and those in Al Ansar hospital, which could be explained by the buildup experience of workers in Makkah center after the falling of a crane in the Haram and stampede of pilgrims in 2015 which resulted in mass casualties and a large influx of injured individuals to the center [11].

The current study showed that the great majority of the health workers in the three sites, with a relatively higher proportion of workers at Makkah center, indicated that they are willing to work even if there is a risk of contracting the infectious disease, as it is part of their job. In this respect, Memish and his colleagues (2014) asserted that the long experience of the Kingdom of Saudi Arabia in organizing the Hajj rituals has provided the workers with a clear view of the risks of mass gatherings, so they are prepared for its management as part of their job. Among these risks, the transmission of infectious diseases between pilgrims, and the indigenous population are considered the topmost concern for preparedness of the health workers [17].

On the same line, the majority of the participants with a relatively greater proportion of those in the Makkah center expressed that they feel confident that they will get adequate personal protective measures to reduce the risk of infection. The basis of this perceived confidence could be attributed to the regulations governing the preparedness of the health institutes dealing with pilgrims, especially during the influenza pandemic in 2009, to have adequate personal protective equipment for their workers [18]. Almost one-half of those in Al Ansar hospital (49%) indicated that they were involved in rescuing victims of traffic disasters, compared to none of the workers in Haram and Madinah centers. This difference could be attributed to many factors. First, is the strict plan executed by the Ministry of Interior which organizes the flow of cars and pedestrians during crowds, accordingly crush accidents are infrequent relative to the size of pilgrims who are moving in a confined space [11]. Second, is the usual referral of victims of traffic accidents to hospitals rather than health centers.

A significantly higher proportion of the workers in the Makkah center indicated that they were involved in rescuing victims of natural disasters than those in Al Ansar hospital and Madinah health center, this difference could be explained by the fact that Makkah is more prone to natural disasters namely flash flood which periodically strikes the city, due to its rugged topography and geological structures in addition to excessive rainfalls [19].

A significantly higher proportion of the workers in Makkah center (78.1%) than those in Madinah center (55.9%) and Al Ansar hospital (52.6%) agreed that they are adequately prepared to deal with the mass influx of patients.

This difference could be explained by the fact that the millions of pilgrims who are coming to perform Hajj or Umrah should complete their rituals at Makkah while visiting Madinah is not mandatory. The intricate religious rituals at Makkah include circumambulating seven times the Kaabah and marching seven times between Safa and Marwa [18]. This extraneous physical activity could result in hazards, especially in crowds and hot humid weather, which are reflected in the increased number of patients referred to the health institutes in Makkah [15].

On the other side, the results showed that a significantly lower percentage of the workers in Al Ansar hospital (57.9%) compared to those in the Makkah center (79.5%) and Madinah health center indicated that there is regular execution of disaster drills. This finding accord with what has been published in 2017 by Al-Shareef and his colleagues, where they found that nine hospitals out of 17 surveyed hospitals in holly areas (64%) were drilling for disasters at least twice per year. They concluded that hospitals are insufficiently prepared for possible future disasters, which carry potential threats to both residents and visitors to Makkah [14].

## CONCLUSION

From the perspectives of the health workers, Makkah center is considerably more prepared to deal with disasters and the mass influx of patients, as it has plans which are well known by the majority of the workers, and they are more frequently subjected to training and involvement in drills if compared to the two investigated sites besides Madinah Haram (Madinah center and Al Ansar hospital). Most of the workers are willing to share work in critical circumstances as they believe that it is part of their job, and they are confident that the workplaces would provide them with adequate preventive equipment and would take care of them if they acquire any sort of harm. Most of the workers perceive that there is still a need for training on the sudden influx of patients.

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