A comparative study of interagency communications and information exchange in disaster response among selected countries

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Abstract:

BACKGROUND: Effective communications and secure information exchange platforms during disasters and emergencies are among the significant factors in inclusive disaster management and can radically contribute to better preparedness, efficient and timely responsiveness, and, finally, maximal reduction of damages and fatalities. The present study was to compare communications and information exchange among disaster response organizations in selected countries.

MATERIALS AND METHOD: This applied research, carried out in 2022, was a qualitative descriptive-comparative study pursuing a content analysis approach. Australia, Turkey, India, America, Japan, and Iran constituted the statistical population of the study. The sampling was based on the countries' disaster histories and response experiences. The note-taking tool was used to extract and collect data during the review of texts, documents, and articles, and the qualitative content analysis method was employed for data analysis.

RESULTS: The outcomes of the descriptive-comparative analysis fell into four main comparative axes of the selected countries, including comparing reference, authority, and coordinator organizations in the response phase, comparing planning records and histories in disaster and emergency management comparing the contribution or non-contribution of government, military institutions, and non-governmental organizations to disaster and emergency management, the commonalities of the selected countries' disaster and emergency management and dependence on government.

CONCLUSION: The results revealed that all selected countries depended on the government in managing disasters and emergencies, and the four communication platforms, i.e., landline telephone, mobile phone, radio communications systems, and couriers, were the common communication and information acquisition sources.

Keywords:

Communications, comparative study, information exchange, response organizations, selected countries

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Introduction

Real-time information and principled communications play significant roles in the higher preparedness and proper responsiveness of health organizations and are efficient in intersectoral communication and information exchange during disasters for the fast access to resources, elimination of time-consuming bureaucracy, attainment of a joint language, and management of time toward the maximal reduction of damages and fatalities.[1]

In the different phases of the disaster management cycle and all pre-disaster, disaster, and post-disaster phases,

Table 1: Comparing reference, authority, and coordinator organizations of response phase in selected countries

Row	Country	Reference response institution	Accountable institution	Response-coordinating institution
1	America	Presidency	U.S. Department of Homeland Security	Federal Emergency Management Agency (FEMA)
2	Japan	Prime minister and cabinet office	Ministry of Crises Management	Central Council of Crisis Management
3	Australia	Prime minister and cabinet office	Emergency Management Australia (EMA)	Australian Council for International Development
4	Turkey	Prime minister	Central Government	Turkey General Office of Emergency Management
5	Iran	Presidency	Ministry of Interior	Crisis Management Organization
6	India	Prime minister and cabinet	Ministry of Interior	National Emergency Management Agency

Information and Communications Technology (ICT) can efficiently contribute to higher preparedness and fast responsiveness.[2] In the response phase, one of the most influential phases of the disaster management cycle, the operating personnel are called to the Emergency Operation Center (EOC) and act based on their particular job specifications within an Incident Command System (ICS).[3]

The communication and coordination between the health system and response organizations, e.g., emergency medical services, red crescent, fire department, police, and hospital, are very important, and up-to-date information is the precedent of this coordination. During the occurrence of a disaster, these organizations should not only play efficient roles separately but also step into a trajectory harmoniously. Thus, healthcare organizations need both intra-organizational and inter-organizational coordination with the mentioned organizations. In this respect, it is imperative to use correct and real-time information and exchange intra-organizationally (in top-down and bottom-up ways) and inter-organizationally (between the mentioned organizations) in real-time is extensively imperative. The lack of uniformity in the collection of healthcare-related data and relevant information during disasters leads to poor quality of provided services at national and international levels.[4] Coordinating intersectoral information of the health system with response organizations regarding their engagement in optimal and timely service provision activities decrease fatalities, increases the number of the rescued, diminishes the complications of disabilities, relieves mental and physical pains, and plays a vital role in disaster management.[5] Therefore, it is indispensable to determine the health system performance criteria for establishing communications and exchanging information with the above organizations in order to facilitate secure, reliable, and effective exchange and processing of information in response to disasters.[6] Several studies reveal that there is no standard system in Iran for presenting real reports and statistics during the incidence of disasters and emergencies. Furthermore, organizing intersectoral communications and exchanging information have been the challenges of past disasters and emergencies.[7] Preparing situational reports, coordinating the on-time and efficient distribution of information among stakeholders, organizing information exchange among national and international disaster response organizations, collecting, organizing, and protecting relevant pieces of information, and promoting, facilitating, and producing communicational sources for the response activities of the health sector is among the main responsibilities tied to information and communication management during disasters and emergencies. Information management can be efficiently applied in disasters and emergencies when there is the necessary coordination among all participating organizations in responding to disasters.[8]

Intersectoral cooperation means communications and interactions among different sectors aiming to reach desirable outcomes. Likewise, intersectoral cooperation can be recognized as a main approach to correct and inclusive disaster management. Intersectoral cooperation as a necessity is not a novel and unfamiliar topic but welcomed by many countries in past decades. In the 1970s, Alma Ata Declaration emphasized healthcare for all until 2000, and in the 1980s, the Ottawa Charter introduced health promotion strategies, both of which were among the significant strategies of intersectoral cooperation.[9] In Iran, the new law of the country's disaster management and establishment of the supreme council of disaster management, prevention organizations, and headquarters, and coordinating and commanding crisis response operations indicate the need for intersectoral cooperation in the disaster and incident management domain.[10]

In Iran, researchers have identified the disintegration of information, lack of shared inter-organizational databases, lack of vivid informational strategies, and lack of a formal system documenting the disaster data at local and provincial levels as the primary difficulties in building efficient communications in the information emergency system. Thus, despite the presence of numerous healthcare-providing systems, it is imperative to develop an effective information and communication network to improve intersectoral and multisectoral coordination in emergency management.[11] Iranian studies revealed that intersectoral communications and information exchange that fall into the response phase functions category in

the roadmap of disaster management and risk reduction in the health system have been among the challenges of past disasters.[12] On the other hand, the ICT mechanism in the country still needs basic actions and fundamentals that can considerably contribute to on-time and efficient responses to disasters using a shared language, a joint communication line and platform, a single telephone and command, and real-timed and reliable information.[13] In addition, the researcher's experience in international incidents and his presence in various disaster-experiencing countries indicate that disintegration among response organizations during incidents and disasters, especially in the response phase, parallelism, and line agents' unawareness of the notified guidelines and rules in the disaster and emergency management domain are among the gross challenges ahead of the respective authorities. Thus, this study aimed to compare communications and information exchange among disaster response organizations in selected countries.

Materials and Methods

Design and statistical population

The present applied research, carried out in 2022, was a qualitative descriptive-comparative study pursuing a content analysis approach. Australia, Turkey, India, America, Japan, and Iran constituted the statistical population of the study. The sampling was based on the countries' disaster histories and response experiences.

Data collection

A data-extraction form was designed for data collection through note-taking. The form included several general questions on the conditions of communications and information exchange in the selected countries. Introducing response organizations, the coordination of communications in the national response to disasters and emergencies, the roles and responsibilities of the respective organizations, coordinating mechanisms, communicational tools, and information exchange platforms were instances of these questions.

To collect data, the researcher acquired the permission of Isfahan University of Medical Sciences and attended its library to use the internet, databases, and available documents, take notes in the designed form and record and extract the needed data.

Data analysis

Qualitative analysis with a descriptive-comparative approach was employed using comparative tables.

Results

The outcomes of the descriptive-comparative analysis fell into four main comparative axes of the selected countries,

including 1) comparing reference, authority, and coordinator organizations in the response phase [Table 1], 2) comparing planning records and histories in disaster and emergency management [Table 2], 3) comparing the contribution or non-contribution of government, military institutions, and non-governmental organizations to disaster and emergency management [Table 3], and 4) the commonalities of the selected countries' disaster and emergency management and dependence on government [Table 4].

The analysis of the data revealed that all selected countries depended on the government in managing disasters and emergencies. Disasters and emergencies are managed in America under the supervision of the U.S. Department of Homeland Security via the Federal Emergency Management Agency (FEMA), in Japan under the supervision of the Central Council of the Ministry of Interior, in Australia under the supervision of the Emergency Management Australia (EMA), in Turkey under the supervision of Disaster and Emergency Management Presidency (AFAD), in Iran under the supervision of the Ministry of Interior with the secretaryship of the Disaster Management Organization, and in India under the supervision of state government of this country. In terms of the planning history and record, America and India had the longest since 1803 (219 years), and India had the shortest history since 1960 (62 years).

The governance structures of disaster and emergency management were centralized in Iran and Turkey, while other countries possessed federal (national), state (provincial), regional, urban, local, and tribal structures. Table 2 shows the governance structure of every country separately.

Concerning the communicational tool employed at response times for communication and the information acquisition resources, the four tools below were similarly used in all selected countries: landline phones, mobile phones, wireless radio communications systems, and couriers. The widely-applied data exchanged among organizations and recorded in the designed form as the data source are described below separately for every country:

America: The type and title of the disaster, the statistics of the injured population, the surviving population, and the dead, the geographical location of the destroyed region in the form of geographical coordinates, the residence-required space, the consequences of the disaster, diseases, departed agents and teams organized based on various skills and specializations, individual and collective pieces of equipment, active and undestroyed care centers, field hospitals, communications, and their types, the logistic and support of support organizations,

Table 2: Comparing planning level and history of response to disasters and emergencies in selected countries

Row	Country	Response planning history	Planning levels
1	America	1803	Federal, provincial, local
2	Japan	1880	Central, provincial, urban, local, or residents
3	Australia	1929	Federal or national, provincial or territorial, regional or local
4	Turkey	1943	Central
5	Iran	1959	Central
6	India	1960	Central, provincial, regional

Table 3: Comparing significant or insignificant roles of government, military institutions, and non-governmental organizations in disaster and emergency management in selected countries

Row	Country	Government	Military institutions	Significant non-governmental organizations
1	America	√	√	-
2	Japan	√	-	-
3	Australia	√	-	-
4	Turkey	√	-	√
5	Iran	√	√	√
6	India	√	-	√

needed medical and pharmaceutical items, and the available and required facilities

Japan: The type and location of the disaster, access ways, stating communication codes and the way for establishing secure communications, initial, secondary, and final reports on the incident, e.g., the incident data and type, rate of fatalities, the degree of injuries, care-needed location, response-required human resources, and the requisite space for residence

Australia: The healthcare domain of individuals, mental and physical health of individuals, nutrition, general and environmental hygiene, malnutrition, shelters, drinking water, diseases, damages to communicational infrastructures, the number of available and required shelters, the number of present and needed personnel beds, the number of available and required hospital beds, the statistics of the injured and fatalities, endangered medical facilities, health capacity, blocked roads, security, the present and required logistics

Turkey: The topographical data, the destroyed region, the degree of financial loss, fatalities, the incident location, access ways, available and required facilities for effective responses

Iran: The type of the disaster, the level, and severity of the incident, the location of the incident, the extent of the regional damage, the likely influenced population, the statistics of the injured, the gender and age of the injured, the statistics of the dead, population needs, needed forces, operational and relief vehicles, individual and collective pieces of equipment, access ways, medical emergency needs,

accessible capacities and facilities, provided services, reports on the actions, the role of the injured households, required vehicles, identities of information providers, depot inventories and biological, hygienic, and edible relieves, healthcare consequences, the present population and potentials in the region, reports on the injured, health requirements, and descriptions of the activities

India: Reports on the type of the disaster, rate of mortality, degree of injuries, economic effects, locational and environmental destructions, central aid prerequisites, resources accessed by the federal government, and the rescue and relief operations' scale.

Discussion

Information and communications management is a component of planning strategies in disaster management. In this domain, the specialized competence and training of response teams are necessary during disasters. However, the Pan American Health Organization (PAHO) distinguishes information management from communications management. Information management deals with four disaster-related domains: 1) compiling situational reports and scientific documents for preparedness, 2) coordinating the on-time and efficient distribution of information, 3) collecting and organizing information exchange with health systems at national and international levels, and 4) organizing and presenting reports and other scientific and technical information on disasters. Communications management deals with seven domains: 1) assisting with health-sector information and communications management planning, 2) promoting, facilitating, and producing communication sources for the response-related activities of the health sector, 3) providing necessary advice in media communications management, 4) counseling with intermediate teams in the Ministry of Health, 5) assisting with managing media communications and distributing key messages, and 6) monitoring media coverage besides facilitating and promoting activities that highlight the contribution of the health system.[14]

Before developing and presenting any model on communications and information exchange management, we should consider ten fundamental principles. The first is accessibility. Philanthropic information should be accessed by those who are active in relief and altruistic aid. In other

Table 4: Commonalities of selected countries in disaster and emergency management

	Shared communication tools and platforms	Shared data elements	Intra-organizational communications	Inter-organizational communications
Commonalities of selected countries in disaster and emergency management	-Mobile phones -Landline phones -Wireless radio systems -Courier -Video conference	-Incident type -Incident level and severity -Extent of financial losses -Statistics of the injured -Statistics of fatalities -Available capacities -Needs	Type of communications: -Bilateral -Vertical (top-down) -Vertical (bottom-up)	Type of communication: -Unilateral and bilateral -Horizontal and level communications

words, it should be compiled in a simple and comprehensible format to be used in disasters and translated into the local language, depending on the influenced region. Besides, accessibility means the ability to utilize information resources from various online and offline channels and media. The second principle is inclusiveness. Information exchange and management should be based on cooperation, participation, and information sharing. In this regard, all stakeholders, especially the representatives of injured communities in disasters, should reach agreements before disasters. The third principle is interoperability. All shared information should be easily retrieved, and all response organizations should access it. The fourth principle is accountability, which refers to the ability to assess information based on known resources reliably and validly. Information providers are accountable for the content they provide to their partners and stakeholders. The fifth principle is verifiability. Information should be accurate, non-contradictory, and based on convincing methodologies besides being confirmed by other external resources (extra-organizational authorities). Relevance is the sixth principle arguing that information should be applied, flexible, responsive, and based on decision and operation needs in all disaster phases. The seventh principle addresses objectivity. Communications and information managers should utilize various information sources for data collection in order to enjoy a thorough and inclusive insight for directing problems and providing necessary recommendations. The eighth principle is about humanity. Information should never be used for deviating from or harming influenced or at-risk populations, and the prestige of the injured should be respected. The ninth principle is the timeliness of the information. Philanthropic information should be collected, analyzed, and disseminated efficiently and be always up to date. Sustainability is discussed in the tenth principle. Information should be kept, indexed, and archived to be used in the future for preparedness and exploitation of teachings.[15,16] In the meantime, building pre-disaster distrust, deficits in communications, and non-alignment in the emergency reactions of communications and information exchange authorities intensify the difficulties of accountability for emergencies.[17,18] Before, during, and after disasters, disaster management should put into its agenda some actions concerning intra- and inter-organizational communications, information acquisition methods and resources, coordination among national disaster and emergency response communications, contribution and responsibilities of respective organizations, coordination mechanisms, communication tools, and information exchange platforms in public, private, and non-governmental organizations. In this regard, it should formulate ideas and approaches commensurate with likely future evolutions and various crisis conditions.[19]

Anne Qureshi and Rudolf Lushner[20] introduced interoperations with disaster response organizations, including organizing, facilitating, and supply chain member organizations, as the main role of the government. In a study entitled A Comparative Study of Crisis Management Information Systems, Rafi *et al.*[21] (2018) investigated inquiries in the literature on designing automatic Disaster Management Information Systems (DMISs) to identify similarities in design assumptions, conceptual designing, and design considerations. Their results showed that the research on DMISs considerably increased in different countries of the world since 2004. Furthermore, the base data and present resources were needed in many of the presented studies since they were important in efficiently responding to a disaster. The proposed communication infrastructures include Local Area Networks (LAN), Wide Area Networks (WAN), and satellite communications for better coordination among various response and relief organizations in different locations. Connection to these networks is enabled through the internet, Wi-Fi, Closed General Radio Services, or satellites. Although the research on DMISs has been extended over the past decade, it is still in its infancy. This paper provides valuable information on the differences among suggested DMISs that can help identify gaps for future progresses in enhancing the efficiency of DMISs. Future opportunities were also determined and discussed in this paper.

In a qualitative study entitled empirical insights for designing information and communication technology for international disaster response, Stute *et al.*[22] investigated disaster response systems and their approaches to information and communication technology separately at the international level. In the first phase of the study, they analyzed documents, including policies, operational

manuals, and strategies pertaining to disasters. Then, they interviewed disaster specialists in the second phase. In this respect, they analyzed the way of applying the term *disaster* and its concept, different disaster classifications, various response organizations, and the contribution of the United Nations. In this respect, 14 insights, including self-sufficiency, the uniqueness of every disaster, communicational loops and ties, flexibility, local resources, simplicity, resilient communications, scalability, centralization, timeliness, integration, accuracy, regular coordination, known processes, automatic reporting, and integrated Cyber-Physical Systems (CPSs), were presented.[22]

In a quantitative-qualitative study, Basset *et al*.[23] (2020) evaluated a framework for disaster response systems in insecure environments. In the first phase, they examined the differences among smart disaster response systems and their impacts on the quality of life of citizens. In the second phase, the evaluative criteria for smart disaster response systems were extracted, and in the third phase, definitions and approaches to developing a framework for smart systems were presented. In the fourth phase, the proposed frameworks were analyzed in detail, and, lastly, an applied sample that measured the reliability of smart systems was presented.

In a study entitled Analytical Tools for Complex Systems and Simulations, Cui *et al*.[24] (2020) presented a dynamic model for disaster information dissemination. This study measured individuals' willingness to share information with respect to their degree of intimacy which reflected the extent of social distance. Then, the model was presented based on individuals' selection priority to share information. The results of their extensive simulations showed that if individuals preferred to disseminate information to those with short social distances, the information dissemination process would be suppressed. Accordingly, to facilitate the dispersion of information, it is useful to consider rewards for information distributors in order to accelerate the dissemination process. In addition, this study examined the efficiency of the government's strategies in the distribution of information.

Seyedin *et al*. (2012) adopted a qualitative-quantitative approach to study the status of the disaster and emergency information and communication Systems in Iran's health sector. The statistical population consisted of Iranian health managers at three national, provincial, and regional levels. Simple randomized and purposeful sampling was used in the quantitative and qualitative phases, respectively. The findings revealed that the mean information-sharing score pertaining to disasters, recording internal and external risks, developing emergency management databases, and establishing incident-recording systems equaled 3.06, 2.66, 2.61, and 2.87, respectively. The disintegration of information and the lack of regional databases, vivid strategies, and formal incident information-recording systems at local and provincial levels were identified as the primary problems in establishing efficient communications and emergency information systems in Iran. Developing incident databases, formulating proper standards and protocols, compiling information strategies, training employees, and establishing a disaster and incident information center can help promote the current communication and information systems of Iran.[1,12,25]

Limitations of the study

Investigating all selected countries' documents and reports was impossible due to some language and internet limitations.

Suggestions for future studies

Future studies are suggested to investigate the inter-organizational coordination between the health sector and other response organizations, such as the police, fire department, etc.

Conclusion

The results of this study generally show that intra-organizational communications in response organizations were bilateral in all countries, and vertical communications were both top-down and bottom-up. Likewise, inter-organizational communications among response organizations were both unilateral and bilateral, as well as horizontal, in the selected countries. Given the reference, authority, and coordinating institutions in the response phase, disaster and emergency management was governed by the presidency, U.S. Department of Homeland Security, and Federal Emergency Management Agency (FEMA) in America, Prime minister and cabinet office, Ministry of Crises Management, and Central Council of Crisis Management in Japan, Prime minister and cabinet office, Emergency Management Australia (EMA), and Australian Council for International Development in Australia, Prime minister, Central Government, and General Office of Emergency Management in Turkey, Presidency, Ministry of Interior, and Crisis Management Organization in Iran, and Prime minister and cabinet, Ministry of Interior, and National Emergency Management Agency in India.

All selected countries depended on the government to manage disasters and emergencies. Besides, the role of military forces as a capacity in the response phase was bolder in Iran and America than in other countries. The roles of voluntary forces and non-governmental organizations were bolder in Iran, Turkey, and India. Japan and Australia were the countries whose governments had higher contributions than military forces and non-governmental organizations or did not play any role.

Concerning the history and level of disaster and emergency response planning, the longest history at federal, provincial, and local levels belonged to America (since 1803). Response planning in Japan dated back to 1880 and was at central, provincial, regional, and local levels. Australia started response planning in 1929 at the federal (national), provincial (territorial), and local (regional) levels. The response planning history in Turkey and Iran began in 1943 and 1959 at central levels, and India had the shortest history of planning (since 1960) at central, provincial, and regional levels. It is worth mentioning that all selected countries, except for Iran and Turkey, with central systems, followed a similar structure.

Concerning the shared communication tools and platforms among response organizations, mobile phones, landline phones, wireless radio communication systems, video conferences, and couriers were common and conventional. Furthermore, the type of the incident, level, and severity of the incident, degree of financial losses, statistics of the injured, statistics of fatalities, available capacities, and needs were the information exchanged among response organizations in the form of shared data elements.

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Conflicts of interest

There are no conflicts of interest.

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