

# Assessment of Crises and Disasters Preparedness and Resilience Levels at Alexandria University Hospitals

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**Abstract:** The dramatic increase in the occurrence of natural catastrophes and the intensified world conflicts and wars make humans more vulnerable to the risk of disasters and crises and exacerbate its impact. The cornerstone to control this vulnerability is establishing robust disaster preparedness and maintaining resilient pattern during response. **Aim:** to assess the level of crises and disasters preparedness and resilience of Alexandria University Hospitals. **Study design:** A descriptive exploratory research design was used in this study. **Setting:** three hospitals affiliated to Alexandria university sector namely; Alexandria Main University Hospital, Al-Hadara University Hospital, and Al-Moassat University Hospital were included to conduct this study. **Subjects:** two categories of subjects were included in the study: (1) key persons of studied hospitals (n= 170), and (2) sample of hospitals staff (n=410). **Tools:** three tools were used to collect the needed data. They entitled hospital disaster preparedness self-assessment tool, hospital disaster resilience capability assessment survey, and demographic and professional characteristics questionnaire of study subjects. **Method:** auditing of the three hospitals using observation, interview, and reviewing of documents was conducted by the researcher to collect the required data. **Results:** two studied hospitals had acceptable but insufficient level of disaster preparedness while the remaining one had unacceptable level of disaster preparedness. Moreover, the three studied hospitals are located in the moderate zone of resilience which is a risky zone. **Conclusion:** the studied hospitals suffer from many serious weaknesses in their preparedness especially in disaster training and drills, disaster leadership and governance, crisis communication, and disaster planning. These weaknesses will deter Alexandria university hospitals from achieving resilience when disasters strike. **Recommendations:** conduct continuous training programs at least twice annually regarding basic life support; disasters management plans and procedures to acquaint all staff with knowledge and skills required for rapid rescue and response. Also, it is vital to establish a department composed of multi-disciplinary team concerned with disasters and crises management in each hospital accountable to develop, update, test, and monitor disasters management plans and procedures.

**Keywords:** crises, disasters, disasters preparedness, resilience, surge capacity.

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## I. INTRODUCTION

In the wake of covid-19 pandemic crisis, the international society realized the fact that when disaster strike in unprepared community, the losses in both life and property cannot be managed which overwhelming the situation leading to downsizing of many international and national systems across the world<sup>(1)</sup>. Fortunately, this wake enforced the international bodies and governments to focus the lights on disasters risk reduction and initiate faster steps toward keeping a well prepared and resilient health sector in order to contain any disaster and mitigate its effects<sup>(2)</sup>.

A disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceed the ability of the affected community or society to cope using its own resources<sup>(3)</sup>. Disasters are often result from combination of elements such as the exposure to a hazard; the conditions of vulnerability that are present and the insufficient capacity or measures to reduce or cope with the potential negative consequences<sup>(4)</sup>.

Disaster management is an ongoing process to prevent, mitigate, prepare for, respond to, maintain continuity during, and recovery from an incident that threatens life, property, operations and or the environment. The process is best presented as the disaster management cycle which articulated around five core phases namely; prevention, mitigation, preparedness, response, and recovery<sup>(5)</sup>. Risk assessment is the basis of disaster management. It is the process of hazard identification, probability analysis, vulnerability analysis and impact analysis. Based on the results of risk assessment, activities are conducted to prevent and/or mitigate the potential hazards<sup>(6)</sup>.

Disasters preparedness is the measures and capacities taken by the hospital's stakeholders to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions<sup>(7)</sup>. Preparedness efforts include; providing elements of surge capacity, developing and maintaining training programs for hospital employees, drills and exercise activities, maintaining mutual cooperation with regional hospitals as well as community organizations regarding emergency preparedness activities<sup>(8)</sup>.

The American College of Emergency Physicians<sup>(9)</sup> proposed nine critical factors that shape efficient hospital disaster preparedness. These factors includes: proactive disaster leadership and good disaster governance; well prepared emergency management planning; dynamic interoperable clinical operations; presence of standardized program for safety, fire prevention, and security; redundant disaster logistic system; well-designed crisis communication system with available backup mechanisms; open channels for stakeholders notifications; continuous disaster training, drills, and exercises; and regular hazards vulnerability analysis for performance improvement.

In the organizational context, hospital disasters preparedness has three critical attributes namely; structural (e.g., hospital infrastructural safety), non-structural (e.g. human resources, medications, equipment, supplies, logistics), and functional attributes (e.g. disasters plans and procedures, training and drills, communication and information management). These attributes are necessary prerequisites for any organization to achieve resilience during disasters<sup>(10)</sup>.

Disaster resilience is the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including the preservation and restoration of its essential basic structures and functions<sup>(11)</sup>. A disaster resilient hospital is one which has the capability to resist, absorb, and respond to the shock of disasters while still retaining their most essential functionality<sup>(12)</sup>.

Hospital resilience articulated around four core elements namely; strength, flexibility, responsiveness, and adaptation<sup>(13)</sup>. Strength refers to the infrastructural robustness and safety of the environment to prevent disasters<sup>(14)</sup>. On the other hand, flexibility reflects the pre-event disaster management procedures, such as resourceful plans and strategies<sup>(15)</sup>. In addition, responsiveness focuses on the organization's rapidity and capacity to maintain and surge the essential functions during the event. Finally, adaptability is the post-event capability for organizations to recovery from disasters and adapt to a new environment. Adaptability can be achieved through providing redundancy of infrastructure, resources, and staff<sup>(16)</sup>.

Efficient hospital disaster resilience is shaped by eight dimensions that constitute the critical pillars to achieve resilience in healthcare. The eight dimensions include: emergency command, communication and cooperation system; emergency services and surge capacity; emergency staff capability; emergency training and drills; disaster plans; hospital safety standard and procedures; disaster stockpiles and logistics management; and recovery and adaptation strategies for recovery and improvement in the aftermath of disasters<sup>(17)</sup>.

Hospital disaster resilience can be measured through four criteria namely; robustness (inherent strength), redundancy (ability of resources), resourcefulness (having plans, procedures and strategies) and rapidity (achieve priorities promptly). These criteria were viewed as performance criteria against which the resilience ability and index of any health facility can be judged<sup>(18)</sup>.

It is a worthy to mention that disaster preparedness and resilience are correlated functions in any organization<sup>(19)</sup>. Preparedness concerned with building a resilience strategy for efficient disaster management. Moreover, better implementation of the preparedness attributes lead to greater resilience during disaster and the organizations have the ability to achieve resilience-outcomes (i.e. robustness; redundancy; resourcefulness and redundancy)<sup>(20)</sup>.

## II. SIGNIFICANCE OF THE STUDY

In the wake of the 25th January Revolution, Egypt faced a great deal of challenges as a result of the atrocious and lawless events which caused material and economic losses at both national and regional levels<sup>(21)</sup>. To cope with these great challenges, the Egyptian government focused on the international approaches in disasters risk reduction (DRR) that were outlined in the Sendai Framework (2015 – 2030); the UN Sustainable Development Agenda (2015 – 2030); in addition to the Paris Agreement on Climate Change approved in December 2015<sup>(22)</sup>.

In keeping with both the national and international obligations, The Egyptian government focused its efforts to build the Egyptian man through establishing a resilient Egypt. One of these efforts is the issuing the national system for disaster risk reduction (NSDRR) 2030 followed by updating the National Strategy for Crisis/Disaster Management and Disaster Risk Reduction that was developed since 2010<sup>(23)</sup>.

The current study is in line with Egyptian strategy 2030 for sustainable development and one of the measures taken in response to the government initiatives to upgrade the health sector disaster resilience. It aims to conduct auditing on Alexandria university hospitals to determine its level of preparedness and resilience in disasters and crises then offer actions to improve the current status of disaster preparedness and resilience of these hospitals.

Finally, the results of this study could foster the effectiveness of disasters response of Alexandria university hospitals and influence considerably the community's response to and recovery from disasters and crises, and ultimately influencing health outcomes. Moreover, it is an important step towards creating more resilient Egyptian communities to better cope with future disasters. Furthermore, the audited hospitals can use the results to delineate weak points in their structure and system with regard to the area of facility and environmental safety then develop corrective actions accordingly and consequently will be able register for eligibility in the new health insurance system.

### AIM OF THE STUDY:

The aim of this study was to assess the level of crises and disasters preparedness and resilience of Alexandria University Hospitals.

### RESEARCH QUESTIONS:

- What is the level of disaster and crises preparedness of Alexandria University Hospitals?
- What is the level of resilience of Alexandria University Hospitals in disasters and crises?

## III. MATERIALS AND METHOD

### MATERIALS

**Design:** A descriptive exploratory research design was used in this study.

**Setting:** Out of 11 hospitals affiliated to Alexandria University, three hospitals namely; Alexandria Main University Hospital, Al-Hadara University Hospital, and Al-Moassat University Hospital were selected to conduct this study. These three hospitals represent more than 25% of the total number of Alexandria university hospitals. Also, these hospitals were selected from university health sector because they had the largest capacity in terms of licensed beds number, surge capacity, and number of population served.

All clinical and non-clinical departments of the selected hospitals were included in the study. The clinical departments that provide direct healthcare encompass; Medical, Surgical, Critical care, Operating Rooms, Emergency, and Outpatient. On the other hand, the non-clinical departments that provide indirect healthcare include; Laboratories, Diagnostic and Intervention Radiology, Blood bank, Pharmacy, Storage, Engineering Management and Maintenance, Quality Management, Continuous Education, Laundry, Kitchen, Infection Control, Medical Records, Rehabilitation &Physiotherapy, Human resources, and Safety and Occupational Health.

**Subjects:** This study included two categories of subjects as follows:

#### A. Key persons of study hospitals:

All key persons of the studied hospitals (n=170) namely: Chief Executive Officers (n=3), Nursing Directors of the Hospitals (n=3), Administrative Managers (n=3), Heads of Clinical Departments (n=43), Head Nurses (n=73), and Heads of Non-Clinical Departments (45) were included in the study.

**B. Hospitals staff:**

A convenience sample of hospitals staff (n= 410) were included in the study. They were selected from the three hospitals as follows; Alexandria Main University Hospital (n=290), Al-Hadara University Hospital (n=66), and Al-Moassat University Hospital (n=54). They were further classified into;

- Clinical staff which include resident physicians (n=71), and nurses (n=109)
- Non-clinical staff which include pharmacists (n=24), technicians (n=29), clerical personnel (n=58), auxiliary personnel (n=36), and miscellaneous employees (n=83) as security, maintenance, food services staff, laundry staff, medical gases personnel, and utilities personnel.

The hospitals staff were distributed through proportional allocation using power analysis technique and Epi info program according to the following parameters: total population = 3979, acceptable error = 5% and  $\alpha = 0.05$ , design effect = 2, confidence level 95%. All hospitals staff with less than three months of experience was excluded because they still under orientation and they are not sufficiently acquainted with their hospitals' system and operations.

**Tools of the study:** Three tools were used to conduct this study as follows:

**Tool (I): Hospital Disaster Preparedness Self-Assessment Tool**

It was developed by the American College of Emergency Physicians (2017) <sup>(9)</sup>. It was adopted to assess and estimate the level of hospitals disaster preparedness. This tool consists of 520 items categorized under two parts.

Part (I) "hospital profile" was used for general description of the studied hospitals status (n=67) in relations to hospital staffing; current patient care capacity; other hospitals capacities such as emergency equipment, supplies, and radiological facilities; and emergency management planning. It contains open ended questions (n=52) and binary questions (n=15) that was assessed by Yes or No.

Part (II) "analysis of critical preparedness factors" was used to estimate the level of disaster preparedness of the studied hospitals. It is subdivided into nine factors namely: leadership and governance; emergency management planning; clinical operations; safety, fire and security; logistics and facilities; communication, warning and notification; public information, media relations and risk communications; training, drills and exercises; and performance improvement and quality. Also, It contains binary criteria (n=453) that were verified by "yes" or "no". The options of "yes" or "no" was assigned the score of "1" or "0", respectively.

The overall level of hospital preparedness was estimated by summing the scores of all binary criteria. The possible preparedness score was ranged from 0 to 453. The level of hospital preparedness was categorized based on the following scale; the preparedness score less than 50% means unacceptable poor hospital preparedness to crises and disasters. Also, the preparedness score from 50% to 75% means moderate level which is still insufficient hospital preparedness to crises and disasters. Finally, the preparedness score more than 75% means effective hospital preparedness to crises and disasters.

**Tool (II): Hospital Disaster Resilience Capability Assessment Survey**

It was developed by Zhong (2014) <sup>(17)</sup> to assess disaster resilience capability of the hospitals and estimate the level of disaster resilience index. It was adopted to conduct the study. It consists of 161 items categorized under four dimensions namely; emergency medical response capability; disaster management mechanisms; disaster resources; hospital infrastructural safety and vulnerability.

The tool consisted from two types of questions; numeric and dichotomous binary questions. The numeric questions (n= 80) were used to describe the current capacities of the studied hospitals in relation to the current situation of resilience. Often these variables asked about percentage or quantity numbers so the responses to these criteria were also in the form of percent or numbers. On the other hand, the dichotomous binary questions (n=81) were used to calculate the hospital resilience index which is a proxy to conclude the overall status of resilience. These binary questions were assessed by "yes" or "no" and the options of "yes" or "no" were assigned the score of "1" or "0", respectively. Then, the scores of each resilience domain were calculated by adding together the score of all the relevant questions.

The hospital resilience index was calculated by summing the scores across all eight domains. According to the hospital resilience index, the status of hospitals resilience was categorized based on the following scale; the resilience index less than 26% means that the hospital is located in the low high risk zone of resilience which indicates that the hospital will has greater difficulty in recovering from disasters. Also, the resilience index ranged from 26% to 75% means the hospital is located in the moderate zone of resilience which is still insufficient resilience. Finally, the resilience index more than 75% means the hospital is located in the high safe zone of resilience which denotes that the hospital achieved the redundant, robustness, resourcefulness, and rapidity criteria of efficient resilience so the hospital will be extremely resilient during calamities.

### **Tool (III): Socio Demographic and Professional Characteristics of Study Subjects**

It was developed by the researcher to assess the socio-demographic and professional characteristics of study subjects. It included 17 items as follows; age, current position, years of experience, unit of current employment, educational qualifications, previous exposure to any disastrous situation or calamities, previous participation in any committee concerned with disaster management, previous training programs about disaster management, and previous workshops attended about disaster management.

In addition, three open ended questions were added to ask subjects about their points of view about their personal preparedness to respond to any disastrous situation in the current time, hospital preparedness to any crises, and subjects' perspectives and recommendations to improve the current situation of disaster preparedness and resilience in the studied hospitals.

### **METHOD:**

- An official letter from the Faculty of Nursing was sent to the directors of the three studied hospitals to collect the necessary data of the study.
- Auditing of the selected hospitals' departments and units to assess the current situation of disaster preparedness and resilience using the three tools of study was conducted by the researcher
- Auditing conducted using the following three mechanisms:
  - Inspection of the related documents to verify the hospitals' plans, policies, procedures, instructions, etc.
  - Observation to assess accessibility, availability, validity of resources, instructions, etc.
  - Interview with hospitals key persons and hospital staff to collect all relevant data related to human resources knowledge, training, roles awareness, etc.
- Tool (III) regarding socio demographics and professional properties of study subjects and their points of view about the current situation of preparedness and resilience was hand delivered to the key persons and hospitals staff to be completed during interview with them.
- Auditing of the selected hospitals took five months from October 2019 to February 2020 in order to collect the necessary data.
- Validity and reliability of the collected data were ensured through triangulation as well as repeating of auditing of many criteria.
- All data collected were coded and open ended questions were categorized into different categories then data were entered into the computer using the Statistical Package for Social Sciences (SPSS) version 25. Data were reviewed and checked for accuracy. Frequency tables and cross tabulations with percentages were used to illustrate the results of categorical data. Quantitative data were summarized by the minimum, maximum, median, arithmetic mean and standard deviation. One way ANOVA test was used to find the statistical difference between levels of disasters preparedness and resilience of the studied hospitals.
- The findings of the analyzed data were utilized to assess the level of study hospitals' preparedness and resilience, and identify the gap in the current situation of preparedness and resilience.

**Ethical considerations:**

- An official approval was obtained from the Ethical Committee of the Faculty of Nursing, Alexandria University to conduct this study.
- A written informed consent was obtained from the study subjects after explaining the aim of the study.
- The Right of the study subjects to refuse to participate in the research was assured.
- The study subjects' right to withdraw during research at any time also was assured.
- Confidentiality of data and anonymity of study subjects was maintained.
- Privacy of the subjects in data collection was also maintained.

**IV. RESULTS**

**Table (1):** describes the professional characteristics of the study subjects. It is was found that near two thirds of the subjects (60.3%) did not participated previously in responding to any types of crises or disasters, which is contrary to 39.7% of them who participated in responding to different types of disasters such as mass transportation causality in the agricultural road (41.3%), violent and terroristic events in 25 January evolution (27%), mass building collapse causality (18.2%), and mass fire causality (13.5%).

Also, the majority of subjects (89.5%) did not participated in any type of committees concerned with disasters management, while around one tenth of them (10.5%) acing as members in one or more of committees concerned with disasters management. Concerning training about disasters management, near three quarters of subjects (71.9%) did not received previous training about disasters management which is contrary to 28.1% of them who received. Regarding attendance of workshops about disasters management in the workplace, the highest percentage of subjects (73.8%) did not attend any workshop about disasters management in their workplace, while the remaining (26.2%) attended workshops about disasters management in the workplace.

**Table 1: Distribution of the study subjects according to their professional characteristics related to crises and disaster management:**

Professional Characteristics Items	Distribution of Subjects N=580	
	No	%
<b>Previous participation in crisis/ disaster response</b>		
▪ Yes	230	39.7
▪ No	350	60.3
<b>Types of crises/ disasters</b> N= 230		
▪ Mass fire causality	31	13.5
▪ Mass transportation causality in the agricultural road	95	41.3
▪ Violent and terroristic events in 25 January Evolution	62	27
▪ Mass building collapse causality	42	18.2
<b>Participation in crisis/disaster management committees</b> N= 580		
▪ Yes	61	10.5
▪ No	519	89.5
<b>Type of crisis / disaster management committee</b> N= 61		
▪ Disaster management	10	16.4
▪ Quality management	38	62.3
▪ Decision support and follow up	13	21.3
<b>Attained training about crisis /disaster management</b> N= 580		
▪ Yes	163	28.1
▪ No	417	71.9

<b>Attended workshops about crisis / disaster management in the workplace</b>		N= 580	
▪ Yes	152	26.2	
▪ No	428	73.8	
<b>Type of workshops attended about crisis/disaster management</b>		N= 152	
▪ Risk management	46	30.3	
▪ Safety requirement in hospitals and civil community	71	46.7	
▪ Civil defense and fire management	35	23.0	
<b>Studied educational courses about crisis /disaster management</b>		N= 580	
▪ Yes	146	25.2	
▪ No	434	74.8	
<b>Type of educational courses studied about crisis /disaster management</b>		N= 146	
▪ Crisis management	52	35.2	
▪ Safety requirements in organizations	68	46.6	
▪ Management of trauma	26	17.8	
<b>Institution provided educational courses about crisis/disaster management</b>		N= 146	
▪ Faculty of Medicine	48	32.9	
▪ Faculty of Nursing	55	37.7	
▪ Institute of Safety and Occupational Health	43	29.5	
<b>Usefulness of these educational courses</b>		N= 146	
▪ Yes	54	37.0	
▪ No	92	63.0	

**Table (2)** illustrates perspectives of study subjects in relation to both their self-preparedness and the studied hospitals preparedness and resilience in crises and disasters. It was found that more than two thirds of the subjects (68.6%) thought that they are not prepared at the current time to face any type of crises and disasters which is contrary to 31.4% of them who emphasized that they are prepared to face any crisis or disaster in the current time.

Concerning the subjects' perspectives about the studied hospitals preparedness and resilience, near two thirds of them (62.2%) believed that their hospitals are not well prepared and will not be resilient in crises. The highest percentage of those (37.7%) thought that the administrative corruption and lack of accountability hinder the efficient preparedness and resilience of the studied hospitals. On the other hand, more than one third of subjects (37.8%) supposed that the studied hospitals are well prepared to face any calamity and will be efficiently resilient during disasters. Among them, 27.4% justified their point of view by affiliation of the studied hospitals to the university with the presence of all medical specialties at all times.

**Table (2): Perspectives of Study Subjects in Relation to both their Self-Preparedness and the Studied Hospitals Preparedness and Resilience in Crises and Disasters**

Items	Distribution of Subjects N=580	
	No	%
<b>Subjects self-reporting about their self-preparedness to crisis/ disaster management</b>		
N=580		
▪ Yes	182	31.4
▪ No	398	68.6
<b>Causes of poor self-preparedness to crisis/ disaster management</b>		
N= 398		
▪ Lack of knowledge about crisis/disasters management in the current time.	99	24.9
▪ Lack of previous training and workshops about crisis/disaster management	196	49.2
▪ Working in fragmented health system that doesn't give priority to crises management	103	25.9

Causes of good self-preparedness to crisis/ disaster management			N= 182	
▪ Previous attendance of training and workshops about cardiopulmonary resuscitation.	57	31.3		
▪ Previous exposure to many risks and crises in workplace and community	52	28.6		
▪ Being a member in this great medical edifice that prepared with many specialties.	73	40.1		
Subjects points of view about the studied hospitals preparedness to crisis/ disaster management			N= 580	
▪ Yes	219	37.8		
▪ No	361	62.2		
Causes of poor hospital-preparedness to crisis/ disaster management			N= 361	
▪ Administrative corruption and lack of accountability	136	37.7		
▪ Shortage of resources with high procrastination to fix this shortage.	86	23.8		
▪ Poor planning and coordination in different sectors	37	10.2		
▪ Lack of sufficient crises management training	42	11.6		
▪ The majority of staff unqualified to respond to any crises	47	13.0		
▪ Poor organizational structure and design	22	6.1		
Causes of good hospital-preparedness to crisis/ disaster management			N= 219	
▪ Affiliation of the hospital to the university with the presence of all medical specialties all times.	60	27.4		
▪ The continuous developmental and maintenance works of the hospital buildings.	27	12.5		
▪ The great surging capacity of university hospitals.	43	19.6		
▪ Availability of large pool of staff in university hospitals.	34	15.4		
▪ The good harmony between all university's hospitals in all aspects of care.	55	25.1		

**Table (3)** categorizes the levels of disasters preparedness of study subjects. It is clear that around two thirds of study subjects (69.8%) have unacceptable level of disaster preparedness and readiness at the current time. On the other hand, 19.5% of them have insufficient but acceptable level of preparedness and a small percentage of them (10.7%) have effective level of disaster preparedness.

**Table (3): Distribution of Study Subjects according to their Level of Preparedness to Disasters**

Preparedness Factors	Levels of preparedness (N=580)					
	Unacceptable		Insufficient		Effective	
	No.	%	No.	%	No.	%
1. Leadership and Governance	357	61.6	202	34.8	21	3.6%
2. Emergency Management Planning	369	63.6	199	34.3	12	2.1%
3. Clinical Operation	464	80%	89	15.3	27	4.7%
4. Safety, Fire and Security	412	71	136	23.4	32	5.6%
5. Logistics and Facilities	395	68.1%	167	28.8	18	3.1%
6. Communication, Warning and Notification	314	54.1	250	43.1	16	2.7%
7. Public Information, media relations, risk communication	325	56%	235	40.5%	20	3.5%
8. Training, Drill and Exercise	498	85.9	78	13.4	4	0.7%
9. Performance Improvement and Quality	430	74.1	108	18.6	42	7.2%
Overall Level of Preparedness	405	69.8	113	19.5	62	10.7%

Unacceptable level: less than 50% Insufficient level: from 50% to 75% Effective level: more than 75%

**Table (4)** illustrates that the mean score percent of the studied hospitals concerning their overall disasters preparedness was  $38.95 \pm 8.00$ . In specific, the highest mean score percent ( $42.58 \pm 13.62$ ) was obtained based on interview with study



subjects followed by observation of structural and functional criteria of disaster preparedness (39.5±5.44) then reviewing of documents related to disaster preparedness (34.76±9.75). Moreover, the three studied hospitals recorded the highest mean score percent in disasters logistics and facilities (55.92±2.30) while the lowest mean score percent was found in disasters training, drills, and exercises (10.78±0.57).

**Table (4): Distribution of Mean Score Percentage of Auditing of the Studied Hospitals Preparedness to Crises and Disasters**

Disasters Preparedness Factors	Mean Score Percent of Studied Hospitals			Overall Mean%±SD
	Interview	Documents Review	Observation	
1. Leadership and Governance	23.86 ± 13.08	35.52±2.81	22.22± 9.91	27.20 ± 2.08
2. Emergency Management Planning	39.92 ± 23.92	40.42±23.66	39.00 ± 0.00	39.78± 8.08
3. Clinical Operation	41.39 ± 11.71	44.28±5.15	41.90 ± 7.33	42.52± 8.71
4. Safety, Fire and Security	43.75 ± 8.89	52.42±18.92	53.33 ± 15.27	49.83± 5.50
5. Logistics and Facilities	45.03 ±16.96	54.11±3.84	68.62 ±8.98	55.92± 2.30
6. Communication, Warning and Notification	38.03 ± 9.07	37.66±11.54	33.33 ± 0.00	36.34±1.15
7. Public Information, media relations, risk communication	42.98 ± 23.72	51.33±30.55	48.00± 0.00	47.43±1.52
8. Training, Drill and Exercise	17.45 ± 22.30	6.68±11.54	8.22 ± 11.54	10.78±0.57
9. Performance Improvement and Quality	39 ± 30.28	41.33 ± 19.33	42.00 ± 25.00	40.77±2.00
Overall level of hospitals preparedness	42.58 ± 13.62	34.76±9.75	39.5 ± 5.44	38.95 ± 8.00

**Table (5)** categorizes the levels of disasters resilience of study subjects. It is obvious that around three quarters of study subjects (74.7%) are located in the moderate zone of disasters resilience. On the other hand, 20.3% of them are located in the low zone of resilience and a small percentage of them (5%) are located in the high zone of resilience.

**Table (5): Distribution of Study Subjects according to their Levels of Resilience in Disasters and Crises**

Hospitals Resilience Factors	Levels of Resilience (N=580)					
	Low Zone of Resilience		Moderate Zone of Resilience		High Zone of Resilience	
	No.	%	No.	%	No.	%
1. Hospital Infrastructural Safety and Vulnerability	273	47.1	218	37.5	89	15.4
2. Disaster Management Mechanisms	170	39.3	388	66.9	22	3.8
3. Disasters Resources	263	45.3	272	46.9	45	7.8
4. Emergency Medical Response Capability	120	20.7	426	73.4	34	5.9
Overall Level of Hospitals Resilience	118	20.3	433	74.7	29	5.0

**Table (6)** illustrate that the mean score percent of the studied hospitals concerning their overall disasters resilience was 36.32± 11.10. In specific, the highest mean score percent (40.99±4.73) was obtained based on observation of structural and functional criteria of hospitals disaster resilience followed by interview with study (36.53±14.20) then reviewing of documents related to hospitals disaster resilience (31.46±5.01). Moreover, the three studied hospitals recorded the highest mean score percent in disaster management mechanisms (39.12±11.21) while the lowest mean score percent was found in emergency medical response capability (32.00±14.03).

**Table (6): Distribution of Mean Score Percentage of Auditing of the Studied Hospitals Resilience in Crises and Disasters**

Hospitals Resilience Factors	Mean Score Percent of Studied Hospitals			Overall Mean%±SD
	Interview	Documents Review	Observation	
1. Hospital Infrastructural Safety and Vulnerability	48.44±44.80	33.33±16.66	33.33±16.66	38.36±9.02
2. Disaster Management Mechanisms	35.50±14.53	31.88±5.02	50.00±0.0	39.12±11.21
3. Disasters Resources	25.60±25.01	20.0±0.0	61.90±8.24	35.83±7.22
4. Emergency Medical Response Capability	36.60±10.78	40.65±1.40	18.75±10.82	32.00±14.03
Overall Level of Hospitals Resilience	36.53±14.20	31.46±5.01	40.99±4.73	36.32± 11.10

## V. DISCUSSION

The hallmark of contemporary and intelligent disaster risk reduction is articulated around developing a robust preparedness to disasters and ensuring resilience of nations, communities, and agencies when disasters strike. This notion received a worldwide consensus after launching the sustainable development goals 2015-2030 when 170 countries around world recognized the fact that being well prepared and resilient nation in times of crises can surely mitigate the serious impacts of disasters<sup>(24)</sup>.

It became obvious that mitigating disasters serious impacts could be achieved when each organization in a given community established high levels of disaster preparedness and maintaining resilient pattern during response<sup>(25)</sup>. Unfortunately, this was not the case in the present study as the results showed that the studied Alexandria university hospitals had low to moderate level of disaster preparedness and moderate insufficient level of resilience during crises.

These results may be attributed to many factors such as poor disaster leadership and governance system characterized by lack of a separate specialized entity for disasters management; outdated emergency management plans; absence of many contingency plans for example fires, evacuation, and patient transportation and tracking during crises; lack of previous testing or exercise of emergency plans which contribute to the poor interoperability of these plans during events in the studied hospitals; little concern for maintaining clinical operations during disaster; absence of surge plans to expand the capacity of clinical operations during events; and high vulnerability of studied hospitals due to lack of hazards vulnerability analysis, absent risk surveillance, and unavailable early warning system.

Moreover, other drawbacks present in the studied setting and contribute to the low levels of preparedness and resilience such as the poor crisis communication system characterized by delayed notification, fuzzy lines of communication during events, difficult flow of information during crisis due to lack of access to digital communication platforms and amateur communication facilities, and out-dated contact information. Also, lack of concern to disaster trainings and drills, weak disaster logistics system than cannot supply demands for at least 4 days during disaster, lack of concern to media relations, delayed public disclosure with resultant poor support from all stakeholders are other causes contributing to low resilience and preparedness level.

In addition, many issues in the studied settings exacerbate the poor preparedness and resilience level such as the lack of backup for disaster information, emergency facilities, and energy; poor staff awareness with disaster plans and procedures; and lack of clear cut points to activate or deactivate emergency plans. Also, lack of concern of recovery activities, lack of disaster management budget, limited partnerships with civil community organizations, and the little concern with incentive and protective strategies for emergency staff are other factors adding to this exacerbation.

It is important to mention that the findings of the present study are supported by the opinions of study subjects who emphasized that the poor preparedness and resilience of the studied hospitals might be attributed to the administrative corruption and lack of accountability, shortage of resources with high procrastination to fix this shortage, poor planning and coordination in different sectors. Also, study subjects proposed that the lack of sufficient crises management training, poor

qualification of the majority of staff to respond to any crises, and poor organizational structure and design are other factors explaining the poor preparedness and resilience levels.

Fortunately, the findings of the present study are parallel to the points of view of the majority of study subjects concerning their self-preparedness to face any type of disasters. It is noted that the majority of study subjects thought that they are not prepared at the current time to face any type of crises and disasters due to lack of previous training and workshops about crisis/disaster management, working in fragmented health system that doesn't give priority to crises management, and lack of knowledge about crisis/disasters management.

It is not surprising to find low levels of disaster preparedness and resilience in Alexandria university hospitals because poor preparedness and resilience is a worldwide phenomenon that rooted since years despite the availability of latest innovative communication and information technologies. Numerous studies all over the world conducted to assess preparedness and resilience of health care facilities to disasters and crises. These studies concluded that many hospitals around world are not well prepared to handle major disasters.

In USA, the 2019 national health security preparedness index which assesses the ability to provide health care in large-scale public threats, revealed only a moderate level of overall preparedness with a score of 6.7 out of 10. However, the metric measuring the ability to maintain quality health care during the event and after was only 4.9, revealing a significant gap in preparedness <sup>(26)</sup>. Also, a study conducted in Texas, USA, found that rural hospitals faced many challenges in disaster preparedness due to insufficient staff, training facilities, and constrained resources <sup>(27)</sup>.

A cross-sectional study that included all the 27 European Union (EU) countries revealed that the average level of disaster management preparedness in the health systems of EU member states was 68%. Despite this level appear acceptable, it is still insufficient to handle disasters efficiently. The highest level of preparedness was seen in the United Kingdom, Luxemburg, and Lithuania. Considering the elements of disaster management system, the highest level of preparedness score was in health information elements (86%), and the lowest level was for hospitals, and educational elements (54%) <sup>(28)</sup>. In Italy, a study examined the preparedness of 15 hospitals and revealed the majority of these hospitals (12) are not well prepared to manage potential disasters <sup>(29)</sup>.

In Asia, studies conducted in Japan <sup>(30)</sup>, China <sup>(31)</sup>, India <sup>(32)</sup>, Sri Lanka <sup>(33)</sup>, Iran <sup>(34)</sup>, Pakistan <sup>(35)</sup>, and Korea <sup>(36)</sup> to examine disaster preparedness of a large numbers of hospitals. These studies revealed poor and ill preparedness across all facilities. These hospitals did not have backup power, essential medical supplies and equipment, communication tools, and there were shortages of human resources with high staff absenteeism. Moreover, lack of disaster plans, lack of standard operating procedures, incident command systems, effective leadership and financial structures hindered an adequate response and resilience of these hospitals during disasters.

In Africa, studies performed in South Africa <sup>(37)</sup>, and Northern Namibia <sup>(38)</sup> found ineffective disasters preparedness among all surveyed hospitals. These studies found serious deficiencies in disaster preparedness especially in staff knowledge, resources shortage, lack of training and drills, poor infrastructure, lack of leadership support with extensive corruptive actions. In Arab countries, studies conducted in Saudi Arabia <sup>(39)</sup>, Jordan <sup>(40)</sup>, Yemen <sup>(41, 42)</sup>, and Palestine <sup>(43)</sup> showed serious insufficiency in disasters preparedness among all evaluated hospitals. These studies found many shortcomings in preparedness that act as a barriers for resilience such as lack of disaster plans, poor staff training, no previous disaster drills, limited logistics, lack of incident command system and disaster operation center, lack of specific programs for expanding surge capacity, and lack of hazard vulnerability analysis.

It is important to note that no one study of all those available in databases and can be accessed in the published literature reported high disaster preparedness of the examined hospitals. All these studies found many weaknesses in disaster preparedness with some variation between hospitals in one or more aspects of preparedness.

Achieving resilience during crises and disasters in Alexandria university hospitals (AUH) is a pressing national issue as these hospitals serve a large scale of Egyptian population. Unfortunately, the present study revealed serious gap in resilience performance of the studied AUH. The present study revealed that achievement of resilience criteria in AUH is faced with many challenges such as poor compliance of many buildings with the Egyptian code for construction, lack of regular investigation of the status of buildings, leakage of water in walls and beams in many areas make concretes are liable for damage with small seismic activity, congestion of buildings with infrastructure, and the old nature of many buildings.

Also, limited measures for resistance against floods and earthquakes, procrastination to identify hazards and fix it, high vulnerable internal environment due to poor diseases monitoring and surveillance associated with shortage of PPE are other shortcomings that hinder robustness in AUH. Furthermore, limited stockpiles of logistics and medicines for disaster use, shortage of some categories of healthcare providers especially nurses, some hospitals do not possess trauma teams, operationalization of disaster plans not guaranteed during activation due to lack of prior testing of these plans associated with lack of previous drills are other challenges toward resilience of AUH. Budget constraints are a serious challenge which impose limitation on recovery and adaptation procedures and prolong the aftermath period of disasters. It hinders continuous commitment of suppliers and stakeholders to fulfill their promises toward AUH when disasters strike.

Surge capacity is the essence of redundancy and resilience during disasters. Despite its significance in resilience, the present study revealed obvious gap in the surge capacity of the studied hospitals. This gap appears in the absence of any prepared spaces and conditions (e.g., electricity, oxygen, water, heat) in place to temporary surge numbers of emergency beds, absence of plan that delineate the number of beds that could be surged. Also, surge procedures for emergency beds often limited to early discharge of patients and cancellation of elective surgery. In addition, surge procedures for staff limited to sharing staff from other university hospitals and recalling off duty staff. This associated with lack of staff surge plan as well as lack of a procedure for rapid surging and transfer of equipment and supplies to disaster scene.

These findings are similar to a research project done to evaluate the level of resilience of 41 tertiary hospitals in Shandong Province, China. The results of this project indicate that hospital disaster resilience in the province was insufficient with considerable variation in the level of resilience of those hospitals<sup>(17)</sup>. Moreover, the Department of Homeland Security (DHS) in cooperation with the Department of Health and Human Services (DHHS) (2014) conducted wide national hospital resilience assessment across the American states. The results of this assessment demonstrated that 222 hospitals that received DHS assessments had poor resilience and the remaining hospitals were still suffering from many drawbacks in resilience activities<sup>(44)</sup>.

In contrary to the results of the present study, the study of Vick et al., (2018)<sup>(45)</sup> in 80 hospitals in New York revealed that nearly three-quarters of hospitals could continue operations for less than a week without external resources. Also, Niska and Shimizu (2011)<sup>(46)</sup> conducted a study on 294 hospitals in USA and found most hospitals had plans for establishment of alternate care areas with beds, staffing, and equipment in non-clinical spaces. Also, the majority of these hospitals had plans for cancellation of elective procedures and admissions. Three quarters of hospitals had plans for setting up temporary facilities during disasters for expanding their surge capacities.

## VI. CONCLUSION

This study concluded that Alexandria university hospitals have poor insufficient level of disasters preparedness and moderate level of resilience. They suffer from many serious weaknesses in their preparedness especially in disaster training and drills, disaster leadership and governance, crisis communication, disaster planning. These weaknesses will deter AUH from achieving resilience when disasters strike. This necessitates conducting urgent improvement actions to control the burden of contemporary disasters.

## VII. RECOMMENDATIONS

It is a mandatory for Alexandria university hospitals to improve the current status of disasters preparedness and resilience, so they should:

1. Conduct continuous training programs at least twice annually regarding basic life support; disasters management plans and procedures to acquaint all staff with knowledge and skills required for rapid rescue and response.
2. Develop a hand book that include all disaster management policies and plans and make it accessible for all staff in all units within Alexandria university hospitals.
3. Establish a department composed of multi-disciplinary team concerned with disasters and crises management in each hospital accountable to develop, update, test, and monitor disasters management plans and procedures.
4. Develop incident command system and hospital command center within each hospital that enable monitoring and control of operations during disastrous incidents.

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5. Prepare hospitals with digital emergency alert system that help Alexandria university hospitals to start disasters response activities at the appropriate time.
6. Establish emergency communication center with a dedicated trunk line and should be equipped with digital and amateur communication tools.
7. Specify different well trained teams in each hospital to be responsible for emergency patient transportation, rapid response and rescue, evacuation, fire response, and recovery in the aftermath of disasters.
8. Conduct vulnerability and risk assessments for critical facilities and infrastructures annually.
9. Monitor disaster management performance through conducting annual audit of disasters plans, operations, and resources.
10. Conduct disasters drills and disasters plans exercises twice annually.
11. Specify adequate numbers of resources and medicines to be used only in disasters situations
12. Secure a backup system for logistics (power, water, oxygen, communications, equipment) to make it ready to provide demands for at least 5 days during disasters
13. Adopting surge plans and procedures to increase the patient care capacity during disasters to at least 25% comparable to capacities in normal operations.
14. Ensure all critical facilities such as emergency department, laboratory, pharmacy, blood bank, and morgue have both surge plans and adequate stockpiles ready for use in disasters.

#### REFERENCES

- [1] Jones DS. History in a crisis—lessons for Covid-19. *New England Journal of Medicine*. 2020 Apr 30; 382(18):1681-3.
- [2] Xie J, Tong Z, Guan X, Du B, Qiu H, Slutsky AS. Critical care crisis and some recommendations during the COVID-19 epidemic in China. *Intensive care medicine*. 2020 Mar 2:1-4.
- [3] Akter S, Wamba SF. Big data and disaster management: a systematic review and agenda for future research. *Annals of Operations Research*. 2019 Dec 1; 283(1-2):939-59.
- [4] Alruwaili A, Islam S, Usher K. Disaster Preparedness in Hospitals in the Middle East: An Integrative Literature Review. *Disaster medicine and public health preparedness*. 2019 Aug; 13(4):806-16.
- [5] Al Thobaity A, Alamri S, Plummer V, Williams B. Exploring the necessary disaster plan components in Saudi Arabian hospitals. *International Journal of Disaster Risk Reduction*. 2019 Dec 1; 41:101316.
- [6] Amerioun A, Alidadi A, Zaboli R, Sepandi M. The data on exploratory factor analysis of factors influencing employees' effectiveness for responding to crisis in Iran military hospitals. *Data in brief*. 2018 Aug 1; 19:1522-9.
- [7] Alpert EA, Weiser G, Kobliner D, Mashiach E, Bader T, Tal-Or E, Merin O. Challenges in implementing international standards for the field hospital emergency department in a disaster zone: the Israeli experience. *The Journal of Emergency Medicine*. 2018 Nov 1;55(5):682-7.
- [8] Atsuji S. *Unsafty: Disaster Management, Organizational Accidents, and Crisis Sciences for Sustainability*. Springer; 2016 Nov 15.
- [9] American College of Emergency Physicians. Hospital Disaster Preparedness Self-Assessment Tool. 2017. Retrieved from <http://cdphready.org/hospital-disaster-preparedness-self-assessment-tool/> (Accessed 10, July 2019).
- [10] Hatami H, Neisi A, Kooti M. Functional, structural and non-structural preparedness of Ahvaz health centers against disasters in 2014–2015. *Jundishapur J Health Sci*. 2017 Jan; 9(1):e66561.

- [11] Kelman I, Mercer J, Gaillard JC, editors. Handbook of disaster risk reduction including climate change adaptation. Routledge; 2017 Sep 19.
- [12] Renschler CS, Frazier AE, Arendt LA, Cimellaro GP, Reinhorn AM, Bruneau M. Developing the 'PEOPLES' resilience framework for defining and measuring disaster resilience at the community scale. In Proceedings of the 9th US national and 10th Canadian conference on earthquake engineering 2010 Jul 25 (pp. 25-29).
- [13] Zhong S, Clark M, Hou XY, Zang Y, FitzGerald G. Development of key indicators of hospital resilience: a modified Delphi study. Journal of health services research & policy. 2015 Apr; 20(2):74-82.
- [14] Paton D, Johnston D. Disaster resilience: an integrated approach. Charles C Thomas Publisher; 2017 Jun 12.
- [15] Witt E, Lill I. Methodologies of contemporary disaster resilience research. Procedia engineering. 2018 Jan 1; 212:970-7.
- [16] Zhong S, Clark MJ, Hou XY, Zang YL, FitzGerald G. Proposing and developing a definition and conceptual framework for health care resilience to cope with disasters Emergencias. 2014 Feb 28; 26:69-77.
- [17] Zhong S. Developing an evaluation framework for hospital disaster resilience: tertiary hospitals of Shandong province, China. Published doctoral dissertation. Queensland University of Technology, 2014.
- [18] Achour, N., Price, A.D.F. (2010). Resilience strategies of healthcare facilities: Present and future. International Journal of Disaster Resilience in the Built Environment, 1(3), 264-276.
- [19] Achour, N., Miyajima, M., Pascale, F., & Price, A. D. (2014). Hospital resilience to natural hazards: classification and performance of utilities. *Disaster prevention and management*, 23 (1),40-52
- [20] Samsuddin NM, Takim R, Nawawi AH, Rosman MR, SyedAlwee SN. Non-structural Components influencing Hospital Disaster Preparedness in Malaysia. In IOP Conference Series: Earth and Environmental Science 2018 Apr 1 (Vol. 140, No. 1, p. 012007). IOP Publishing.
- [21] Ghoneem MY, Elewa AK. The early warning application role in facing the environmental crisis and disasters: Preliminary risk management strategy for the greater city of Cairo. Spatium. 2016 (29):40-8.
- [22] Abulnour A. Towards efficient disaster management in Egypt. Housing and Building National Research Center Journal, 2013, 7(4), 1-10.
- [23] Egyptian Cabinet, Information & Decision Support Center, Crisis Management and DRR Sector. National Strategy for Crisis/ Disaster Management and Disaster Risk Reduction. 2018. Available at: [https://www.preventionweb.net/files/57333\\_egyptiannationalstrategyfordrrrengli.pdf](https://www.preventionweb.net/files/57333_egyptiannationalstrategyfordrrrengli.pdf)
- [24] Sheikhbardsiri H, Raeisi AR, Nekoei-Moghadam M, Rezaei F. Surge capacity of hospitals in emergencies and disasters with a preparedness approach: a systematic review. Disaster medicine and public health preparedness. 2017 Oct 1;11(5):612-20.
- [25] Shabanikiya H, Gorgi HA, Seyedin H, Jafari M. Assessment of hospital management and surge capacity in disasters. Trauma monthly. 2016 May; 21(2).
- [26] Mays GP, Childress M, Zephyr D, Hoover A. Methodology for the 2019 National Health Security Preparedness Index. Lexington, KY: University of Kentucky Center for Public Health Systems and Services Research; 2019. Available at: [https://nhspi.org/wp-content/uploads/2019/05/NHSPI\\_2019\\_Key\\_Findings.pdf](https://nhspi.org/wp-content/uploads/2019/05/NHSPI_2019_Key_Findings.pdf)
- [27] Cliff, B. A study of disaster preparedness of rural hospitals in the united states. published doctoral dissertation. Western Michigan University. Faculty of the Graduate College, 2007.
- [28] Djalali A, Della Corte F, Foletti M, Ragazzoni L, Gallardo AR, Lupescu O, Arculeo C, von Arnim G, Friedl T, Ashkenazi M, Fischer P. Art of disaster preparedness in European Union: A survey on the health systems. PLoS Currents. 2014 Dec 17;6.

- [29] Ingrassia PL, Mangini M, Azzaretto M, Ciaramitaro I, Costa L, Burkle JF, Della FC, Djalali A. Hospital Disaster Preparedness in Italy: a preliminary study utilizing the World Health Organization Hospital Emergency Response Evaluation Toolkit. *Minerva anesthesiologica*. 2016 Dec;82(12):1259-66.
- [30] Öztekin SD, Larson EE, Akahoshi M, Öztekin İ. Japanese nurses' perception of their preparedness for disasters: Quantitative survey research on one prefecture in Japan. *Japan journal of nursing science*. 2016 Jul;13(3):391-401.
- [31] Li X, Huang J, Zhang H. An analysis of hospital preparedness capacity for public health emergency in four regions of China: Beijing, Shandong, Guangxi, and Hainan. *BMC public health*. 2008 Dec 1; 8(1):319.
- [32] Phalkey R, Dash S, Mukhopadhyay A, Runge-Ranzinger S, Marx M. Prepared to react? Assessing the functional capacity of the primary health care system in rural Orissa, India to respond to the devastating flood of September 2008. *Global health action*. 2012 Dec 1; 5(1):10964.
- [33] AlBattat, A. R. Disaster and emergency planning and preparedness in Jordanian hotel industry. Published Doctoral Dissertation. Universiti Sains Malaysia. School of Housing, Building and Planning, 2016.
- [34] Zaboli R, Sajadi HS. Assessing hospital disaster preparedness in Tehran: Lessons learned on disaster and mass casualty management system. *International Journal of Health System and Disaster Management*. 2014 Oct 1;2(4):220.
- [35] Ul-Haq Z, Shah BH, Ardakani M, Khan SA, Muhammad S, Farooq S, Khan SH, Huda Q. Health system preparedness in Pakistan for crisis management: a cross-sectional evaluation study. *Eastern Mediterranean health journal*. 2019; 25(8):553-61.
- [36] Lee HY, Oh MN, Park YS, Chu C, Son TJ. Public health crisis preparedness and response in Korea. *Osong public health and research perspectives*. 2013 Oct 1; 4(5):278-84.
- [37] Stander M, Wallis LA, Smith WP. Hospital disaster planning in the Western cape, South Africa. *Prehospital and disaster medicine*. 2011 Aug 1;26(4):283.
- [38] Ncube A, Chimanya GN. Hospital disaster emergency preparedness: a study of Onandjokwe Lutheran Hospital, Northern Namibia. *African Safety Promotion: A Journal of Injury and Violence Prevention*. 2016;14(2):1-7.
- [39] Al-Shareef AS, Alsulimani LK, Bojan HM, Masri TM, Grimes JO, Molloy MS, Ciottone GR. Evaluation of hospitals' disaster preparedness plans in the Holy City of Makkah (Mecca): a cross-sectional observation study. *Prehospital and disaster medicine*. 2017 Feb 1; 32(1):33.
- [40] Al Khalailah MA, Bond E, Alasad JA. Jordanian nurses' perceptions of their preparedness for disaster management. *International emergency nursing*. 2012 Jan 1; 20(1):14-23.
- [41] Aladhrai SA, Djalali A, Della Corte F, Alsabri M, El-Bakri NK, Ingrassia PL. Impact of the 2011 revolution on hospital disaster preparedness in Yemen. *Disaster medicine and public health preparedness*. 2015 Aug; 9(4):396-402.
- [42] Naser WN, Ingrassia PL, Aladhrae S, Abdulraheem WA. A study of hospital disaster preparedness in South Yemen. *Prehospital and disaster medicine*. 2018 Apr 1; 33(2):133.
- [43] El Qadoud TS. Assessment of Health System Crisis and Disaster Preparedness among Governmental Hospitals in Gaza Strip, Palestine. Published master thesis. Islamic university of Gaza, 2018.
- [44] Department of Homeland Security's Office of Cyber and Infrastructure Analysis (DHS/OCIA). Sector Resilience Report: Hospitals. National Protection and Programs Directorate (NPPD), USA. 2014.
- [45] Vick DJ, Wilson AB, Michael Fisher DB, Roseamelia C. Assessment of community hospital disaster preparedness in New York State. *Journal of emergency management*. 2018 Jul 1; 16(4):213-27.
- [46] Niska RW, Shimizu I. Hospital preparedness for emergency response; United States, 2008. *National Health Statistics Reports*, 2011.