# Study of Disasters Medical Severity Index in Kerman Province

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## A B S T R A C T

**Background:** Disasters always threaten human societies and cause high property damages and civilian casualties. Therefore, many studies are carried out to find the optimal policies and procedures for preparedness. This study was conducted to determine medical severity index of Kerman Province regarding disasters and accidents.

**Materials and Methods:** This descriptive and cross-sectional study was carried in Kerman Province in 2015. Data were analyzed using N×S/TC equation. Medical severity index (MSI) was rated on Likert-type scale as very low, low, moderate, high, and very high.

**Results:** The results showed that the mean MSI was 4.58 in Census method cities, which were the highest level and 0.25 in kerman city, which was the lowest. Highest MSI is related to earthquake risk (MSI=225) and the lowest MSI is related to flood risk (0.03).

**Conclusion:** As the means of MSI were high and very high, it is recommended to apply the required interventions to improve the effective components and increase hospital treatment and medical rescue capacities.

## 1. Introduction

Natural and man-made disasters and accidents always threaten human societies and cause high property damage and civilian casualties [1]. During the last 10 years, 3583 disasters occurred throughout the world that affected about 1.7 billion people. Mostly in Asia [2], these damages and losses reached about 3% of the domestic gross product of the countries with low preparedness [3]. Previous experiences in Iran show that natural disasters happen with high incidence rate and extreme severity. Severity of damages and high number of casualties due to disasters prompted many researchers to search for optimal policies and procedures for preparedness and damage estimation in disasters [4].

Medical centers and hospitals can play a significant role in this area as the most important and the first line of disaster response [5]. Estimating the capabilities of the medical teams at the scene and the reception centers is called "medical severity index of disaster." It is one of the well-known tools to evaluate severity of the disasters and accidents and the amount of impact on the medical system [6]. In 2005, Ferro studied the last century disasters in Italy by disasters severity index and found that this index is about 8 [7]. In 2009, Chang carried out a study in city of Carlisle, and calculated the mentioned index as 77 with respect to the flood risk [8]. The present study carried out with the objective of determin-

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**Table 1.** Scale and color schemes of disasters medical severity index.

| Severity | Disasters medical severity index (MSI) | Color |
|----------|----------------------------------------|-------|
| Very low | MSI≤0.5 | |
| Low | 0.5 <MSI≤1 | |
| Moderate | 1 <MSI≤1.5 | |
| High | 1.5 <MSI≤ 2 | |
| Very High | MSI>2 | |

ing MSI of Kerman Province in disasters and accidents. This research can provide the managers with scientific information to determine medical centers capacities and to increase the preparedness level of these centers in disaster situations.

## 2. Materials and Methods

This descriptive and cross-sectional study was carried out in 2015 in Kerman Province. The study population was all

**Table 2.** Total capacity and Kerman Province medical severity index.

| City | TC | MSI | | | | |
|------|----|----|----|----|----|----|
| | | Earthquake | Flood | Air accident | Explosion and fire | Road accident |
| Kerman | 457 | 0.98 | 0.03 | 0.09 | 0.04 | 0.11 |
| Zarand | 89 | 5.5 | 0.16 | 0.5 | 0.24 | 0.58 |
| Ravar | 53 | 8.4 | 0.28 | 0.84 | 0.41 | 0.98 |
| Koohbana | 9 | 50 | 1.1 | 5 | 2.44 | 5.7 |
| Rafsanjan | 327 | 1.48 | 0.04 | 0.13 | 0.06 | 0.15 |
| Anar | 11 | 50 | 1.36 | 4.09 | 2 | 4.7 |
| Shahrbabak | 67 | 6.7 | 0.22 | 0.67 | 0.32 | 0.77 |
| Sirjan | 161 | 1.98 | 0.09 | 0.27 | 0.13 | 0.32 |
| Bardsir | 80 | 5.7 | 0.18 | 0.56 | 0.27 | 0.65 |
| Baft | 82 | 5.4 | 0.18 | 0.54 | 0.26 | 0.63 |
| Rabor | 4 | 112.5 | 3.75 | 11.25 | 5.5 | 13 |
| Orzooieh | 11 | 50 | 1.36 | 4.09 | 2 | 4.7 |
| Bam | 162 | 2.7 | 0.09 | 0.27 | 0.13 | 0.32 |
| Rigan | 5 | 90 | 3 | 9 | 4.4 | 10.4 |
| Rostam Abad | 2 | 225 | 7.5 | 22.5 | 11 | 26 |
| Fahraj | 4 | 112.5 | 3.75 | 11.25 | 5.5 | 13 |
| Jiroft | 101.5 | 4.4 | 0.14 | 0.44 | 0.27 | 0.51 |
| Anbar Abad | 8 | 56.2 | 1.87 | 5.62 | 2.75 | 6.5 |
| Fariab | 2 | 225 | 7.5 | 22.5 | 11 | 26 |
| Kahnooj | 9 | 45 | 1.66 | 5 | 2.4 | 5.7 |
| Ghaleh Ganj | 5 | 90 | 3 | 9 | 4.4 | 10.4 |
| Manoojan | 9 | 50 | 1.66 | 5 | 2.4 | 5.7 |
| Roodbar | 5 | 90 | 3 | 9 | 4.4 | 10.4 |

**Table 3.** Frequency percentage of 5 levels of Kerman Province medical severity index in disasters.

| MSI | Frequency percentage | | | | |
|---|---|---|---|---|---|
| | Earthquake | Flood | Air accident | Explosion and fire | Road accident |
| MSI≤0.5 | 0 | 39.1 | 26.1 | 43.5 | 17.4 |
| 0.5 <MSI≤1 | 4.35 | 0 | 17.4 | 0 | 26.1 |
| 1 <MSI≤1.5 | 4.35 | 8.7 | 0 | 0 | 0 |
| 1.5 <MSI≤ 2 | 0 | 21.8 | 0 | 0 | 0 |
| MSI>2 | 91.3 | 30.4 | 56.5 | 56.5 | 56.5 |

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educational and noneducational hospitals (27 hospitals) and 4 Kerman Province medical universities. The required data to determine the hospital treatment capacity (HTC) in disasters and accidents were obtained from the studied hospitals separately. In this regard, we used the tools approved by the Ministry of Health and Medical Education (scientific tools of studying risks and the hospital capacity). Main criteria in determining HTC are the hospital capability in creating physical spaces and the required equipments, providing skilled and professional human resources, and implementing standard procedures for disaster response [9].

Data related to medical transfer capacity (MTC) of the injured and medical rescue capacity (MRC) were collected using structured questionnaires that their validity and reliability were confirmed by the experts group, and then the collected data were analyzed using equation N×S/TC [10], where N is the number of the injured due to the accident that is determined based on the retrospective studies, S refers to the injured damage severity that is classified from level 1 to 4 based on the priority on receiving medical services and transferring to medical centers. While most of the injured people are in need of rapid medical treatment, they will be in priority 1 and 2 of SRART triage system. S also will be considered between 1 and 2 (1.5) according to the accident type. TC refers to all medical system capacity in responding to disasters and accidents, including the total hospital treatment capacity (HTC), medical transfer capacity (MTC), and medical rescue capacity (MRC) [10].

In this study, the important and common disasters and accidents of the province were detected by using professional and skilled experts' advice and according to the available documents in the country southeast emergency operation center (Kerman). These disasters and accidents comprised earthquake, flood, road accidents, explosion, fire, and aviation accidents. Finally medical severity index of disasters was evaluated and analyzed in comparison to the above risks. The obtained results based on 5-point Likert-type scale were considered as medical severity index of disasters (MIS) of

very low, low, moderate, high and very high according to Table 1. The higher score of MIS indicates a more undesirable condition in response to disasters and accidents. Finally, the obtained results of this study besides demonstrating Kerman Province medical system capacity in facing disasters and accidents, provide the required information for planning, prioritization, and allocation of resources to implement preparedness plans and increase capacity to respond to emergencies and disasters.

## 3. Results

The study results indicate that MSI related to the earthquake risk in 3.4% of Kerman Province medical system is low, in another 3.4% moderate, and in 4.9% of the system very high. MSI ranges related to flood were very low in 3.9%, moderate in 7.8%, high in 2.1%, and at very high in 4.30%. MSI ranges regarding the aviation accidents were very low in 1.26% of the province medical system, low in 4.17%, and very high in 5.56% of medical system. Regarding risks of explosion and fire 5.43% of medical system was in very low condition of medical severity index, and 5.56% was in very high level. Regarding road accidents, 4.17% of Kerman Province medical system was at very high condition. In Table 2, the overall capacities (TC=HTC+MTC+MRC) with the final results related to MSI calculation of each city are separately presented. Finally, Table 3 presents MSI frequency percentage in 5 levels of severity (very low, low, moderate, high, and very high).

This study showed that throughout the province, Rostam Abad and Fariab cities with MSI average of 4.58 have the highest MSI rate and kerman city with MSI average of 0.25 has the lowest MSI. In studies related to risks, the highest MSI is related to earthquake risk (MSI=225) and lowest MSI is related to flood risk (MSI=0.03).

## 4. Discussion

A part from this research, no similar study on the subject was not found in Iran. To this effect, the study results were

compared with the studies carried out abroad. According to the obtained results, the average medical severity index level in Kerman Province regarding road accidents is very low (0.11). This index illustrates that the available capacity in Kerman Province medical field of offering the appropriate response and desired management in these type of Disasters. In this study, the evaluated earthquake medical severity index of Kerman Province was very high. This index indicates province medical capacity insufficiency in responding to earthquake occurring with similar dimension of previous earthquakes in Kerman Province. Ling Cho et al. (2004) evaluated the medical severity index in Taiwan as high which is similar to the mentioned index in Sirjan City (98.1) [12]. Kanter and Moran (2007) in a study carried out in one of the New York City hospitals evaluated this index as moderate which is similar to MSI study results of Rafsanjan City earthquake [13].

The obtained results of MSI indicate that the province medical system has a more appropriate capacity for flood risk than for the earthquake risk. However, this capacity does not have the required capability to manage the injured people due to flood incidents. The medical severity index average in flood was evaluated to be 1.8 (high). Jiang et al. (2007) in their study calculated this index as very low in China that is not consistent with flood MSI in Kerman Province [14].

The average MSI related to aviation accidents and explosions were found to be very high that this level of medical severity index, confirms the need of paying attention to and developing the province medical and health capabilities in management and responding to disasters, especially disasters with the injured people suffering from severe burns. This study finally showed that total medical severity index in Kerman Province disasters is at very high and equals 21.7.

In conclusion, the average MSI of disasters in Kerman Province for earthquake, explosion, and fire, and also aviation accidents risks in all studied medical science universities were considered high and very high. In order to decrease the province MIS, we suggest to execute the required interventions with the objective of improving the effective components on increasing hospital treatment capacity (HTC) by creating substitute spaces in hospitals, developing plans to increase capacity (surge capacity) on human resources fields and equipment as well as increasing medical rescue capacity (MRC) by creating and developing disasters medical assistance teams.

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