Original Article

Early warning system-related challenges in health sector: A qualitative content analysis study in Iran

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Abstract:

CONTEXT: Iran's health system has always faced many challenges in the field of disaster risk management. The establishment of early warning systems in countries has been identified as an important component of preparedness and risk reduction.

AIMS: This study aims to extract the experiences of those involved in the field of risk management in relation to the challenges and problems of early warning system establishment in the Iran's health system.

SUBJECTS AND METHODS: This was a qualitative study, which has been conducted using a content analysis method. Data were collected through semi-structured interviews with 16 individuals who had at least one disaster management experience at the emergency operation centers. Sampling was done purposefully. The data were then analyzed using the Grenheim method.

RESULTS: Nine subcategories of data were analyzed that included legal vacancies, challenges related to protocols and guidelines, weaknesses in the prediction infrastructure, weaknesses in the communication infrastructure, poor coordination, scarcity of resources, inadequate education, information management challenge, and evaluation challenge, and three main categories were extracted that included policy challenges, infrastructure challenges, and management challenges that represented the issues experienced in establishing an early warning system in the Iranian health system.

CONCLUSION: Policy-makers and managers of health system need to pay special attention to improve the legal framework and standard protocol, strengthening infrastructures, increasing management performance in the field of coordination, education, allocation of resources, flow of information, and evaluation system.

Keywords:

Challenge, content analysis, early warning system, health sector

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Received: 04-09-2019
Accepted: 08-10-2019
Published: 28-02-2020

Introduction

Emergency and disaster are on the rise in the world. In the period between 2000 and 2017 alone, disasters killed 77,144 individuals and affected 193,312,310 people.[1] More than 90% of the deaths and economic damages resulting from disasters have occurred in Asia.[2] Iran is now ranked among the ten most disaster-prone countries in the world. Iran's topography, geography, and climate coupled with vulnerabilities such as infrastructural fragility, uncontrolled urbanization, and challenging social and economic conditions make it particularly susceptible to natural disasters such as earthquakes, floods, droughts, landslides, and major storms.[3] Depending on its nature, natural hazards always have numerous health implications.[4] In the Sendai

How to cite this article: Hosseini SH, Khankeh HR, Farrokhi M, Hosseini MA, Koolivand P, Raeiszadeh M. Early warning system-related challenges in health sector: A qualitative content analysis study in Iran. J Edu Health Promot 2020;9:38.

document (2015–2030) as a roadmap for countries to reduce the risk of emergencies and disasters, the role of the health sector and its importance in reducing disaster risk has been several times emphasized.[5,6] One of its goals is to reduce deaths in populations affected by natural hazards.[7] In Iran, the health system has always faced numerous challenges in the field of disaster risk management, including mass casualties, demolition of health facilities, and damage to infrastructure.[8-10] The health system has initiated numerous health management programs since the Bam earthquake in 2003, and according to the disaster management roadmap, the most developed country in the region with the least vulnerability and highest preparedness is a goal to be reached by 2025.[11] In this regard, the development of warning systems is one of the most important issues that will improve the preparedness and the ability of the disaster response phase in the disaster risk management cycle.[12] Many studies and upstream documents have emphasized the importance of early warning systems as a component of risk management and risk reduction.[5,13-15] The warning system has an important role in reducing the consequences of emergencies and disasters through the timely generation and dissemination of information to individuals, communities, and organizations at risk.[16] However, after years of developing roadmaps and recommendations at international meetings and despite the considerable growth of evidence on health services in emergencies and disasters in Iran, studies on early warning systems have often been sketchy and limited and the experiences of those involved have received less attention.[17,18] Qualitative studies in the field of disaster risk management in the Iranian health system have generally examined certain aspects of the system and have not been evaluated about the warning system. For example, Moradian *et al.* have studied the corrective actions of a dust storm warning system in Tehran,[19] Khankeh *et al.* have studied the challenges of disaster management in the health system in general,[9] or Sorani *et al.* and *Djalali et al.* have probed the problems of prehospital emergency care in disasters.[10,20]

Understanding and experience of those involved in the warning system and identifying and solving the problems in the field will improve the quality and efficiency of the system and will be very helpful in policy-making and implementation at both managerial and operational levels of the health system. The present study is a part of a qualitative study that aims to extract the experiences of people involved in risk management in the health system regarding the challenges and problems of early warning systems.

Subjects and Methods

A qualitative content analysis method was used in this study, which is the preferred method for studying a

new phenomenon or studying a phenomenon with a new approach.[21,22] Qualitative studies are based on the experiences of key persons, and in the current study, participants had the following characteristics: ability to communicate verbally and having at least one disaster management experience at emergency operation centers of the Ministry of Health, medical sciences universities, or satellite centers. Initially, the samples were selected purposefully, and in the next stages, they were recruited as needed. There were 16 participants. Sampling was carried out until data saturation,[21] which means that the number of samples was not predetermined and sampling and interviewing were carried out until there was no new code being extracted and the data were being repeated. In-depth and semi-structured interviews were used to collect the data.[21,23] Interviews started with a general open-ended question, for example: how was the notification process in the event you were recently involved in? Following these questions and answers, probing questions were occasionally asked, if needed. All interviews were recorded with a voice recorder and transcribed immediately after listening several times. The data were then analyzed using the Grenheim method which is a qualitative content analysis method.[24] At the analysis stage, the meaning units were first identified. Then, open coding was done. In the next step, the codes were grouped according to their similarities and differences, thus forming main categories and subcategories. The analysis process is shown in Tables 1-3. To ensure the validity and credibility of the data, Lincoln and Guba indices including field note, memo, prolong engagement, peer check, and member check have been used.[25] This study has been approved by the Ethics Committee of Tehran University of Social Welfare and Rehabilitation Sciences and has been registered under the number IR.USWR.REC.1397.082. First, the purpose of the study and its process were explained to each participant, then written consent for participation in this study was obtained, and participants were assured that they could stop participating in the study at any time they wish. All documents and credentials are kept confidential.

Results

In this study, we reached three main categories encompassing policy challenges, infrastructure

Table 1: Developing conceptual codes

Conceptual code	Meaning unit
Lack of multilayer communication channels	We are currently communicating with the centers via telephone and fax to transmit an alert message, but the experience of the incident has shown that there is a need for supporting methods and channels at the time of the incident, which can be alternatively used in case of disruption of each method

challenges, and management challenges, which are shown in Table 4.

First category: Policy challenges

The category itself consists of two subcategories, including legal vacancies and challenges related to protocols and guidelines.

Legal vacancies

Participants believe that one way to reduce the risk of disasters and deploying early warning systems is appropriate policy and legislation at different local-to-national levels. Lack of legal support for risk reduction causes these actions to be temporary and inaccessible. One participant mentions that:

"An early warning system has a variety of components many of which need clear legal support to function properly, otherwise a manager will do something which may not be followed by the next managers."

Challenges related to protocols and guidelines

Participants believed that for many elements of the warning system, such as risk assessment, leveling, and response, there are no indigenous and standard protocols and guidelines available at the Ministry of Health. One interviewee points that:

"Currently it is unclear at many centers what a hospital should do in the orange alert status and what to do when the red alert is announced; currently all kinds of warnings are given alike response."

Second category: Infrastructure challenges

This category consists of two subcategories: weaknesses in the prediction infrastructure and weaknesses in the communication infrastructure.

Weaknesses in the prediction infrastructure

Participants believe that some predictions, including climate hazards, are largely inadequate due to lack of up-to-date technology. One participant states that:

"Warnings are inaccurate in floods, storms, and in general in the climate hazards for which the Meteorological Organization of our country is responsible for monitoring, warnings are general and there is no ability for spot prediction."

Weaknesses in the communication infrastructure

Based on the experiences of the participants, the use of new technologies such as the Internet and satellite technologies in the dissemination of alerts can be

Table 2: Developing subcategory from conceptual codes

Subcategory	Conceptual code
Weaknesses in communication infrastructure	Lack of multilayer communication channels
	Vulnerability of communication channels

Table 3: Developing main category from subcategory

Category	Subcategory
Infrastructure challenges	Weaknesses in communication infrastructure
	Weaknesses in prediction infrastructure

Table 4: Categories, subcategories, and the extracted codes

Category	Subcategory	Code
Policy challenges	Legal vacancies	Unclear responsibilities of partner and supporting organizations
		Incomplete legal framework
	Challenges related to the protocols and guidelines	Defects in the tool and leveling protocol
		Lack of response guideline
		Failure to formulate a response plan
Infrastructure challenges	Weaknesses in the communication infrastructure	Lack of multilayer communication channels
		Communication channel vulnerability
	Weaknesses in the prediction infrastructure	Unpreparedness of the infrastructure for forecasting
		Lack of up-to-date forecasting technology
Managerial challenges	Poor coordination	Independent operation of units
		Ignoring stakeholders
		The fragile interorganizational relationship
	Scarcity of resources	Lack of equipment for response
		The response requiring financial resources
		Lack of skilled staff
	Inadequate education	No leveling training for managers
		Insufficient training of the programs
	Information management challenges	Challenges of data interpretation
		Challenges of data analysis
		Insufficient incident information
	Evaluation challenges	Lack of evaluation documentation
		Relative evaluation
		Nonpublication of the evaluation results

effective in reducing the time and speed of action by the target individuals. On the other hand, due to the vulnerability of the communication infrastructure to the risks, multilayer channels are required. One participant says that:

"At the moment we are communicating with the centers via telephone and fax and transmitting a warning message, but the experience of the previous incidents has shown that there is a need for supporting methods and channels at the time of the incident, so that we can use other methods in case of disruption."

Third category: Managerial challenges

Management challenges consist of five subcategories, including poor coordination, scarcity of resources, inadequate education, information management challenge, and evaluation challenge.

Poor coordination

Based on the experiences of the participants, since the warning system is a collaborative system of different organizations and institutions, most of the warning communications are not properly implemented due to poor internal and interorganizational coordination of the monitoring and receiving organizations. One of the participants points that:

"To monitor the hazards due to their diversity, we have different monitoring organizations available. These organizations are tasked with monitoring and issuing warnings, each of which acts in its own way, which has a negative impact on the effectiveness of the warning system."

Scarcity of resources

Participants believed that the allocation of resources to universities and centers, especially in the area of risk management, was not properly implemented because the health system at the various local and national levels did not consider separation of risk management budget. One of the consultants says that:

"In order for the evacuation plan to be operational, it is necessary to purchase transportation equipment, beds, and so on. A hospital that has numerous financial problems for everyday life has no money to buy the necessary equipment."

Inadequate education

Based on the experiences of the participants, the response program needs to be pretrained and practiced in order for the warning to receive an appropriate response message, while training does not have the necessary consistency. One of the participants states that:

"The circumstances of the accident are so vague and stressful that people may not even be able to perform their routine duties and responsibilities. Now you deal with an untreated program and people don't know how to respond to it properly."

Information management challenge

Participants believed that leveling the warning would require a series of baseline requirements and information from the area, a range of hazard information, and extent of impact. However, much of these data are unavailable or may receive late, or the information received is incorrect and contradictory. One of the participants says that:

"In order to determine the level, in addition to having risk information such as severity, timing, and so on, one needs to have some information on the characteristics of the affected areas."

Evaluation challenge

Participants believed that the warning system, like any other system, needed an evaluation system to improve processes and functions. Lack of standard and specific evaluation pattern, as well as lack of documentation, can be a challenge for the health-care system's warning. One of the participants points that:

"Now, reviewing different universities and even cities, we notice that they have worked on certain components [of warning systems] and on the contrary some other components are generally overlooked by them. Why? Because we do not have a specific evaluation model yet."

Discussion

This was a qualitative study of the challenges and problems of the early warning system deployment in the health system. The study findings are categorized into three main categories: policy challenges, infrastructure challenges, and management challenges. One of the challenges in policy-making has been legal weakness, and a review of the successful experiences of the alert system indicates the existence of a clear legal support and a certain organizational order.[26] In our country, the rules are generally not clear in the field of risk management resulting in parallel work and in some cases shortcomings. Therefore, having a solid and transparent legal background in the field of risk management can help in the optimal deployment of its components. Challenges related to protocol and instructions were other problems with the deployment of the warning system. To respond well to an alert, a clear, pretrained instruction is needed based on which individuals and staff can respond appropriately. The development and delivery of indigenous and standard guidelines and protocols by the Ministry of Health can be also helpful. In the Ardalan's study, one of the detected challenges was associated with the lack of a written response protocol to the disaster, especially about population evacuation. Its absence in the health-care system has also been conclusive.[27] In the Allahbakhshi *et al*.'s study, participants noted that in

the health-care system, there were no national treatment protocol and comprehensive operational response plan for dust storm management.[28] Infrastructure challenge was another finding of the study. Risk monitoring is technology-dependent. Monitoring requires a scientific prediction to be accurate and speedy, but limited infrastructure and lack of advanced technologies have caused many forecasts to be inaccurate and in many cases incorrect. Failing to predict precipitation point is one of the findings of the Ardalan's study. In his report on lessons learned from deploying a warning system in seven different countries, Golnaraghi recommended the improvement of operational capability for risk prediction and monitoring.[26] In order to transfer warnings to people at the right time and to transmit risk information from relevant organizations to emergency operation centers, multilayer communication channels need to be used. Up-to-date technologies must also be used. In terms of communication infrastructures, the Ministry of Health and medical universities generally use the telephone and fax, which may be disturbed at the time of the disaster. In the Ardalan's study, low levels of technology and equipment in Golestan Province were identified as problems in conveying a warning message to the villagers. In the Sorani's *et al.* study, which focused on the challenges in providing emergency medical services in times of disasters, in line with the findings of the present study, one of the main categories was the weakness of the communication infrastructure.[20] The United Nations Office for Disaster Risk Reduction (UNISDR) has counted the inadequate communication system for timely and meaningful hazard prediction as one of the warning system deployment problems.[29] Another finding of the study highlights the weaknesses of internal as well as interorganizational coordination. An early warning system is a system with the participation of several areas at different levels. Therefore, in order to achieve the desired outcome, coordination at all levels and areas needs to be improved. Allahbakhshi *et al.* pointed that lack of inter- and intraorganizational coordination, collaboration, and communication at all levels was one of the dust storm preparedness challenges in the health system. Khorasani-Zavareh *et al.* in their study, in line with the present study, considers lack of co-ordination as one of the major problems in the management of traffic accidents in Iran.[30] This finding has also been mentioned in the study conducted by Khankeh *et al.*, as one of the challenges of the health system in disaster management.[9] Holding training classes and consulting sessions, writing a memorandum, and developing a preparedness and response plan can have positive effects on enhancing coordination. Since there are no distinct budget lines in the health sector in the various sectors of risk management, lack of resources has always been a challenge of risk management in the Ministry of Health. In addition to the inappropriate management of

resources, economic sanctions in recent years are other noteworthy reasons.[31,32] The health-care system has also been affected by sanctions, especially in the field of preparation and response technology.[33] Various studies in Iran have also addressed this issue.[8,20] The UNISDR World Report on the status of the early warning system addresses the lack of investment in different parts of the warning system in developing countries as an important challenge.[29] It seems that the establishment of disaster risk management in the health system and the allocation of dedicated budget lines for risk management can solve many of the problems in this sector. Inadequate education has been another challenge that has been in various components of risk knowledge, leveling, and response. The importance of education in promoting knowledge and awareness of risk has been proven.[5,13] Holding training courses as well as a variety of exercises and extracting strengths and weaknesses can be very important in enhancing readiness and turning it into actual preparedness. In her report, Golnaraghi mentioned the relevance of training programs and exercises as one of the necessities of operational readiness and increased risk awareness.[26] The UNISDR report identifies the lack of risk-related education in most developing countries as one of the existing challenges.[34] Public education for taking safety measures after receiving the alert or when exposed to the disastrous situation is recommended in Moradian *et al*.'s study.[19] Blashki *et al*. stated that before disasters, training should be prioritized.[35] The government's attention to the use of knowledge and education at all levels is one of the key priorities of the Hyogo framework. Measures such as specialized training to improve the preparedness of the various groups of the health sector, holding of workshops, and inclusion of early warning lessons in the educational curriculum of schools and universities are strongly recommended. Other problems have been the independent functioning of the units and organizations in the field of information sharing. The relevant organizations do not have the necessary cooperation in the field of information sharing, and this has prevented the flow of information between different departments within and outside the organization. The experience of disasters in Iran shows that there is no established information system for collecting, recording, and sharing disaster information.[20] Weaknesses in interorganizational and interpersonal communication are due to a lack of understanding of the nature of the warning system as mentioned in the UNISDR report.

The warning system review in successful countries indicates that the establishment of evaluation and feedback system in these countries improves the efficiency of the system. The lack of a specific pattern of evaluation in the health system has decreased the quality of evaluation and has made the lessons learned from

different events unavailable. In the study of Ardalan, in line with the findings concerning the overall evaluation and effectiveness of the system, no written evaluation program for the current system or previous events was observed. There was no special report in the health system too. It is recommended to develop an evaluation plan based on the aspects of overall effectiveness, component performance, and documentation of lessons learned and feedbacks. This study was one of the few with qualitative approach to address the challenges and problems of early warning system in the Iranian health system. The time constraints of some people for interviewing due to their managerial positions were considered as the limitations of the present study, but the research team tried to saturate concepts by other well-experienced participants. Due to time limits, we were not capable of studying all the affected universities.

Conclusion

Despite the dramatic improvement of the Iranian health system in the field of disaster risk management in the recent years, for establishing successful early warning systems, it is necessary to pay attention to these issues: clear legal support and determination of responsibilities in the legal framework, preparation protocols and guidelines from local to national levels, strengthening and developing up-to-date infrastructure, adequate allocation of resources for further strengthening of the systems, holding training courses and conducting drills and simulations for specific hazards, an open flow of information inter- and intraorganization, and establishment of evaluation and feedback system. The present study is a starting point for identifying barriers and developing processes in early warning systems. It is hoped that managers and policy-makers in the health risk management sector can use the results of this study to increase the effectiveness and performance of early warning systems and take a step toward comprehensive disaster risk management.

Conflicts of interest
There are no conflicts of interest.

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