# Study and Mapping of Natural Disaster (earthquake and Drought) risk Perception of Society in Kerman province

Introduction

Creating community based preparedness against natural disasters is considered among main approaches of reducing vulnerability and important strategies of managing disasters. This approach is associated with a continuous trend of policy making which considers a special value and significance for knowledge and capacities of the region people based on local resources(1). The community based readiness approach points to people self-resilience using resources of local organizations against the region risks and unsuitable effects of natural disasters(2). Public perception of disasters risk is considered a unique ground and requisite of creating resilience against natural disasters in future(3). The rate of public knowledge and awareness from disasters risk is among important factors which in individual and group form, could result in reduction of at risk people and the society vulnerability against risks(4). Based on report of Iran national monitoring center and Drought warning, in 3 months period till the end of January 2015, from total 22 cities of Kerman province, only 3 cities had a normal status and other cities have experienced severe to medium Drought. In the 7-year period ending in December 2015, the population influenced by Drought in Kerman province has been 94.7% and the area influenced by Drought 91%(5). Risk evaluation and analysis of natural and human- made risks of Kerman province and also matrix of risks indicate that in this province earthquake and Drought as 2 preferential risks require necessary planning(6).So and regarding that two risks of earthquake and Drought are introduced as the most important threatening risks of Kerman province, then implementing community based plans for reducing and managing risk of these disasters requires awareness from level and rate of perception from the mentioned natural events by people. this study has addressed determining the society risk perception rate from natural disasters in Kerman province and provides scientific grounds of implementing community based plans in managing events and disasters and in the framework of reducing disasters world document (document 2015-2030).
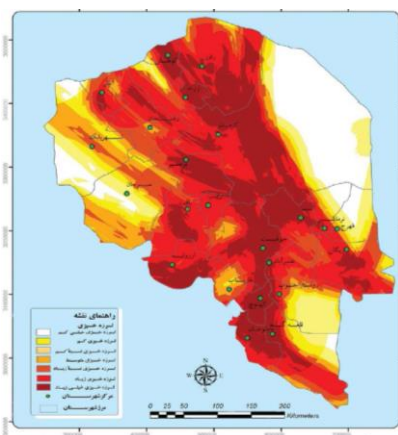
Risk of Earthquake in Kerman Province
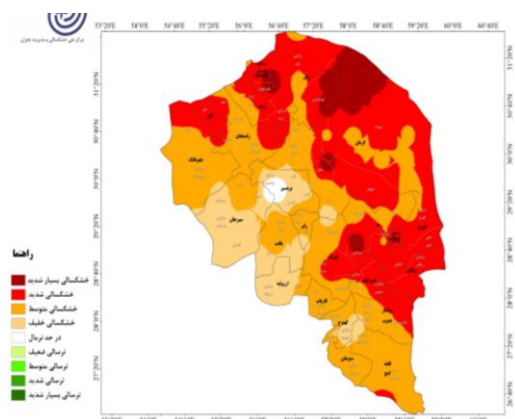
Severity of Drought in Kerman Province

General objective:

Study and Mapping of the drought and earthquake risk perception in Kerman province is the main goal and aim of this research.

Specific objectives:

a) Study of the Kerman province people awareness level from earthquake and drought risk
b) Study of the Kerman province people concern level from earthquake and drought risk
c) Study of the Kerman province people preparedness level against earthquake and drought risk
d) Mapping of the drought risk perception in Kerman province
e) Mapping of the earthquake risk perception in Kerman province

Data and Methods

Study setting / data sources: This study is a descriptive and analytical (cross - sectional) research. The sample content has been separately estimated based on population over 18 years old in each city and in separation for urban and rural population and using Morgan table. In this study, due to low population of the province tribes (3.6% of total population of Kerman province), Scarcity of tribe population and difficult access and also lack of constant residency in a special geographic region, the tribe population has been omitted from the statistical population.

Study population: The statistical population in this study is men and women of minimum 18 years' age and resident in regions with medium to very high relative risk of earthquake and also men and women of minimum 18 years old and resident in regions suffering Drought (medium to very severe) in Kerman province.

Figure 1: **Province Map (Kerman)**

Sample size: The statistical samples were selected among people older than 18 years old relating to families' resident in urban and rural in kerman province. The sample size is 7815 people.

Sampling method: The sample content has been separately estimated based on population over 18 years old in each city and in separation for urban and rural population and using

Morgan table. considerations regarding confidentiality preservation and non-publication of all data and information of people completing questionnaire will be observed.

Data collection: Data collecting tool in these studies is questionnaire which collects data relating to disasters risk perception rate in statistical samples in various dimensions relating to awareness, concern and preparedness against main studied risks (earthquake and Drought). The validity of instrument was calculated using Cronbach's alpha (alpha= 0.73). for reducing this limitation, required explanations are provided for people about the research and its benefits are explained for them.

Data management plan:: included the results of the 2016 National Population and Housing Census of Iran. According to these statistics, the total population of this province is 3164718. The samples were selected from people aged between 18 and 65 years in the villages and cities of this province using Morgan's table. Therefore, the statistical population size was set to 2215302 and the samples were classified by county. Given that Kerman Province occupies a vast area, a total of 22 experts working in the unexpected health care events sector of Kerman counties were requested to complete the research questionnaires. Seventeen contracts were signed and due to the shortage of 5 experts, five crisis management undergraduate students were invited to the research. A session for teaching and explaining the questionnaires and ICF issues to the colleagues was held on July 12. A total of 7815 questionnaires were distributed among the project colleagues in each county in proportion to the sample size.

Results

The latest demographic statistics of the counties, districts, cities, and villages of Kerman Province were obtained from the General Bureau of Statistics of the province. These statistics The questionnaires were provided to the respondents in relation to the population of urban citizens and villagers. The respondents included people visiting the hospitalized patients, people attending mosques, university students, office employees, farmers, housewives, clients of health centers, and shopkeepers. The questionnaires had been completed and sent by the respondents in 19 counties by August 17 (i.e. within one month). On July 17, the questionnaires were returned from Sirjan, Zarand, and Kahnooj counties with a one-week delay due to the personal problems of our colleagues. Finally, 7815 questionnaires were collected and the data extracted from the questionnaires was entered into SPSS by a two-member team from August 30 to October 12. The initial analysis of the collected data has finished. The summary of the data analysis is presented in the following tables. The original GIS map of Kerman Province was purchased to record the data on the county scale. Moreover, the results of analyzing the data based on three sub-variables namely awareness, concern, and preparedness, and a main variable (i.e. the population's perception of drought and earthquake) were incorporated into GIS maps for the 23 counties of Kerman Province. Nine tables and two maps were prepared using the outputs and results of the data analysis. Table (1) shows the results of analyzing the demographic characteristics of the study item by the items on the first page of the questionnaire. Tables (2) and (3) present the statistical analyses of the three sub-variables (i.e. awareness, concern and preparedness) based on the study samples. The results of analyzing the relationship between the main variables and the demographic variables of the study population are listed in tables (4) and (5). Tables (6) and (7) show the results of analyzing the coefficient of correlation of the sub-variables

(awareness, concern and preparedness) with regard to drought and earthquake. The effects of each component on the population's perception of the risks of earthquake and drought are illustrated in the form of the effective factor pyramids in figures (1) and (2) with regard to the 3 main variables. The output of the research data was incorporated into the drought risk perception and earthquake risk perception maps (figures 3 and 4).

Table (1): The distribution of the frequencies of the demographic variables of the study population

percentage	Number	Type	Variable	percentage	Number	Type	Variable
3.3	257	Shopkeeper	**Occupation**	–	7815	–	**Age**
6.5	507	Farmer		53.4	4173	Female	**Gender**
4.6	358	Driver		46.6	3642	Man	
42	3282	government's employee		26.1	2040	Single	**Marriage**
7.5	586	Private company employee		73.6	5775	Married	
2.3	178	student		2.9	227	illiterate	**education level**
7.8	609	University student		4.9	383	reading and writing	
0.3	23	retired		10.1	789	guidance school	
1	78	Unemployed		29.3	2289	High school	
16.2	1266	Residence in the provincial capital	**Location**	52.8	4127	College	
40.6	3173	Residence in the shahrestan		21.2	1657	housewife	**Occupation**
15.3	1195	Accommodation in small town		1.3	101	skilled worker	
27.9	2181	Housing in the village		2.3	179	worker	

Table (2): The mean, standard deviation, and mean percentage of the scores obtained out of the maximum score within the score range (drought risk)

Score range	Score (%) out of the maximum score	Standard deviation	Mean	Variable
2.28	0.77	0.38	3.86	**Awareness**
2.86	0.64	0.53	3.15	**Concern**
4	0.59	0.96	2.95	**Preparedness**

Table (3): The mean, standard deviation, and mean percentage of the scores obtained out of the maximum score within the score range (earthquake risk)

Score range	Score (%) out of the maximum score	Standard deviation	Mean	Variable
3.17	0.68	0.63	2.85	**Awareness**
5	0.24	0.31	2.85	**Concern**
1.17	0.67	0.94	1.47	**Preparedness**

Table (4): The relationships between awareness, concern, and preparedness in terms of demographic variables (drought risk)

P value					
Location	**Occupation**	**education level**	**Marriage**	**Gender**	**Variable**
0.007	0.118^{*}	0.55	-0.164^{**}	- 0.012	**Awareness**
0.041	-0.012	-0.066	0.11	0.007	**Concern**
0.060	0.018	0.016	0.33	-0.098	**Preparedness**

(P < O.01)

Table (5): The relationships between awareness, concern, and preparedness in terms of demographic variables (earthquake risk)

P value					
Location	**Occupation**	**education level**	**Marriage**	**Gender**	**Variable**
0.185^{**}	0.150^{**}	0.148^{**}	-0.120^{**}	-0.54^{**}	**Awareness**
-0.083	-0.068	0.011	-0.056	0.035	**Concern**
-0.097	0.108	0.114	0.015	-0.044	**Preparedness**

(P < O.01)

Table (6): The correlation coefficient matrix of awareness, concern, and preparedness
(drought risk)

Age	Preparedness	Concern	Awareness	Variable
-0.077	0.202[**]	0.404[**]	1	**Awareness**
0.055	0.510[**]	1	0.404[**]	**Concern**
-0.086	1	0.510[**]	0.202[**]	**Preparedness**
1	-0.077	0.055	-0.086	**Age**

(P < O.O1)

Table (7): The correlation coefficient matrix of awareness, concern, and preparedness
(earthquake risk)

Age	Preparedness	Concern	Awareness	Variable
0.0064	0.251[**]	0.253[**]	1	**Awareness**
0.010	0.073	1	0.253[**]	**Concern**
0.058	1	0.073	0.251[**]	**Preparedness**
1	0.058	0.010	0.0064	**Age**

(P < O.O1)

Table (8): The mean score and perception of the risk of drought in Kerman Province in respect of awareness, concern, and preparedness

Risk Perception (Average)	Preparedness	Concern	Awareness	construct shahrestan
3.11	2.94	3.51	2.88	Kerman
2.68	2.25	2.78	3.01	Zarand
3.20	2.66	3.17	3.77	Ravar
3.42	3.11	3.20	3.95	Koohbanan
1.33	1.23	1.64	1.14	Bardsir
1.80	1.11	1.28	3.01	Sirjan
3.52	3.14	3.49	3.93	Shahrbabak
2.72	2.89	3.11	2.16	Baft
3.61	3.64	3.30	3.89	Rabor
3.21	2.14	3.95	3.54	Orzooieh
3.24	2.96	3.01	3.75	Bam
3.48	3.24	3.27	3.94	Fahraj
3.23	2.66	3.06	3.97	Rigan
3.31	2.92	3.05	3.97	Jiroft
3.46	3.03	3.32	4.03	Anbarabad
1.80	1.25	1.27	2.89	Roodbar
2.72	2.29	2.78	3.11	Fariab
3.24	2.80	3.05	3.87	Kahnooj
3.25	2.81	3.16	3.80	Ghaleh ganj
3.26	3.39	2.89	3.51	Manoojan
3.32	3.01	3.05	3.90	Rafsanjan
1.99	1.78	2.16	2.04	Anar
3.24	2.95	2.98	3.81	Rostam abad
2.96	2.61	2.89	3.38	Total(Province)

Table (9): The mean score and perception of the risk of earthquake in Kerman Province in respect of awareness, concern, and preparedness

| Risk Perception (Average)	Preparedness	Concern	Awareness	construct / shahrestan
3.10	2.07	4.22	3.03	Kerman
3.24	1.96	4.03	3.74	Zarand
2.69	1.41	3.79	2.88	Ravar
2.87	1.51	3.85	3.25	Koohbanan
1.83	1.14	3.11	1.25	Bardsir
2.14	1.27	3.07	2.08	Sirjan
2.45	1.47	3.23	2.65	Shahrbabak
2.30	1.05	3.24	2.62	Baft
2.48	1.70	3.13	2.62	Rabor
2.61	1.01	3.87	2.96	Orzooieh
4.11	3.18	4.32	4.83	Bam
2.58	1.53	3.54	2.68	Fahraj
2.75	1.51	3.95	2.80	Rigan
2.42	1.36	3.30	2.62	Jiroft
2.72	1.49	3.72	2.95	Anbarabad
2.48	1.38	3.51	2.55	Roodbar
2.59	1.14	3.73	2.91	Fariab
2.25	1.20	3.22	2.35	Kahnooj
2.62	1.51	3.43	2.92	Ghaleh ganj
2.49	1.36	3.56	2.55	Manoojan
2.70	1.42	3.73	2.95	Rafsanjan
2.50	1.73	3.51	2.27	Anar
2.82	1.53	3.82	3.10	Rostam abad
2.59	1.45	3.57	2.77	Total(Province)
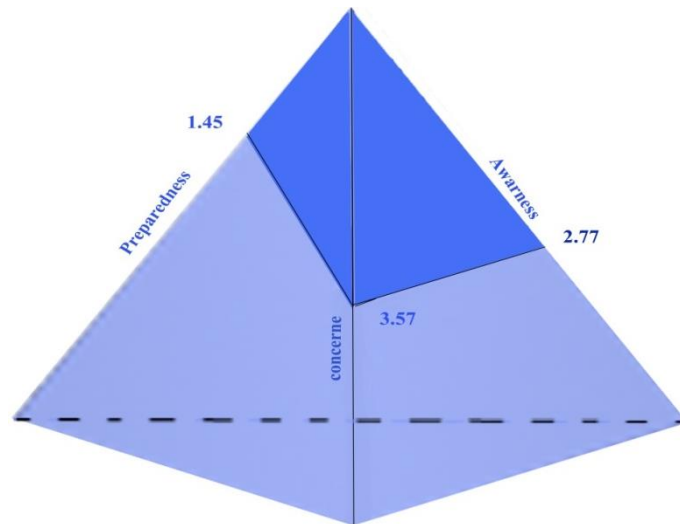
Figure 1 :Pyramid of the factors influencing the population's perception of the risk of earthquake in Kerman Province
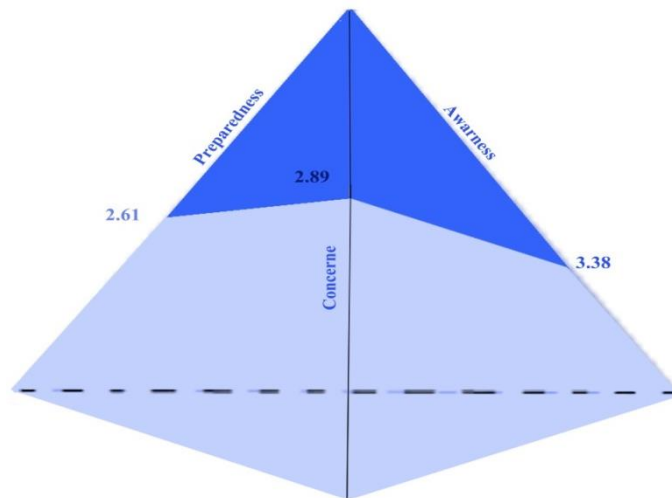

Figure 2: Pyramid of the factors influencing the population's perception of the risk of drought in Kerman Province

Perception of the risk of drought: The research findings suggest that the people of Kerman have average awareness of the risk of drought and a low level of concern for this risk. The preparedness of Kerman Province for drought is low. In general, the people of this province have a poor perception of the risk of drought. Of the 23 counties of this province, 4 (17.3%), 3 (13.2%), and 16 (13.2%) had an extremely low, low, and average perception of the risk of drought, respectively. Therefore, the residents of none of the counties of this province had a high perception of the risk of drought(figures 3).
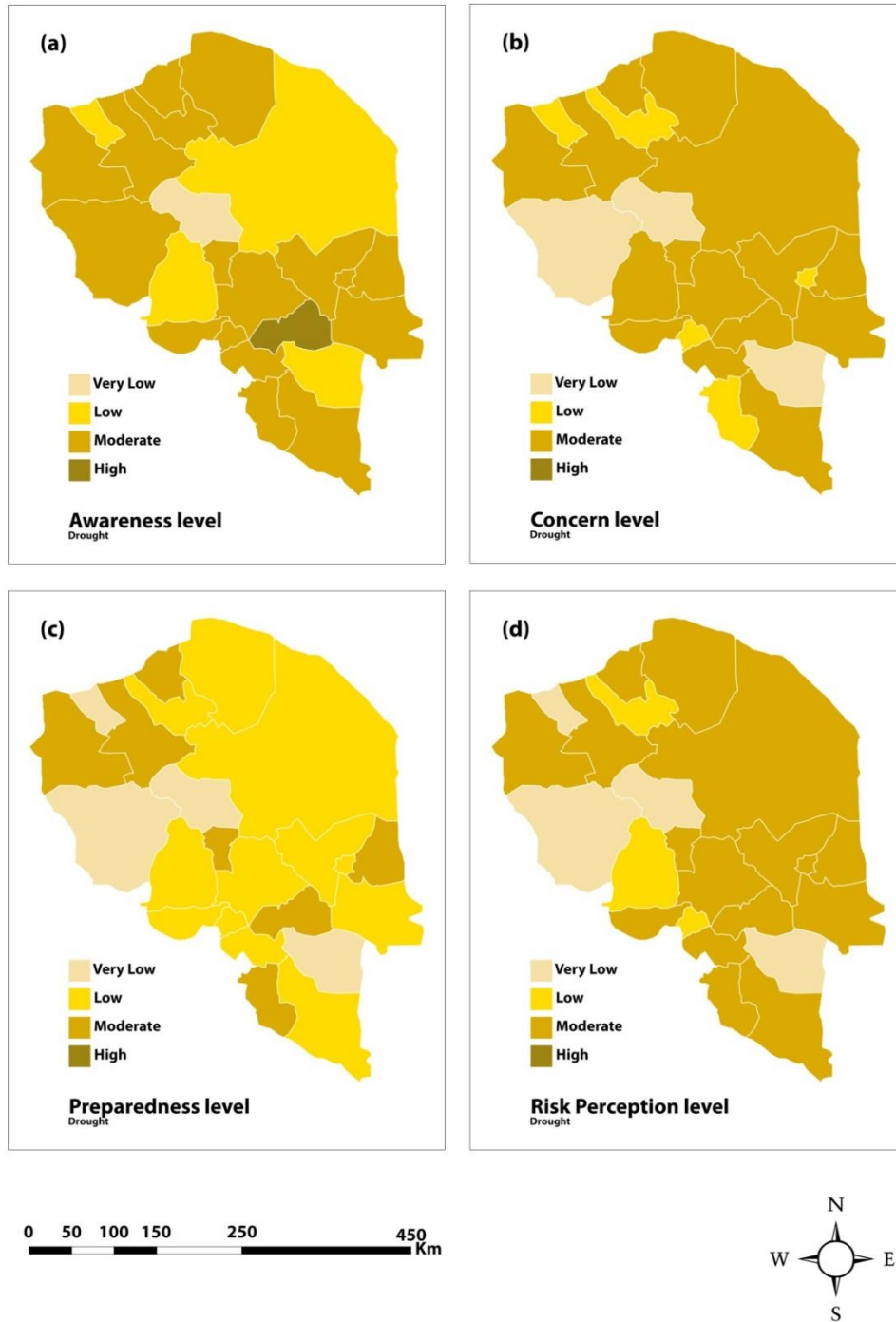
Drought Risk Perception

Figure 3: Drought risk perception maps of Kerman province

Perception of the risk of earthquake: The results of the analysis of the data on the people's perception of the risk of earthquake in Kerman Province indicates that despite the relatively high risk of earthquake in this province, the residents of Kerman Province have a poor understanding of this hazard. In addition, in this province, the levels of awareness of the risk of earthquake, concern for earthquake, and preparedness for earthquake are low, average and extremely low, respectively. Concerning the people's perception of the risk of earthquake, the residents of 1 (4.3%), 19 (82.6%), 2 (8.6%), and 1 (4.3%) counties had a very low, low, average and high perception, respectively. The final report of this research will present the analysis of the investigation findings in respect of the demographic characteristics and it will include the comparison between these results and the risks of earthquake and drought in each county.
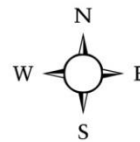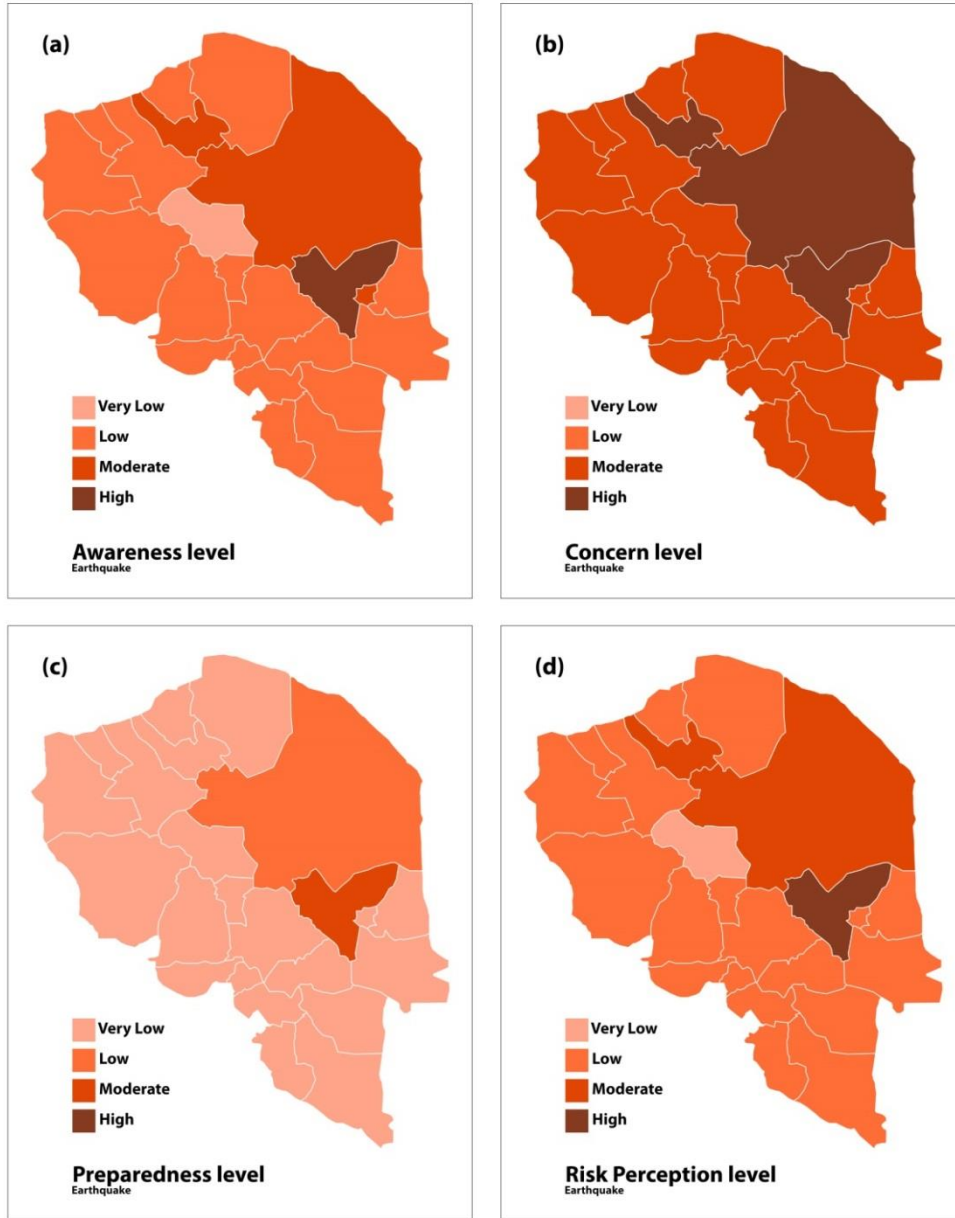
Earthquake Risk Perception

Figure 4: Earthquake risk perception maps of Kerman province

Discussion

This study shows that in general, Kerman province has a weak risk perception about earthquake and drought. The average risk perception of earthquake is 2.59 and the average risk perception of drought in Kerman province is 2.96. A study by Van Duinen et al in 2014 in the southwest of the Netherlands has estimated that the risk perception of drought in farmers is at high levels (7). Kung and Chen in 2012 regard the peril of the earthquake hazard in Taiwan with the experience of earthquakes in the past as well as the gender of the people involved. The results of the study in Taiwan confirm the findings of the research carried out in Kerman province(8). The findings of this study show that all three components affecting drought perception are significant. However, for risk perception of earthquake, only the variables of knowledge and risk perception have a meaningful relationship with the place of residence and the variables of worry and readiness have no significant relationship. The educational level of people is also related to their level of awareness about the risk of earthquake and drought. The age of the subjects is related to the three components of concern, preparation and awareness of the earthquake hazard. The findings of the study indicate that age has a significant effect on the drought risk concern, but has no significant relationship with readiness and awareness. Armas, in 2006, linked the perceived risk of earthquakes in Bucharest citizens to the age, gender, and level of knowledge of people at risk, which is consistent with the results of this study(9). The study of risk perception maps and the results of this study and their comparison with the relative risk maps of earthquake and drought shows that the regions and cities with lower social and economic development have a lower perception of the risk of drought and earthquakes. The most important problem is the fact that comparisons show that the cities with high risk of drought and earthquakes have less risk perception, and this can exacerbate the consequences of these incidents. The present study indicates that implementation of disaster risk management plans in Kerman province requires more attention to the issue of risk perception and the people's attitude about the implementation of these programs. Risk perception of earthquake and drought in Kerman province makes it difficult and largely impossible to implement centralized and state-run risk management programs. Therefore, improving the perceived risk of earthquakes and droughts and the people's approach can be considered as the most important priority of the authorities and organizations in reducing the risk of disasters. The maps and final results of this study emphasize the role and impact of demographic factors and social components, as well as the individual and social development of some of the areas at risk. What is to come out of the findings of this study is that the level of preparedness of the community in the face of earthquake and dangers is in urgent need of immediate intervention. This study can help decision-makers in the field of disaster risk management, in order to prioritize risk-based areas for planning and intervention based on a cognitive-anxiety-based approach, using relative indigenous and local capacities to promote understanding and reduce the risk of disasters, as well as the readiness of people and communities.

Policy recommendations:

Given that increased risk perception in the community requires the active participation of all social levels and is one of the main priorities of the sendai framework, so the recommendations from the results of this study are presented at three effective levels (policy makers and local managers, social activists, artists, individuals, and citizens of the province).

1. Given that the process of increasing and deepening the perceived risk of earthquakes and droughts requires inter-sectoral collaboration and , and individuals and organizations have a role and responsibility in creating and shaping risk perceptions, it is suggested that a comprehensive program to promote drought risk assessment as well as a comprehensive earthquake risk assessment plan be developed with the responsibility of the Provincial Crisis Management Organization and communicated to all administrative agencies of the province of Kerman. In this plan, the duties and responsibilities of each organization are determined in increasing the community's perceived risk, and the Kerman Crisis Management Organization also monitors and reports on the implementation and activities of each organization over time.

2. Socializing and promoting a discourse of understanding by artists, scholars, and prominent figures in the province can help to promote a culture of risk perception, providing the necessary platform for active participation of NGOs and companies as well as non-state activists in increasing risk perception. Mass media, social media and the press can discuss the dimensions of risk perception and increase three different aspects of risk perception (awareness, concern, and readiness). Therefore, it is suggested that provincial media and the press communicate with the subject of risk perception and transfer concepts and methods of risk perception to the community and target groups.

3. Given that people's awareness of the hazards in the living environment is the first step in understanding the risk, earthquake and drought maps should be available to all sections of society. It is recommended that the map of earthquake and drought risk as two main risks of Kerman province be installed in schools, departments and cultural-social centers of the province, and also shared on social networks.

4. It is recommended that training programs be organized at workshops and seminars at the local level, based on the maps drawn from this study, and individuals, based on their age and target group, should be trained according to the risks in their area.

5. It is recommended that the structural, non-structural and functional vulnerability of the assets and resources in the province against drought and earthquake risks be identified and the risk of damage to these resources is disclosed to beneficiaries. According to Sendai framework, this, in addition to increasing the perceived risk of earthquakes and droughts in Kerman province, provides an area for increasing community resilience.

6. It is recommended that the results and findings of this research be presented as an operational plan with the aim of implementing the first priority of the Sendai Framework (2030-2015) in the two sectors of society and governance to the responsible organizations and people who are qualified.

7. Given that this study indicates that the experience of previous events can lead to increased risk perception, it is recommended that previous experiences and

documentation related to earthquake and drought related events in Kerman province be formulated as Infographic plans and distributed in areas at risk.

8. It is recommended that this study be carried out every 3 years in the province, and the impact of interventions and the status of the perceived risk of earthquake and drought be continuously monitored.

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