

# The Effects of Implementing and Activating the Early Warning System on the Preparedness of Sari Imam Khomeini Hospital (RH) in Disasters and Incidents



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## ABSTRACT

**Background:** Iran as a developing country is located in the most accident- and disaster-prone geographical areas, and considered among the 10 most disaster-stricken countries in the world. Therefore, healthcare system should be able to deliver a coordinated response in disasters and effectively propose and execute plans to reduce the adverse effects and response time, and also increase preparedness before disasters. Establishing early warning systems before incidents and disasters in hospitals can properly organize the resources and equipment in order to deliver better and more effective services to more people in need.

**Materials and Methods:** The research was conducted at Imam Khomeini Hospital (RH), Sari, Iran, in 2016. The study was done through several meetings with some professors of Health in Disasters and members of Disaster Risk Management Committee at incidents to execute early warning systems according to Disaster Preparedness Country program in hospitals. The hospital preparedness in various components was evaluated by the World Health Organization standard checklist, before the intervention and then 1 month and 3 months after the intervention. The obtained data were analysed by Friedman statistical test.

**Results:** The results showed 52 points increase in the preparedness of the hospital after the intervention, which indicated a significant increase in the hospital preparedness in disasters and incidents from poor level to moderate level.

**Conclusion:** Sari Imam Khomeini Hospital (RH), was at poor level with regard to preparedness in disasters. However, the significant increase in preparedness after executing early warning system indicates the necessity of developing and implementing this system in other hospitals to increase their level of preparedness.

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## 1. Introduction

Today, There are lots of different incidents threatening the human and financial resources throughout the world. Despite great advances in confronting and timely responding to incidents, humans could not completely and properly controlling them [1]. History proves that human communities have always been involved in different types of disasters. More than 600 disasters are recorded annually, accounting for more than 90% casualties in developing countries, which indicate an essential threat [2].

Incidents and disasters are those events that interfere with normal routines of life and bring about casualties and financial harms out of the capability of the region to confront with. Nowadays, governments allocate a great portion of their resources to deal with disasters and incidents. Every day Broadcasting networks report some news about various incidents all over the world with lots of casualties and financial losses to people and states [3].

Iran, as a developing country is located in one of the most disaster- and incident-prone geographical regions, also among the top ten disaster-stricken countries in the world; and about 90% of its population is at risk of different types of natural disasters. In recent decades besides floods, local storms, and minor earthquakes, Iran has suffered from a national tragedy every ten years [4]. That how people react to the incidents and disasters depends on the capabilities of their community to return to normal life after each accident [5]. It requires the country to have a program for facing the disaster [6]. WHO defines a disaster by two properties: low probability, and high impact. In such situations, many injured and wounded people refer to the hospitals and clinics to get health and care facilities and services [7].

The main reason for survival of humans on natural disasters is the proper health services. Healthcare systems, all around the world, face lots of challenges in responding to disasters and incidents at national, regional, and international levels. Disasters and incidents, due to any reasons, require prepared healthcare systems. However, most hospitals are normally late in their preparedness and giving appropriate responses. This delay is mostly because of financial problems and inappropriate understanding of the status of a hospital in giving services during the incidents [2].

Healthcare services should be able to deliver a coordinated response during the incidents and to effectively program and execute plans to reduce impacts, to lessen

response time, and to be readily prepared for the services prior to any disaster to happen. "Time of response" is a major element in decreasing complications and irreparable injuries in accidents [8].

Nurses, as the largest group of the healthcare system, and pioneers in delivering health services, play an important role in, during, and after each incident [4]. Nurses have always been one of the major keys in providing services and have had effective impacts in such situations. They must be appreciated and encouraged to consider their preparedness as a part of their tasks [9].

According to Delshad study in Shahid Mottahari Hospital, Tehran, Iran, the hospital preparedness in response to disasters and incidents changed from medium to high level after using early warning system. This study focused on the necessity of using rapid warning system according to national hospital program for confronting with disasters for all hospitals throughout the country [10].

Khankeh et al. (2006) showed the unpreparedness of hospitals and healthcare centers all around the country and insisted on better attention to the problem [10]. Amiri et al. (2011) study indicates the average level of preparedness in all studied hospitals [11]. The research done by Heydari et al. (2010) evaluated the preparedness of the hospitals as 62.3% (average level) [12]. Early warning system is considered such a major element in incidents and disasters that WHO announced early warning system as the first step in a response program [8]. To be prepared and have early warning system in hospitals before occurring any disaster, can well organize the resources and equipment to help a greater number of people more effectively and efficiently. Otherwise, inconsistency and confusion caused by the situation brings about lots of duplicate activities and delay in work [3]. Poor management and communication, structural problems, poor facilities, and misorganizations in using resources are among the most important problems with which the hospitals confront during disasters and incidents [20].

With regard to the importance of early warning system and its implementation in all hospitals, which brings credits to the country hospitals, and also according to the instruction given by Emergency Events Center, it is necessary to improve this system and execute it in all hospitals all around the country.

## 2. Materials and Methods

This was an interventional and quasi-experimental study with two groups, and pretest and posttest which

was approved by the Research Deputy at Tehran University of Welfare and Rehabilitation Sciences. The research aimed to determine the impact of implementation and using early warning system on the preparedness of Imam Khomeini (RH) Hospital in disasters and incidents in 2016. Due to its advanced and full-time health services in emergency medicine, neurosurgery, vascular surgery, orthopedic surgery, general surgery, and paraclinical services and facilities, this hospital is the trauma center, which gives its services to Mazandaran Province, and also other neighboring provinces such as Guilan, Golestan, and Semnan. This hospital is chosen based on the study purpose and according to the opinion of Deputy of Treatment and Health Services of Mazandaran University of Medical Sciences. A total of 54000 patients are admitted to this hospital every year. It also gives education and research services to physicians, staff, and students of medicine, nursing, and midwifery. Since the members of crisis committee and senior officials of the hospital have a major role in development and implementation of the system, they all attended in the meetings to cooperate in the study.

Data were gathered by WHO standard checklist. This instrument is provided as an evaluation response checklist of hospital emergencies to help the hospital staff and managers of emergency department deliver efficient response to the most probable case scenarios in disasters and incidents. This 91-component device was translated by Karimiyan et al. in Research Health Center in Disasters of School of Welfare and Rehabilitation Sciences and examined its reliability and validity to be used in this study. The checklist was filled in by the researcher and the secretary of Crisis Committee, before the intervention and then 1 month later, through observation and review of documents, to evaluate preparedness of the hospital in 9 following components [14]: command and control, communication, safety and security, triage, surge capacity, continuity of essential services, human resources, logistics and supply management, post-disaster recovery.

Each question in the checklist has three options: pending, ongoing, and completed. The option pending gets score 1, the ongoing 2, and completed 3, in order to get a total score at the end. Based on the total score, the level of overall preparedness of hospital is categorized as poor (score range: 93-152), medium (score range: 153-212), or strong (score range: 213-273) [14].

After getting permission from the Ethics Committee of Mazandaran University of Medical Sciences and Health Services, Sari, Iran, the data were collected in

9 areas by the help of the members of the Committee on Disaster Risk Management in hospital through using the checklist, observation, interview, and review of documents in the Committee for Disasters and Incidents in the hospital.

Then, a 1-day seminar, entitled "The Importance of Early Warning System in Disasters and Incidents" was held in May 31, 2016 in Imam Khomeini Hospital, Sari. In this seminar, where senior officers, including treatment and support vice presidents, secretary of crisis committee, matron, supervisors, chiefs, nurses, and so on took part, early warning system, its importance, and increase of public awareness about the importance of using early warning system were introduced. Next, a 2-day workshop, entitled "The Necessity of Implementation and Activation of Early Warning System, and the way to Implement It for responding during disasters and incidents" was held in Imam Khomeini Hospital, Sari. The outlines of the workshop were compiled from "National Program for Preparedness of Hospitals in Disasters and Incidents", by Khankeh et al. (2013) [3].

Hospital preparedness plan and risk analysis were completed by members of the Risk Management Committee in the first day after explaining the concept and meaning of disasters and early warning system. In the second day and with cooperation of Risk Management Committee members, the primary activation flowchart and how to circulate the news in the hospital was prepared according to the instruction book and the setting and management structure of Sari Imam Khomeini Hospital (RH). Also, several meetings were held with the professors and officials in Disaster Risk Management Committee in the hospital to implement the system. The plan was also revised by active participation of the Disaster Risk Management Committee during two months, and was sent to the professors of this field. Afterwards, with the help and collaboration of some professors of this field, the final flowchart was compiled according to their ideas and also National Hospital Preparedness Program for Disasters and Incidents. In the final session, it was taught to the supervisors and heads of departments and units.

Warning system activation flowchart and the way of announcement (notification), and notification lists were circulated to all hospital wards and installed in key areas. In cooperation with the Committee on Disaster Risk Management, the checklist was filled by the researcher 1 month and 3 months after the intervention again.

Two of 15 components required for early warning system, which were notified to the hospital director by a letter, have already been observed. Early warning system activation flowchart has been installed in all departments and key points in hospitals. During the period of intervention, out of the remaining 13 components which were not implemented yet, allocating a mobile phone to contact supervisors, installing notification boards to inform patients at the entrances and emergency department informing the contact numbers and places to refer to were realized with the assistance of members of Risk Management Committee in Disasters.

Also, a trustworthy person was appointed to deliver the message to the university during the disasters and incidents, and to check everyday communications with conducting headquarter of the university. A direct phone number was specified to connect the supervisor to the conducting headquarter. Furthermore, the supervisor's job description, and a list of issues to inform the supervisor and conducting headquarter specific to each hospital were prepared and installed in proper places at the hospital. In addition, job descriptions of all medical staff were determined and a place for the command center and control during disasters and incidents was defined. Four components were canceled because of high cost and time consuming administrative correspondence, yet they remained in the agenda to be considered later.

Pretest and posttest data were separately analyzed by Friedman statistical test for each component, and then as whole, for all 9 components, using SPSS 16.

### 3. Results

The research findings showed the hospital preparedness of Imam Khomeini Hospital in response to disasters and incidents was poor prior to the intervention, and became average afterwards. The findings showed the score of hospital preparedness in disasters and incidents, in each component, increased after intervention (Table 1). The increase was statistically significant in 7 components; but in just two components of continuity of essential services, and post-disaster recovery, the increase was less than 2, which was insignificant ( $P > 0.05$ ).

The biggest change relates to communication, with 10 points increase. Increase in communication component may directly relate to using early warning system and establishing 15 items as the requirements for implementation of the system according to the national program of preparing hospitals to deliver better services in disasters and incidents. Increasing the hospital preparedness score from 149 before the intervention to 201 after the intervention was significant which indicates the change from poor to average level in hospital preparedness ( $P < 0.001$ ).

### 4. Discussion

Because Iran is one of the most disaster-prone countries, preparedness of healthcare system, especially hospitals, as the major units to deliver healthcare services during disasters and incidents helps increase the number of the rescued, decrease the disabilities, and

**Table 1.** Evaluation scores of hospital preparedness during disasters and incidents before and after the intervention

Key Components	Before the Intervention	After the Intervention	Difference	P
Command and control	10	15	5	0.028
Communication	13	23	10	0.002
Safety and security	18	27	5	0.021
Triage	18	23	5	0.015
Surge capacity	25	30	5	0.015
Continuity of essential services	12	14	2	0.135
Human resources	23	30	7	0.020
Logistics and support management	17	23	6	0.011
Post-disaster recovery	13	15	2	0.097
Total score	149	201	47	0.000

relieve mental and physical pain of survivors. The findings showed that Imam Khomeini Hospital was at poor status of preparedness before the intervention, which was in line with the report of Ojaghi et al. about the hospitals in Kermanshah [15], but contradicted with Karimiyan et al. study which evaluated the preparedness of the hospital as strong.

Hospital preparedness was evaluated in 9 components separately and in total. There were no significant differences in two components of continuity of the essential services and post-disaster recovery before and after implementation of early warning system. With regard to the component of command and control, the increase was significant, which was consistent with Amiri et al. study who evaluated good the hospital preparedness level in the area of unexpected situation management program [11]. This result was also in line with Delshad study who assessed the preparedness of Motahari Hospital as high [10].

With regard to the component of communication, we observed the largest significant increase, similar to Delshad study who assessed the preparedness of Motahari Hospital after implementation of early warning system. However, it was not in the line with the study of Shojaie et al., who believed hospital preparedness regarding communication component was not efficient in response to incidents [16].

With respect to safety and security, hospital preparedness increased significantly after intervention, which corresponded the results of Salavaty study who considered nonstructural and functional safety training for nurses helpful in rising the safety and preparedness of the hospital [17]; this increase can be the result of describing the necessity of identifying vulnerabilities in the workshop of the early warning system application, and drawing attention of the head departments to identify the risks as one of their tasks. With regard to triage, though the score for preparedness was average, the change was significant and in accordance with Faraji et al. study [18]; this similarity can be because of the intervention in both cases, and not just for training.

With regard to the component of surge capacity, the increase in hospital preparedness was significant, which was obtained by choosing alternative treatment places for admitting nonemergency injured people, identifying alternative locations outside the hospitals in coordination with local authorities, planning for prioritizing services in emergency situations, and canceling nonemergency services [19]. The significant increase in

human resource was in line with the studies of Daneshmandi et al. and Delshad.

The strong preparedness of hospital showed significant increase in logistics and support management. In this regard, effective communication and coordination with conducting operation center, decision makers, organizations for monitoring disaster, and pre-hospital emergency were of great necessities of using early warning systems; and change in this component was among the best changes.

Though the hospital got better scores in two components of continuity in essential services and post-disaster recovery, the increased scores were not statistically significant. The result in this intervention were the same as obtained by Delshad et al. [10], who concluded the average level of the hospital preparedness. Significant increase in hospital preparedness after implementing early warning system indicates the necessity of development and implementation of the system to improve the hospital preparedness in response to disasters and incidents [10].

Also in 2015, Salavaty studied the impact of non-structural and functional safety training in hospitals by nurses, and its effect on the preparedness of Razi and Day hospitals of Tehran, showed that the preparedness of both hospitals got significantly better after intervention. Therefore, nonstructural and functional safety training and its application by the nurses could improve the level of preparedness and safety [17]. Expressing the necessity of identifying vulnerabilities and drawing the attention of the officials for identifying the risks as one of their tasks in the workshop of the early warning system application caused the improvement of the hospitals in this aspect.

Finally, implementation of early warning system improved the preparedness in hospitals to get to the higher level for confronting with incidents. Likewise, Karimiyan found positive and effective impact of the contingency plans on the preparedness of the hospital in responding to disasters in his study [13].

## 5. Conclusion

Considering the findings of this study, and regarding the position of our country with regard to disasters, it is necessary to implement national hospital preparedness program to improve the level of hospitals preparedness. Also, it is recommended that early warning system be implemented in all country hospitals in accordance with the

specific condition of each hospital to receive quick and proper responses when a disaster or an incident occurs.

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### Conflict of Interest

The authors declared no conflict of interests.

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