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Criteria and components of the emergency and disaster database in Iran: A content analysis study

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Abstract:

BACKGROUND: Nowadays, emergencies and disasters are considered one of the biggest problems in human life. To reduce the risk of emergencies and disasters, governments must develop strategies and policies using evidence-based methods. Disaster databases are the main source and tool for storing and managing a wide range of data in this field. This study was conducted with the aim of exploring the necessary criteria and components of the emergency and disasters database in Iran.

MATERIALS AND METHODS: This qualitative study was performed using content analysis in which 18 managers and experts with experience in registering, documenting, or responding to emergencies and disasters were selected through purposive sampling. Data collection was done using semi-structured interviews that continued until saturation. Data were analyzed by means of qualitative content analysis recommended by Landman and Graneheim.

RESULTS: In total, three main concepts concerning the necessary criteria and components of the database of natural and artificial emergencies and disasters in Iran were explored. The main concepts include information resources, information evaluation, and information management. Subconcepts include data collection, information transfer, access to information, information validation, disaster leveling, information registering, information storage and retrieval, information analysis, and information dissemination.

CONCLUSION: The experience of the participants showed that there are many challenges in the field of monitoring and gathering information about injuries and damages caused by emergencies and disasters in the country. The knowledge obtained from this study can be used to create and develop a database of emergencies and disasters in Iran. It will also provide insights for healthcare policymakers and managers in future planning areas to more effectively address identified challenges in preventing and responding to disasters at both regional and national levels.

Keywords:

Data management, database, disasters, emergencies, mass casualty incidents, natural disasters

Introduction

In today's world, emergencies and disasters are considered as one of the biggest problems in human life.^[1] In 2019, at least 396 natural disasters were reported in Emergency event database (EM-DAT), killing 11,755 people, affecting 95 million others, and costing nearly 130 billion US\$.^[2]

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According to the World Health Organization, 90% of deaths due to emergency events occur in developing and low-income countries that do not have the necessary capacities for prevention, management, and postevent care.^[3] In this regard, the issue of natural disasters is of special interest to scientists and policymakers in different countries. At the Third World Conference on Disaster Risk Reduction in March

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2015, a new Disaster Risk Reduction Framework, the Sendai Framework, was adopted by 187 countries and included seven global objectives.^[4] This new framework will apply between 2015 and 2030. In addition to this worldwide document, the Sustainable Development Goals Document was adopted in September 2015. The goals of these documents include reducing mortality, reducing the number of injured people, and reducing the amount of direct economic damage caused by disasters, among other things. It is essential to provide accurate information on human impacts and disaster damage to measure and monitor these objectives.^[4,5]

To reduce the risk of disasters, governments must develop strategies and policies using evidence-based methods. Disaster databases are the primary source and tool for storing and managing a wide range of data in this field.^[6-8] Disaster data should be standardized and registered using a standard global methodology. Data on the current and historical emergencies and disasters can be used for various kinds of analyses and purposes and requested by different organizations. Among them, we can mention multiple scientific institutes, researchers, government organizations, organs affiliated to the United Nations and the European Union, nongovernmental organizations (NGOs), and the insurance and financial sectors. Besides, disaster data help identify global or regional trends in disaster risks and their consequences. Beyond, the knowledge gained from identifying various hazards may lead to the beginning of disaster prevention measures.^[9-11]

Disaster planning and response are one among the most important health issues in developing countries that should be considered.^[12-14] Iran is a neighbor of countries that do not yet have a dynamic, active, and cohesive health system and is located in the Mediterranean region of the WHO.^[15,16] Moreover, as Iran is one of the high-risk countries in the field of disasters, to create a suitable environment for preparing and responding to disasters at the local and national level, the need for careful planning based on scientific documents, recognizing the type and behavior of hazards and their dimensions is felt. Accordingly, this study was conducted with the aim of exploring the necessary criteria and components for emergency and disaster database in Iran through a qualitative study.

Materials and Methods

This study is part of a large study to design and deploy a database of natural and artificial emergencies and disasters. In this study, based on the experiences of experts in the field of disaster documentation and based on the context of Iran, the criteria and components of the disaster database were determined.

Study design, participants, and sampling

This is a qualitative content analysis study in which the selection of participants is based on purposeful sampling. A semi-structured interview has been done to obtain the maximum diversity in terms of age, gender, education, operational experience, and organizational class. Participants are included of specialist in the field of response and disaster documentation.

Inclusion and exclusion criteria

Inclusion criteria included all people who had experience, knowledge, and expertise related to registering the occurrence of emergencies and disasters and responding to them and also had a desire to participate in the study. These people are among the managers and employees of organizations related to emergency and disaster registration and response, who have had at least 3 years of experience as a manager or authority in the field of disaster registration or experience of at least attending three disasters or participating in collecting documentation of emergencies and disasters. If any study participant was reluctant to continue to participate in the study, they have been excluded.

Data collection tool and technique

The interviews lasted 40–70 min (average 50 min). The interview guide was used following the predetermined subsets. It is noteworthy that according to the rules of social distance at the time of the outbreak of the COVID-19 pandemic, interviews were conducted by telephone or via Skype.^[17]

First, informed consent was obtained from the participants and interviews were conducted. Interviews started with open and general questions such as “Tell us about your experience in registration of emergencies and disasters” and moved on to more detailed and specialized questions. If further interviews are required, the second interview was arranged based on the agreement of the participants. All interviews were recorded with the full consent and willingness of the interviewee. Field data were also used in data collection, and all interviews were written word for word on paper, which was used to document the interviews. During the interview, all participants were asked to extract appropriate criteria and components based on the criteria that exist in the world, the conditions and facilities of Iran, and live experiences of the participants. The process of selecting samples and collecting data continued until data saturation was achieved.

Data analysis

Qualitative data content analysis was performed by Landman and Graneheim five-step analysis. To ensure the validity and reliability of the data, four criteria

of credibility, dependability, confirmability, and transformability have been used.^[18] To increase the credibility of the study, constant comparison, active listening, long-term engagement with data, immersion in data and data sources, as well as triangulation techniques, were used. To ensure the dependability of the findings, analytical activities have been registered and documented for follow-up. Confirmability of the study findings was confirmed by using peer review and member check. We also attempted to consider participants with maximum diversity to improve the transformability of the study findings. To manage the data, MAXQDA software version 11 (It is being developed and distributed by VERBI Software based in Berlin, Germany) was used. To fully understand the content, the text of the interview was read several times to create an overview of the data and to determine the most important units of meaning simultaneously. Then, the coding was done, and the codes were placed in appropriate categories. Finally, main concepts have been developed.

Ethical consideration

Ethical approval of this study was obtained from the Ethics Committee of the University of Social Welfare and Rehabilitation Sciences in Tehran, Iran (IR.USWR.REC.1399.074).

Results

A total of 20 emergency management experts were interviewed, including some members of national headquarter for disaster risk management, emergency operation center (EOC) staff, disaster policymakers, faculty members, and people with scientific and practical experience in documenting, registering, and responding to disasters [Table 1].

From the analysis of interviews, three main concepts in the field of registering natural and artificial disasters in Iran were extracted. The main concepts were information resources, information evaluation, and information management [Table 2].

Information sources

Depending on the interviewees' experiences, various sources can be used for the disaster database's input data: information collected in the field, official information of disaster-related centers, information contained on websites, reports of NGOs, data compiled by scientific centers, media reports, and so on. They state that the information transfer cycle in emergencies and disasters does not work correctly and that information may be distorted. In some cases, an informal information transmission network is formed. Sometimes, access to information is not easy. To eliminate the gaps

in this field, it is necessary to emphasize the online transmission of information and the unity in information systems (P. 1) (P. 4).

"We provided the information in the field as much as possible. I, as the Director of the University's Center for Crisis Management and Medical Accidents and Emergencies, obtained information through field visits that indicated the failure of the information system" (P. 1).

"The most reliable data channels are experts and trained people in the area. In some cases, such as security cases, we were not allowed to access the information. Sometimes, the information changed, so online transmission channels can prevent misinformation. Or, even if the information is to be corrected, the previous information should not be erased so that it can be compared if needed."

"The informal communication channels that we created and through which transmitted information to the EOC and the responsible media[...] while news sites and media are agents and channels of information. It was also the Institute of Geophysics of the University of Tehran that registered earthquakes, for example. And, the only site that registers information very well as the Institute of Geophysics, and we do not have anyone else, or indeed an institution, to tell us the rest" (P. 1).

Information evaluation

Interviewees stated that given the volume and quality of information from input sources, the presence of experts to evaluate the information, both in terms of validation and disaster leveling, is necessary. The validity of information can be compromised for various reasons, including deficiencies in information, obtaining information from unreliable sources, the existence of rumors at the time of emergency events and disasters, and the existence of information from multiple sources (P. 9).

"The team that is the expert will be in charge of screening the information. For example, you get information from an unreliable news site [...] So, we get it from different channels. For example, we have reputable news sites. Invalid or average news sites in terms of credit and weak or journalists or those who are trusted or experts in the region" (P. 9).

In this context, establishing a qualitative scoring mechanism to determine the validity of the data for registering in the next steps was suggested by the interviewees (P. 3).

"Give a qualitative score! That is, we determine from which channel actually we get this information. For example, the qualitative score can have a grade, such as from one to, say, 10" (P. 3).

Table 1: Profiles of managers, policymakers, faculty members, and staff participating in the study

Participant number	Gender	Age	Education	Service location
Participant 1	Male	48	Emergency Medical Expert	Dezful Emergency, Dezful
Participant 2	Male	41	Ph.D. of Health in Disasters	Golestan University of Medical Sciences, Golestan
Participant 3	Male	42	Master of Nursing	EOC-Emergency Organization, Tehran
Participant 4	Female	43	Master of Information Technology	Emergency Organization, Tehran
Participant 5	Male	38	Master of Special Nursing	EOC-Dezful Emergency, Dezful
Participant 6	Female	37	Master of Nursing	EOC-Ilam Emergency, Ilam
Participant 7	Male	44	Emergency Medical Expert	EOC-Kerman Emergency, Kerman
Participant 8	Male	46	Ph.D. of Health in Disasters	Baqiyatallah University of Medical Sciences, Tehran
Participant 9	Male	43	Ph.D. of Health in Disasters	Kerman University of Medical Sciences, Kerman
Participant 10	Female	41	Ph.D. of Health in Disasters	Kerman University of Medical Sciences, Kerman
Participant 11	Male	47	Emergency Medical Expert	EOC-Ahvaz Emergency, Ahvaz
Participant 12	Male	47	Emergency Medicine Specialist	Ahvaz Jundishapur University of Medical Sciences, Ahvaz
Participant 13	Male	44	Master of Nursing	EOC-Kermanshah Emergency, Kermanshah
Participant 14	Male	40	Ph.D. of Health in Disasters	Dezful University of Medical Sciences, Dezful
Participant 15	Male	43	Master of Nursing	EOC-Alborz Emergency, Alborz
Participant 16	Male	48	Emergency Medical Expert	Alborz Emergency, Alborz
Participant 17	Male	44	Emergency Medical Expert	Bushehr Emergency, Bushehr
Participant 18	Male	40	Master of Information Technology	Ahvaz Jundishapur University of Medical Sciences, Ahvaz
Participant 19	Male	48	General Physician	Jahrom Emergency, Jahrom
Participant 20	Male	39	Master of Nursing	EOC-Sabzevar Emergency, Sabzevar

EOC=Emergency Operation Center

Table 2: The main concepts and sub-concepts

Theme	Main concepts	Subconcepts
Database structure	Sources of information	Data collection
		Field data collection
		Sites and news sources
		Official and unofficial sources of information
		Data transfer
	Information evaluation	Access to information
		Validity of information
		Defects in information
		Information source credibility
		Multiplicity of the information sources
Information management	Disaster leveling	Human damages
		Economic losses
		Geographical area
		Information registration
		Classification of emergencies and disasters
	Information management	Coding
		Dimensions of disaster or emergency
		Geographical attributes
		Information storage and retrieval
		Data analysis
Dissemination of information	Public access	
	Dedicated access	

The experiences of the study participants indicate that to determine the extent of the emergency or disaster, it is essential to consider disaster leveling. According to the existing guidelines for disaster leveling in Iran, cases such as human losses (10 killed or 100 injured or 1000 people in need of assistance), economic

losses (\$10 million by calculating the inflation rate), and geographical width (several villages, one district, and/or a county) should be taken into account (P. 6).

“If we want to take a good look, we can calculate based on the national level and the existing guidelines [...] accidents with

deaths and injuries and economic damage and accidents that damage the structure or interrupt the flow of life or the normal flow of work can be examined” (P. 6).

Information management

According to the interviewees’ experiences, after confirming the information about the emergency or disaster in the previous stages, the issue of information management process is raised. The information process can include registering information, storing and retrieving information, analyzing information, and spreading information.

Respondents’ experiences concerning information registration included disaster classification, coding, disaster dimensions, and geographical characteristics of the emergency or disaster. They stated that it is necessary to act by international protocols for the registration of emergencies and disasters and to use the standard designations made by the world’s reputable bases in this field. The registration of incidental information about the emergency or disaster, such as geographical characteristics and other indicators of the emergency or disaster (killed, injured, affected, homeless, missed, displaced, insured economic damages, total economic damage, damage to infrastructure, property damage, and damage to the environment), can also be useful in performing subsequent analyzes.

The interviewees further stated that the storage and retrieval of information should be based on the latest technology in this field. Data analysis and database output can be determined based on the information requested by stakeholders and specific use in different domains.

Regarding disseminating information, the interviewees stated that due to security aspects or macronational policies, not all information about a particular emergency event or disaster might be publicly available (P. 2) (P. 8).

“If we can have a single system and a unique software in the whole country and based on what is being done in the world, ask everyone to work with that system, aggregate and store the data in one special place, so that everyone can use it[...] this is ideal, because there are special methods for naming and coding disasters in the world’s reputable databases” (P. 2).

Discussion

The experience of the participants showed that there are many challenges in the field of monitoring and gathering information related to the occurrence of injuries and damages caused by emergencies and disasters in the country. The lack of a comprehensive disasters database that has classified documents, homogeneous and

consistent with the typology of disasters, lead to attention to disasters only reactively, momentarily, and without prior planning. This has caused irreparable damage to the country. Due to the lack of a standard database to register the occurrence and effects of disasters, many emergencies and disasters are not adequately addressed. El Hadri *et al.* in their study stated that such reasons as distance from the center, lack of media coverage, low population of the region, and political and social conditions can affect the amount and type of disaster response.^[1]

The study results show that the participants in this study realized the importance of information sources in the structure of the database and stated that the first part in the database structure is information resources. This section can collect its data through various channels. However, for early collection, none of the available routes as much as field visits from the disaster scene can work. Field visits are often conducted by an initial assessment team of emergency relief personnel. This information is usually transmitted to higher levels through EOC centers. This can show the importance of rapid assessment teams. Angelica Wirtz *et al.* found that the EM-DAT and NatCat-SERVICE databases are also committed to the rapid registration of disaster data and enter additional information over time after the initial information is recorded. The speed of initial estimation of loss and damage is very important in response to emergencies and disasters.^[10] Other sources of formal and informal information include NGOs, news sites, and more. Among these, official national and international reports are the most reliable sources of information. Zêzere *et al.* emphasized the validity of official data over other data, such as data from unofficial institutions. This highlights the need for the database to use official data.^[19]

Regarding information sources, newspapers are the most accessible and reliable sources of information for registering past events. Disaster databases around the world list various sources for the input data of a disaster database: UN agencies, meteorological services, geological services, press, reports, and official announcements, information collected while searching the Internet, reports of humanitarian actions of NGOs, data compiled by academic institutions, media reports, etc.^[20-23] Due to the nature of information about emergencies and disasters, the interviewees emphasized the need for defined communication channels to transmit information correctly and quickly. On the other hand, users of disaster information also need accurate and fast information to respond promptly and appropriately to emergencies and disasters.

Evaluation of information after receiving it from various sources is done to achieve two goals: the validity of information and the level of emergencies and disasters. To

obtain valid data, data validation and cross-control must be done. The EM-DAT, Sigma, and NatCat-SERVICE databases have their specialists for evaluating data set quality control, while DesInventar data quality is government controlled.^[1,10] The Munich Reinsurance Company relies on several reputable sources in the NatCat-SERVICE database, including news agencies (Factiva/Dow Jones, Associated Press), which ranks them based on the agency's history over time. A ranking of 25 is defined as the most valid while a ranking of 6 is determined as the lowest credit of the source.^[8,24] The interviewees stated that the second purpose is to evaluate emergency event or disaster leveling information, which can be done in accordance with the N.R.F. national protocols and guidelines.

Disaster databases around the world are each categorized in different groups based on the nature of their work. The NatCat-SERVICE database is mostly active in the areas of insurance and finance and ranks disasters based on the amount of economic damage, although this database also records the amount of human damage. The EM-DAT database investigates the emergencies and disasters based on humanitarian issues.^[22]

The central concept of information management to integrate the methods of classification, registering and coding of emergencies and disasters, and modern information technology in information storage and retrieval is debatable. Interviewees emphasized the use of emergency and disaster classification methods agreed upon by experts in the area. The EM-DAT database uses standard disaster classification and coding methods.^[25] Storing and retrieving information are considered the technical requirements of the data bank. To create and develop a database, we need to provide the necessary infrastructures, maintain, and update them. Providing useful and usable information to provide stakeholders' feedback is one of the main goals of creating a disaster database.

Based on the interviewees' experiences, documenting information and disaster damage is a dynamic and changeable process. Inevitably, the whole process of collecting, registering, and analyzing information in the database needs to be continuously reviewed and updated. In this regard, the NatCat-SERVICE database is reviewed every 3–6 months. The review process includes checking the data quality by mentioning the ranking of the data source and evaluating the amounts of damages by comparing them with insurance claims. The Munich Reinsurance Company reviews all damages and checks suspicious amounts with local authorities if needed.^[7,24]

Limitations

Due to the characteristics of qualitative research, the generalization of this study's results is limited to the context of the study.

Recommendation

The study method, extracted indicators, and evaluation and validation methods can be used for other countries. It is also recommended that a similar study be conducted in different countries and in other areas related to disaster prevention and response.

Conclusion

There are serious challenges in collecting and recording emergency and disaster data. Considering the emphasis of national and international documents on creating a database for disaster management in the country and its impact on the process of sustainable development of the country, it seems necessary to create emergency and disasters database. The knowledge obtained from this study can be used to create and develop a database of emergencies and disasters in Iran. It will also provide insights for healthcare policymakers and managers in future planning areas to address identified challenges in preventing and responding more effectively to disasters at both regional and national levels. Further investigations to develop national disaster database are recommended based on the results of the study.

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Conflicts of interest

There are no conflicts of interest.

References

1. El Hadri H, Mirza D, Rabaud I. Natural disasters and countries' exports: New insights from a new (and an old) database. *World Econ* 2019;42:2668-83.
2. CRED. Disaster Year in Review 2019. *CRED Crunch*. 2020;(58):1-2.
3. Napolitano E, Marchesini I, Salvati P, Donnini M, Bianchi C, Guzzetti F. LAND-deFeND – An innovative database structure for landslides and floods and their consequences. *Environ Manage* 2018;207:203-18.
4. Aitsi-Selmi A, Murray V. The Sendai framework: Disaster risk reduction through a health lens. *Bull World Health Organ* 2015;93:362.
5. Suppasri A, Muhari A, Syamsidik S, Yunus R, Pakoksung K, Imamura F, *et al.* Vulnerability characteristics of tsunamis in Indonesia: Analysis of the global centre for disaster statistics database. *Disaster Res* 2018;13:1039-48.
6. Bazyar J, Pourvakhshoori N, Safarpour H, Far-Rokhi M, Khankeh HR, Daliri S, *et al.* Hospital disaster preparedness in

- Iran: A systematic review and meta-analysis. *Iran J Public Health* 2020;49:837-50.
7. Huggel C, Raissig A, Rohrer M, Romero G, Diaz A, Salzmann N. How useful and reliable are disaster databases in the context of climate and global change? A comparative case study analysis in Peru. *Nat Hazards Earth Syst Sci* 2015;15:475-85.
 8. UNDP. A Comparative Review of Country-Level and Regional Disaster Loss and Damage Databases. 2013. p. 51.
 9. Kron W, Steuer M, Löw P, Wirtz A. How to deal properly with a natural catastrophe database – Analysis of flood losses. *Nat Hazards Earth Syst Sci* 2012;12:535-50.
 10. Wirtz A, Kron W, Löw P, Steuer M. The need for data: Natural disasters and the challenges of database management. *Nat Hazards* 2014;70:135-57.
 11. Nakhaei M, Bahrapouri S. Editorial: A Study of Disaster Databases. *Heal Emergencies Disasters*. 2016;1 (2):63-4.
 12. Safarpour H, Sohrabzadeh S, Malekyan L, Safi-Keykaleh M, Pirani D, Daliri S, Bazyar J. Suicide Death Rate after Disasters: A Meta-Analysis Study. *Arch Suicide Res*. 2020 Jul 16:1-14. Available from: <https://www.tandfonline.com/doi/abs/10.1080/13811118.2020.1793045>. [Last accessed on 2020 Nov 28].
 13. Mazhin SA, Khankeh H, Farrokhi M, Aminizadeh M, Poursadeqiyani M. Migration health crisis associated with climate change: A systematic review. *J Educ Health Promot* 2020;9:97.
 14. Bazyar J, Farrokhi M, Salari A, Khankeh HR. The principles of triage in emergencies and disasters: A systematic review. *Prehosp Disaster Med* 2020;35:305-13.
 15. Aminizadeh M, Farrokhi M, Ebadi A, Masoumi G, Kolivand P, Khankeh H. Hospital Preparedness Challenges in Biological Disasters: A Qualitative Study. *Disaster Med Public Health Prep* [Internet]. 2020 Nov 5 [cited 2020 Dec 3];1-5. Available from: https://www.cambridge.org/core/product/identifier/S1935789320004346/type/journal_article
 16. Aminizadeh M, Farrokhi M, Ebadi A, Masoumi G, Kolivand P, Khankeh H. Hospital management preparedness tools in biological events: A scoping review. *Educ Health Promot* 2019;8:234.
 17. Poursadeqiyani M, Bazrafshan E, Arefi M. Review of environmental challenges and pandemic crisis of COVID-19. *Educ Health Promot* 2020;9:250.
 18. Graneheim U, Landman B. Qualitative content analysis in nursing research: Concepts, procedures and measures to achieve trustworthiness. *Nurse Educ Today* 2004;24:105-12.
 19. López-Peláez J, Pigeon P. Co-evolution between structural mitigation measures and urbanization in France and Colombia: A comparative analysis of disaster risk management policies based on disaster databases. *Habitat Int* 2011;35:573-81.
 20. Santos PP dos, Tavares AO, Zêzere JL. Risk analysis for local management from hydro-geomorphologic disaster databases. *Environ Sci Policy* 2014;40:85-100.
 21. Vos F. WORKING PAPER Work Package 3 Review of Disaster Databases Collecting Human Impact Data in Europe; 2012.
 22. Moriyama K, Sasaki D, Ono Y. Comparison of global databases for disaster loss and damage data. *Disaster Res* 2018;13:1007-14.
 23. Gall M. The suitability of disaster loss databases to measure loss and damage from climate change. *Int J Glob Warm* 2015;8:170.
 24. Mohleji S. Gaining from losses: Using disaster loss data as a tool for appraising natural disaster policy. ProQuest Dissertations and Theses. University of Colorado; 2011.
 25. Guidelines | EM-DAT. Available from: <https://www.emdat.be/guidelines>. [Last accessed on 2020 Dec 16].