ORIGINAL ARTICLE

Disaster and Emergency Medicine Journal
2022, Vol. 7, No. 1, 11–20
DOI: 10.5603/DEMJ.a2022.0002
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ISSN 2451–4691, e-ISSN 2543–5957

DISASTER RISK ASSESSMENT OF PRIMARY HEALTHCARE FACILITIES IN SOUTH EAST OF IRAN: A STUDY WITH APPROACH OF DISASTER RISK REDUCTION

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ABSTRACT

INTRODUCTION: Disaster risk management requires a systematic process, including executive, organizational decisions, other capacities to perform policies, strategies, and social capacity to reduce the negative effects and consequences of risks. The purpose of this study is to investigate the risk assessment process in all healthcare facilities of South East of Iran.

MATERIAL AND METHODS: This cross-sectional study was conducted at the Kerman University of Medical Sciences in 2021 and the population participating in this study was all healthcare facilities, n = 2835 in the cities of South East of Iran that were selected with a census method. The risk assessment of healthcare facilities was performed with two qualitative and quantitative methods.

RESULTS: The results of the current study showed that 26 main hazards threaten healthcare facilities in South East of Iran and high priorities of healthcare hazards were earthquake, dust, drought, flood, and traffic incidents. Also, the results indicated that the vulnerability total mean score (733.26) of healthcare facilities was at a high level and the total mean score of response capacity (418.13) in healthcare facilities was at a moderate level. The results based on the assessment of three dimensions of hazard, vulnerability, and response capacity showed the risk total mean scores of healthcare facilities (117.39) was at a high level.

CONCLUSIONS: Current research showed that the risk level of disasters was very high in the majority of healthcare facilities of South East of Iran. Therefore, national and provincial decision-makers or policymakers should make the right decisions to decrease disaster risks level through special attention to structural, non-structural, functional, managerial vulnerabilities and improvement of response capacity of healthcare facilities.

KEY WORDS: risk assessment; hazard; vulnerability; capacity; healthcare facilities; disaster

Disaster Emerg Med J 2022; 7(1): 11–20

INTRODUCTION

Iran with a population of about 75 million is prone to a variety of natural and man-made disasters [1]. Providing resiliency for the society, health care facilities attempted to deliver essential services, improve the health condition, and deal with emergencies, efficiently [2]. Healthcare facilities should remain stable and deliver services when disasters occur [3, 4]. The goal of disaster risk management in health care systems is to reduce the adverse effects and consequences of natural and unnatural disasters [5]. The first step in the disaster risk management process

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Received: 31.10.2021 Accepted: 21.02.2022 Early publication date: 18.03.2022

to prevent and reduce damage is to perform a risk assessment [6]. Disaster risk assessments analyze potential hazards and evaluate vulnerability to identify the nature and extent of risk, which may harm exposed people, property, services, livelihoods, and the environment [7, 8]. Components of risk assessment are hazard identification and monitoring, vulnerability assessment, and capacity assessment [9].

By analyzing and studying the probability of hazards occurrence, we can determine and address the health-related risks. Thus, in addition to hazards, which threaten and change organizational performance and processes, hazard analysis improves risk management in health organizations [6, 10]. Vulnerability is a component of the risk assessment and it is defined as the conditions affected by physical, social, economic, and environmental factors or processes, which increase the vulnerability of a community to the hazards [7, 11]. With the disaster capacity program of the health system, healthcare centers can provide continued healthcare in emergency and non-emergency situations during disasters.

Literature review

A study estimated hospital safety from disasters in Iran in 2015 and showed that the total disaster safety of Iran's hospitals was 43%. About 20% of the hospitals had low safety and the rest had moderate safety [12]. Researchers found that many healthcare facilities were influenced by climatic hazards [13]. A study was conducted in Roburnia Plantation, Mpumalanga, South Africa, and indicated that Roburnia Plantation was highly vulnerable to hazards, including fires, harsh weather conditions, tree diseases, pests, and pathogens [8]. According to a study of the vulnerability of public hospitals affiliated with Tehran University of Medical Sciences to earthquakes, researchers reported functional safety to be 77.16% in six hospitals [14]. One study investigated the safety of selected hospitals affiliated with Shahid Beheshti University using the WHO/Pan American Health Organization Checklist and concluded that most of the studied hospitals had moderate safety [15].

Research aim and question

Although disaster risk assessment is very important in reducing adverse effects and consequences of disasters, it has not yet been taken into account seriously in the Iranian healthcare system. Therefore, the purpose of this study is to investigate the risk assessment process (hazard analysis, response capacity, and vulnerability) in all healthcare facilities of South East of Iran. In other words, the present research attempts to answer the following questions:

a) what are the hazards threatening healthcare facilities in South East of Iran?
b) Which hazards are in higher priorities?
c) What is the level and condition of vulnerability (structural, non-structural, and functional) of healthcare facilities?
d) What is the response capacity of healthcare facilities to disasters?
e) What is the level of risk (quantity and quality) in healthcare facilities?

Decision-makers can use the results of this study to prioritize the resources and apply information obtained from the disaster risk assessments in the design and construction of new healthcare facilities to reduce vulnerability or increase the capacity of the existing healthcare facilities.

MATERIAL AND METHODS

The Kerman University of Medical Science approved this study prior to the collection of data. A cross-sectional design was employed in 2021. Kerman is the largest province of Iran located in southeastern Iran. According to the statistics center of Iran in 2016, its population was 3 164 717 people. Kerman is one of the largest cities of Iran in terms of area, which is about more than 11% with about 183 193 square kilometers. Twenty-seven percent of Kerman province is exposed to drought and strong winds in different seasons, especially in the southern and eastern regions, which severely restricted the life of people in these regions. There are 13 active faults in Kerman province with more than 84% of the population exposed to seismic hazards.

Samples and settings

The population participating in this study was all healthcare facilities, n = 2835 included (the deputy of health, district health centers, comprehensive urban health centers, comprehensive rural health centers, comprehensive urban-rural health centers, urban health posts, health house in the cities of Kerman province (Kerman, Baft, Kouhbanan, Shahrbabak, Ravar, Bardsir, Orzueyeh, Rabor, Rafsanjan, Anar, Jiroft, Kahnooj, Anbrabad, Roodbar, Ghalehganj, Manoujan, Fareyab, Bam, Fahraj, Rigan, Rostamabad, Sirjan), which were selected with a census method, therefore a total of healthcare facilities have participated in this study. The risk assessment of healthcare facilities was performed qualitatively (identification and prioritization of hazards) and quantitatively (assessment of capacity and vulnerability).

Inclusion and exclusion criteria

Inclusion criterion includes all healthcare facilities in Kerman province, which provide all healthcare services, and exclusion criterion includes dissatisfaction with sharing organizational information as well as dissatisfaction of experts with participation in Interactive Group discussion (IGD) sessions.

Data collection

Qualitative method (identification and prioritization of hazards)

First, all the hazards threatening the healthcare facilities of Kerman province, including geological, climatic, social, biological, technological, and man-made hazards were identified and extracted with the cooperation of relevant organizations and based on joint meetings through IGD discussion and brainstorming, previous maps and researches of organizations and historical evidence of the occurrence of disasters.

Three 8-hour sessions of IGD consisting of eight people (one geologist, one expert in provincial crisis management, two experts of disaster risk management in health system, one meteorologist of the province, one regional water expert, one firefighter, and one Red Crescent expert) were held in the medical emergencies and incidences management center of Kerman University of Medical Sciences. In the first two sessions, two experts experienced in disaster conducted sessions and one individual wrote down the information. After the acquisition of informed consent from the participants, a tape recorder was also used to record information. In the third session, the probability, frequency severity, and impact of hazards were determined separately for each city based on the opinions of the IGD members and using the national tools of health assessment in disasters [16], Shows in (Tab. 1 and 2). Table 2 shows how to prioritize hazards based on scores obtained from Table 1 and the coefficients of frequency [7], probability [2], severity [6] and impact [5] are the constant base of national tools of health assessment in disasters. In this study the scores between 20–40 show low-level hazards, 41–60 show moderate-level hazards, 61–80 show high-level hazards and 81–100 show very high-level hazards. Based on the above tool, all-hazards extracted at this stage were prioritized based on hazard characteristics.

Quantitative method (assessment of vulnerability and capacity of healthcare facilities)

A disaster risk assessment checklist in Iranian primary healthcare facilities [17] was used to assess the vulnerability (structural, non-structural, and functional) of healthcare facilities. After gaining the necessary training in the medical emergencies and incidences management center, a team consisting of a structural engineer, hospital vital system expert, medical engineer, an expert in mechanical and electrical system maintenance or facility, health specialist, health specialist in disasters and emergencies carried out the assessment for each city separately. In this assessment tool, structural vulnerability dimensions (5 items), non-structural vulnerability dimensions (154 items) included two sections: general with 44 items and technical with 110 items and functional dimension (241 items) have been scored with three levels, (low vulnerability& high safety = 3 scores), (moderate vulnerability & moderate safety = 2 scores) and (high vulnerability & low safety = 1 score). Scores ranging from 400 to 600 show very high vulnerability, 601 to 800 show high vulnerability, 801 to 1000 show moderate vulnerability, and 1001–1200 show low vulnerability.

The response capacity of healthcare facilities was evaluated by national tools of health assessment in disasters [16], with three dimensions of Stuff (74 items), Staff (49 items), and Structure (119 items) at three levels of low capacity (score 1), moderate capacity (score 2) and high capacity (score 3). The scores ranging from 242 to 363 show low capacity, 364 to 484 show moderate capacity, 485 to 605 show high capacity, and 606 to 726 show very high capacity. Both tools [16, 17] used in this study were standardized and validated by conducting several meetings with experts and they are currently approved by experts and health managers in Iran.

In the final step, risk assessment was performed based on the following standard and accepted formula and vulnerability and hazards were calculated based on response capacity [8] layers in each city. In this study, scores between 33–66 show low-risk levels, 67–99 show moderate risk levels, 100–132 show high-risk levels and 133–166 show very high-risk levels.

$$\text{Risk} = \frac{H^*V}{C}$$

Table 1. Hazards prioritization of the healthcare facilities in terms of (frequency, probability, severity, and impact)

Hazards characterize	Criteria
Frequency level	Hazard level in terms of frequency
1	No hazard has been recorded in the last twenty years
2	One hazard has been recorded in the last twenty years
3	2–3 hazards have been recorded in the last twenty years
4	4–5 hazards have been recorded in the last twenty years
5	Hazard more than five have been recorded in the last twenty years
Probability level	Hazard level in terms of probability
1	The probability of the hazard occurring at the site is very rare
2	The hazard may occur over the next 20 years
3	The hazard may occur over the next 10–20 years
4	The hazard may occur over the next 5–10 years
5	The hazard may occur in less than 5 years in the future
Severity level	Hazard level in terms of severity
1	– The hazard has not affected the health of the people in the region – Financial losses less than one milliard rials – No homeless – Hazard has not affected the provision of health services
2	– Victims: One-two people – Injured: one-five people – Financial losses of more than one to 10 milliard rials – Between one and 100 homeless people – The 0–2-hour disruption in the provision of health services
3	– Victims: Three to five people – Injured: six to nine people – Financial losses of more than 10 to 200 milliard rials – Between 101 and 1000 homeless people – The 2–12-hour disruption in the provision of health services
4	– Victims: Six to nine people – Injured: 10 to 99 people – Financial losses of more than 200 to 500 milliard rials – Between 1001 and 10 000 homeless people – The 12–24 disruption in the provision of health services
5	– Victims: more than 10 people – Injured: more than 100 people – Financial losses of more than 500 milliard rials – More than 10 000 homeless people – Above 24-hour disruption in the provision of health services.
Impact level	Hazard level in terms of impact
1	If hazards occur, there will be physical, financial or functional losses for less than 20% of the exposed population
2	If hazards occur, there will be physical, financial or functional losses for 21–40% of the exposed population
3	If hazards occur, there will be physical, financial or functional losses for 41–60% of the exposed population
4	If hazards occur, there will be physical, financial or functional losses for 61–80% of the exposed population
5	If hazards occur, there will be physical, financial or functional losses for 81–100% of the exposed population

Data analyses

Data were analyzed using Excel software and descriptive tests, including frequency, percentage, mean and standard deviation.

RESULTS

The results of the current study showed that 26 main hazards threaten healthcare facilities in Kerman province and high priorities of healthcare hazards in Kerman province were earthquake, dust, drought, flood, and traffic incidents. In addition, low priorities of hazards were blizzard, avalanche, fog, river flooding and glacial as shown in Table 3.

The results of the study showed that the hazard total mean score of healthcare facilities in Kerman province was at a high level (63.86). Among the cities of Kerman province, the healthcare facilities of

Table 2. How to calculate of total scores of the hazards (sample)

Row	Hazard	Frequency [7]	Probability [2]	Severity [6]	Impact [5]	Total score
1	Earthquake	4 × 7 = 28	5 × 2 = 10	5 × 6 = 30	5 × 5 = 25	93
2	Dust	5 × 7 = 35	5 × 2 = 10	5 × 6 = 30	2 × 5 = 10	85

Note: the coefficients of frequency [7], probability [2], severity [6], and impact [5] are constant

Table 3. Hazard prioritization of the healthcare facilities in Kerman province

Hazard	Frequency	Probability	severity	Impact	Score	Priority
Earthquake	4 × 7 = 28	5 × 2 = 10	5 × 6 = 30	5 × 5 = 25	93	1
Dust	5 × 7 = 35	5 × 2 = 10	5 × 6 = 30	2 × 5 = 10	85	2
Drought	4 × 7 = 28	5 × 2 = 10	4 × 6 = 24	2 × 5 = 10	78	3
Flood	4 × 7 = 28	5 × 2 = 10	4 × 6 = 24	2 × 5 = 10	78	4
Traffic incidents	3 × 7 = 21	5 × 2 = 10	4 × 6 = 24	4 × 5 = 20	75	5
Storm	4 × 7 = 28	5 × 2 = 10	4 × 6 = 24	2 × 5 = 10	72	6
Epidemic	3 × 7 = 21	5 × 2 = 10	4 × 6 = 24	3 × 5 = 15	70	7
Airplane Fall	2 × 7 = 14	4 × 2 = 8	4 × 6 = 24	3 × 5 = 15	61	8
Complete power outage	3 × 7 = 21	3 × 2 = 6	4 × 6 = 24	2 × 5 = 10	61	9
Severe dehydration	2 × 7 = 14	4 × 2 = 8	5 × 6 = 30	1 × 5 = 5	57	10
Chemical incident	5 × 7 = 35	4 × 2 = 8	1 × 6 = 6	1 × 5 = 5	54	11
Water pollution	2 × 7 = 14	3 × 2 = 6	4 × 6 = 24	1 × 5 = 5	49	12
Fire	2 × 7 = 14	4 × 2 = 8	3 × 6 = 18	1 × 5 = 5	45	13
Dam break	2 × 7 = 14	4 × 2 = 8	3 × 6 = 18	1 × 5 = 5	45	14
Explosion of gas lines	2 × 7 = 14	4 × 2 = 8	3 × 6 = 18	1 × 5 = 5	45	15
Hail	2 × 7 = 14	3 × 2 = 6	3 × 6 = 18	1 × 5 = 5	43	16
Industrial explosion	2 × 7 = 14	3 × 2 = 6	3 × 6 = 18	1 × 5 = 5	43	17
Mine incidents	2 × 7 = 14	4 × 2 = 8	2 × 6 = 12	1 × 5 = 5	39	18
Landslide	1 × 7 = 7	4 × 2 = 8	3 × 6 = 18	1 × 5 = 5	38	19
Radioactive incidents	1 × 7 = 7	4 × 2 = 8	3 × 6 = 18	1 × 5 = 5	38	20
Explosion of oil lines	1 × 7 = 7	4 × 2 = 8	2 × 6 = 12	1 × 5 = 5	32	21
Glacial	2 × 7 = 14	3 × 2 = 6	1 × 6 = 6	1 × 5 = 5	31	23
River flooding	1 × 7 = 7	3 × 2 = 6	2 × 6 = 12	1 × 5 = 5	30	22
Fog	1 × 7 = 7	3 × 2 = 6	2 × 6 = 12	1 × 5 = 5	30	24
Avalanche	1 × 7 = 7	3 × 2 = 6	2 × 6 = 12	1 × 5 = 5	30	25
Blizzard	1 × 7 = 7	3 × 2 = 6	2 × 6 = 12	1 × 5 = 5	30	26
Hazard total mean score = 52						

Table 4. Qualitative and quantitative risk levels of the healthcare facilities in Kerman cities in terms of (hazards, vulnerability and response capacity)

Name of City	Hazard Condition	Vulnerability Condition	Response Capacity Condition	Risk Condition
Kerman	64 = high	720 = high	402 = moderate	114.62 = high
Zarand	78 = high	432 = very high	486 = high	69.33 = moderate
Ravar	52 = moderate	1010 = low	490 = high	107.18 = high
Sirjan	46 = moderate	821 = moderate	720 = very high	52.45 = low
Kouhbanan	90 = very high	410 = very high	242 = low	152.47 = very high
Shahrbabak	68 = high	774 = high	521 = high	101.02 = high
Baft	44 = moderate	1008 = low	724 = very high	61.25 = low
Bardsir	28 = low	1023 = low	512 = high	55.94 = low
Ourzueyeh	68 = high	547 = very high	263 = low	141.42 = very high
Rabor	74 = high	624 = high	285 = low	162.02 = very high
Bam	64 = high	1001= low	660 = high	97.06 = moderate
Fahraj	72 = high	586 = very high	309 = low	136.54 = very high
Rigan	81 = very high	620 = high	363 = low	138.34 = very high
Jiroft	81 = very high	802 = moderate	482 = moderate	134.77 = very high
Roodbar	78 = high	540 = very high	261 = low	153.49 = very high
Ghale Ghanj	62 = high	602 = high	260 = low	143.55 = very high
Manoojan	42 = moderate	1032 = low	277 = low	156.47 = very high
Kahnooj	84 = very high	680 = high	358 = low	159.55 = very high
Rafsanjan	68 = high	815 = moderate	694 = very high	79.85 = moderate
Anar	32 = low	1042 = low	512 = high	65.12 = low
Anbarabad	73 = high	468 = very high	252 = low	135.57 = very high
Rostam Abad	48 = moderate	720 = high	252 = low	137.14 = very high
Fariyab	72 = high	588 = very high	292 = low	144.98 = very high
Total mean score	63.86 (high)	733.26 (high)	418.13 (moderate)	117.39 (high)

Kuhbanan (score = 90), Rigan (score = 81), Jiroft (score = 81) and Kahnooj (score = 84) cities were exposed to the most hazards and the healthcare facilities of Bardsir (score = 28) and Anar (score = 32) cities were exposed to the least hazards as shown in Table 4.

According to this research, the total vulnerability mean score (733.26) of healthcare facilities in Kerman province was at a high level. The results of the study showed that the healthcare facilities of Kuhbanan (score = 410) and Anar (score = 1042) cities had the highest and the lowest levels of vulnerability, respectively. The results also indicated that 30.43% of the healthcare facilities had a very high vulnerability, 30.43% of the healthcare facilities had a high vulnerability, 13.04% had a moderate vulnerability and 26.08% had a low vulnerability as shown in Tables 5 and 4.

According to this research, the total mean score of response capacity (418.13) in healthcare facilities of Kerman province was at a moderate level based of three components of (stuff, staff and Structure). The results of the study showed that the healthcare facilities of Koohbanan city (score = 242) had the lowest response capacity and the health centers of Baft city (score = 724) had the highest response capacity. The results also showed that 52.17% of the healthcare facilities had a low response capacity, 8.69% of them had a moderate response capacity, 26.08% had a high response capacity and 13.04% had a very high response capacity as shown in Tables 6 and 4.

The results showed that based on three dimensions of hazard, vulnerability and response capacity, the total risk mean scores of healthcare facilities (117.39) was at a high level. The results showed that among healthcare facilities in Kerman province,

Table 5. Vulnerability (structural, non-structural and functional) of the healthcare facilities in Kerman cities

Name of City	Structural	Nonstructural	Functional	Total
Kerman	10	238	472	720
Zarand	7	174	251	432
Ravar	8	378	624	1010
Sirjan	8	200	613	821
Kouhbanan	6	162	242	410
Shahrbabak	6	293	475	774
Baft	6	350	652	1008
Bardsir	7	360	656	1023
Ourzueyeh	6	196	345	547
Rabor	6	253	365	624
Bam	10	313	678	1001
Fahraj	7	247	332	586
Rigan	6	258	356	620
Jiroft	8	307	487	802
Roodbar	7	180	353	540
Ghale ghanj	6	198	398	602
Manoojan	6	359	667	1032
Kahnooj	7	281	392	680
Rafsanjan	9	201	605	815
Anar	6	359	677	1042
Anbarabad	7	217	244	468
Rostam abad	6	331	383	720
Fariyab	7	233	348	588
vulnerability total mean score = 733.26				

healthcare facilities in Rabor city (score = 162.02) had the highest risk levels and healthcare facilities of Sirjan (score = 52.45) had the lowest risk levels. The results also showed that 56.52% of the healthcare facilities had a very high-risk level, 13.04% had a high-risk level, 13.04% had a moderate risk level and 17.39% had a low-risk level as shown in Table 4.

DISCUSSION

The results of the study showed 26 main hazards in Kerman province and high priorities of healthcare facilities hazards (frequency, probability, severity, and impact) were earthquake, dust, drought, flood, and traffic incidents, respectively. In addition, low priorities of hazards were blizzard, avalanche, fog, river flooding and glacial, respectively. This result was consistent with the studies conducted by Jafari et al. [2], and Saner et al. [18]. A 10-year retrospective study on the safety assessment of 1401 primary healthcare centers in Iran indicated that more than 140 primary healthcare centers were annually influenced by natural disasters [19]. Ghazali et al. [13] found that many healthcare facilities were influenced by climatic hazards.

A possible reason for this result is that there are 13 active faults in Kerman province, which threaten 41 towns of 57 cities [20]. About 15 cities with a population of 1 096 115 laid along the fault lines and 15 cities with a population of 1 251 658 laid within 1 km from the fault. This means that regarding the Kerman population estimated in future, more than 84% of the Kerman population expose to serious risk of earthquake. Atmospheric instability can be one of the most important factors of wind erosion and subsequently dust occurrence in Kerman in addition to the geopolitical situation of Kerman province in a semi-arid region of Iran due to lack of sufficient rainfall and humidity in this province [21, 22]. According to a national report

Table 6. Response capacity (Stuff, Staff, Structure) of the healthcare facilities in Kerman cities

Name of City	Stuff	Staff	Structure	Total
Kerman	120	171	111	402
Ravar	75	57	354	486
Zarand	80	54	356	490
Sirjan	193	141	386	720
Kouhbanan	87	52	103	242
Shahrbabak	95	58	368	521
Baft	87	55	582	724
Bardsir	79	54	379	512
Ourzueyeh	79	50	134	263
Rabor	82	50	153	285
Bam	118	79	463	660
Fahraj	84	49	169	309
Rigan	88	49	226	363
Jiroft	114	78	290	482
Roodbar	87	50	124	261
Ghale ghanj	78	50	132	260
Manoojan	78	54	145	277
Kahnooj	80	68	210	358
Rafsanjan	117	80	497	694
Anar	77	49	386	512
Anbarabad	78	51	123	252
Rostam abad	78	50	124	252
Fariyab	74	49	169	292
Capacity total mean score = 418.13				

on drought warnings, 74% of the Iranian area is affected by drought and more than 98% of the Kerman area, the largest province of Iran with an area of about 11.15%, is affected by mild to very severe drought [23, 24].

According to this research, the total vulnerability mean score of healthcare facilities in Kerman province was at a high level. In the safety evaluation of health facilities in Eastern Europe in 2010, one of the major challenges of hospitals was structural safety, which was mainly related to the oldness of buildings and not taking renovation measures [13]. Especially, structural safety represents the structure's resistance to external forces [25].

High vulnerability level in a healthcare center means lack of accountability and lack of provision of continued services to injured people due to hazards. Since the majority of healthcare facilities in Kerman were at very high and high vulnerability levels; therefore, it is impossible to provide double and continued services during hazard occurrence. Regarding sensitivity of this issue, it is suggested to strengthen and rebuild healthcare facilities. However, it should be noted that many old healthcare centers are currently providing services to patients in Kerman province. At the same time, there is no difference between old and structurally weak facilities and modern facilities in providing services and no one is ready to spend huge costs to stop the activity of old facilities and rebuild them at least in a short time period.

According to this research, the total mean score of response capacity of the healthcare facilities in Kerman province was at a moderate level based on three components of (stuff, staff, and Structure).

This result was consistent with the studies of [18, 26]. They showed that sufficient response capacity to disasters was one of the most important structural and non-structural aspects of healthcare systems to provide adequate healthcare services to victims of disasters. It is noteworthy that healthcare centers should continue their activities when responding to disasters for at least 72 hours without receiving help from systems out of health facilities. Therefore, to promote response capacity of the healthcare facilities, Kerman Universities of Medical Science must provide needed equipment, design physical space proportional to the response capacity of each healthcare center, provide adequate human resources as well as needed guidelines and protocols, conclude required agreements with relevant and supportive organizations, and implement operational programs through exercise.

The results of the study showed that based on the three dimensions of hazard, vulnerability, and response capacity, the risk level of the healthcare facilities was high. Results also showed high-risk level of the healthcare facilities in Kohbanan, Fahraj, Rabor, Orzoieh, Rudbar, Anbarabad, Fariab, Ravar, Rigan, Ghale Ganj, Rostamabad, Jiroft, Kahnuj and Manujan cities. The reasons may be geographical location and topographical features of southern cities of Kerman province, their location along the fault lines, high population density of healthcare centers in areas prone to earthquake, and high structural and non-structural vulnerability of healthcare facilities, which lead to high mortality and injury rates and other unexpected consequences of natural hazards.

The finding of this study could be beneficial for international decision-makers, policymakers that used from standard tools designed by the Ministry of Health Islamic Iran based on three important indicators of (risk, vulnerability and capacity) for the quantitative and qualitative risk assessment of healthcare centers. Therefore, the information obtained from the assessments can be used in the design and construction of new healthcare centers, and in vulnerability reduction or capacity enhancement of existing healthcare centers.

CONCLUSIONS

Current research showed that the risk level of disasters was very high in the majority of healthcare facilities of Kerman province. Therefore, national and provincial decision-makers or policymakers should make the right decisions for decrease disaster risks level through special attention to structural, non-structural, functional, managerial vulnerabilities and improvement of response capacity of healthcare facilities of Kerman province. Adopting appropriate policies for improving structural safety such as setting a sufficient budget or investing in constructing new healthcare buildings or retrofitting the existing facilities are recommended. Additionally, strengthening the intersectional and intra-sectional coordination, training the personnel and people in charge of the management programs of disaster risk mitigation, and organizing the periodic exercises are suggested for increasing the functional preparedness of healthcare facilities in Kerman province, especially in southern cities. Thus, disaster risk comprehensive management requires accurate and continuous hazards studies and assessments, vulnerability analysis, strategic and operational planning to improve the response capacity of healthcare facilities.

Acknowledgments

This paper was derived from the research project approved by the Student Research Committee, Kerman University of Medical Sciences, under no. 400000958, which was funded by Vice Presidency for Research and Technology of this university. The Ethics approval Code is IR.KMU.REC.1400.636.

Funding

Kerman University of Medical Sciences financially supported this study.

Conflict of interest

The authors declare that they have no competing interests.

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