

Concepts in Disaster Medicine

Cite this article: Rajabi E, Bazyar J, Delshad V, Khankeh HR (2022) The evolution of disaster risk management: historical approach. *Disaster Med Public Health Prep* **16**: 1623–1627. doi: <https://doi.org/10.1017/dmp.2021.194>.

First published online: 17 August 2021


Keywords:

concept formation; disaster medicine; disasters; history; risk management

Corresponding author:

Hamid Reza Khankeh,
Email: hamid.khankeh@ki.se

The Evolution of Disaster Risk Management: Historical Approach

Elham Rajabi, Jafar Bazyar , Vahid Delshad and Hamid Reza Khankeh

Health in Emergency and Disaster Research Center, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

Abstract

The concept of Disaster Risk Management (DRM) has changed throughout history. Identifying changes and related factors can be effective in adopting logical, scientific and evidence-based approaches in the future. Therefore, this study was conducted with the aim of depicting the process of changes in the concept of DRM and creating an original perspective. In this narrative literature review study, we used historical approach. Literature, regardless of the time of publication, was searched using divergent keywords including “disaster, health, emergency, management, risk, disaster medicine, and hazard.” DRM evolution started with the emergence of civil defense during the last century. Although DRM was initially focused on responses, currently, this concept includes disaster risk reduction (DRR) and disaster management. DRR includes prevention and mitigation, and disaster management includes response and recovery measures. DRR considering underlying risk factors such as social factors, and focusing on participation of communities are important steps to be taken.

Introduction

Based on EM-DAT database, since 1900 to the present, more than 22000 mass disasters have occurred around the world.¹ As one of the most effective disasters after World War II., the current COVID-19 pandemic was unprecedented in terms of the global spread, damage and casualty of the virus.²

The nature of these disasters, is such that not only can we not eliminate them, but rather we have seen an increase in them across the world, so that disasters have become one of the major challenges of development; in response, communities have always attempted to adopt measures to deal with the adverse consequences of disasters. All actions taken in this direction pursue a common goal, which today is referred to as the concept of “Disaster Risk Management (DRM).”^{3,4} The Sendai framework, as an authoritative international document for action by 2030, calls for DRM for all global policies.⁵ The concept of DRM is described in 4 stages of mitigation, preparedness, response, and recovery.³ The Sendai framework envisages health at the heart of DRM and, for the first time, suggests that health and DRM are significantly intertwined at the multi-sectoral global policy level; consequently, all events that affect human health can affect this concept, as well. If sufficient capacity is created in countries and communities for mitigation, preparedness, response, and recovery, then hazard, exposure, and vulnerability management can reduce disasters and damage to health. The relationship between health and DRM has had significant achievements, but it has always faced challenges affecting DRM.⁶ Since, the concept of DRM has constantly changed, these questions are raised in this respect: why has this concept changed over time? What features and indicators have dominated at each time interval that led to a change in this concept? What changes have occurred and why? In other words, the question, which should be addressed, is as follows: “what is the original picture of DRM from the beginning of its formation until today?”

Since changing a concept and its evolution are based on the conditions of different time periods and related events, reviewing changes and understanding the evolution of the concept of DRM can be used to identify the challenges that human society faces in this regard. It seems that identifying these changes and the effective factors can be beneficial in adopting logical, scientific and evidence-based approaches in the future. This paper aims to depict the process of changes in the concept of DRM, identify the roots, and dimensions of this concept, and draw an original picture of DRM.

Methods

This study was conducted in the form of a narrative literature review adopting a historical approach. Historical literature review focuses on reviewing the contents of articles, books, etc., over a period of time. This review often begins with the first appearance of a problem, concept, theory, or phenomenon in the literature, and then traces its developments. The purpose of

such reviews is to place developments in a historical context in order to become acquainted with gradual progress and to identify possible directions for the future.⁷

From April to September 2019, the research team searched for English language articles in the field of disaster medicine, regardless of the time frame. At this stage, by using the keywords, “disaster, health, emergency, management, risk, disaster medicine, and hazard,” which were combined with “AND” and “OR” in scientific databases including PubMed, Scopus, Google scholar, and Medline, data was collated and the search was complete. Reference books in this field were either read manually or, if a PDF file was available, keywords were searched and related sections were studied. The gray literature used included the websites of international organizations in the field, such as the United Nations Office for Disaster Risk Reduction (UNDRR), the WHO, the Prevention Web, and authoritative international documents such as *the Hyogo Framework for Action*, and the Sendai Document. The items that appeared to have had a significant impact on the formation, change and evolution of the concept of DRM and have been a turning point in its history were selected. These pieces were then put together like a puzzle, in chronological order, so that the events and developments that have influenced the evolution of the DRM concept, were listed from old to new. In this way, a process of change over time, from the past to the present, was shown.

Results

The Origin of DRM Modernization

Until the middle of the 20th century, modern disaster management did not appear in the form of an emerging set of global standards and organized efforts. There is a certain period in recent history that witnesses the greatest general movement toward centralized safeguarding of citizens, and this period is the time of the formation of civil defense. In the same vein, a number of civil defense units were promoted over time to more comprehensive organizations for managing disasters. Additionally, legal frameworks were created to support these organizations, and the basis for modern management of disasters was formed.^{4,8}

The Tendency of Societies to Focus on Disaster Response

The advancement of disaster management practices has evolved from the 1970s and humanity has gained a deeper understanding of the reality of disasters over a long period of time. In the same vein, integrated and holistic approaches were developed to reduce the impact of disasters. In the 1970s and 80s, the emergency management capacity played a significant role at national level in the countries that focused on the creation of emergency management systems at the national level. Many of these countries developed their disaster management capabilities, irrespective of necessity.¹

The International Decade for Natural Disaster Reduction, IDNDR

On December 11, 1987, the United Nations General Assembly announced that the 1990s will be named as “The International Decade for Natural Disaster Reduction (IDNDR)”, to raise awareness of the importance of reducing disaster risk.⁹ This effort was undertaken to promote internationally organized efforts to build capacity, and reduce the loss of economic, and social resources after natural disasters, especially in developing countries. Following this action, on December 22, 1989, the General

Assembly, by means of United Nations Resolution 236/44, identified its goals to be achieved by the end of the decade and set up a special office for the United Nations to coordinate related activities in Geneva. This resolution calls for various UN agencies to build capacity, pay special attention to developing country assistance, design guidelines and strategies, foster scientific and technical endeavors, publish new technical information, and develop appropriate tools.⁴

DRM evolution during the last century depends on 3 important events which include Yokohama, Hyogo, Post Hyogo or Sendai.

1) The Yokohama Strategy

In May 1994, the United Nations announced that it was necessary to hold an international conference on natural disaster reduction to assess the achievement of the goals previously set for IDNDR in Yokohama, Japan. At the meeting, Yokohama’s strategy and its plan of action were formulated to create a more secure world, as it was recognized that humanity needs world-class risk management.¹⁰

At the end of the IDNDR, it was concluded that international communities are increasingly aware of natural disasters and consider these disasters as a serious threat to economic and social stability. Since the prevention of disasters is the most important long-term solution to this threat, the biggest challenge of the decade was to create a global prevention culture. In this context, the IDNDR Secretariat at the United Nations organized the Forum IDNDR program in the final years of this decade.

Following the positive advances made by the United Nations and a number of countries in the 1990s, the UN General Assembly set up an international agency in December 1999 called the International Strategy for Disaster Reduction (ISDR).¹

2) The HYOGO Framework for Action (HFA)

When the Kobe area was severely affected by the 7.7 magnitude, Great Hanshin Awaji earthquake on January 17, 1995, Japan, which was prepared to respond to major disasters, was once again evaluated in this respect. In the Kobe earthquake, which affected vast areas in Hyogo, about 6400 people died and 40000 were injured.¹¹

In 2005, 168 countries gathered at the international conference on disaster reduction in Kobe, Japan and designed the Hyogo Framework for Action during the years 2005 to 2015, in order to make nations and communities resilient against disasters. The 10-year program, called the HFA plan, has led the international community to adopt a more comprehensive and holistic approach to mitigate disaster risk. It also called for countries to pursue 3 strategic goals during the decade,¹² including: (1) Integrate Disaster Risk Reduction (DRR) programs into all sustainable development policies and programs, (2) Develop and strengthen institutions, mechanisms, and capacities to create resiliency against hazards, and (3) The systematic implementation of risk reduction approaches in implementing emergency preparedness, response and recovery. These goals were considered in line with the Millennium Development Goals (MDGs), including the understanding and recognition of a close relationship between DRR and overall development of the countries.⁴

3) The Post-2015 Framework (Post-HFA)

After the huge tsunami following the 9-magnitude earthquake on March 11, 2011, in Sendai, Japan, infrastructure and buildings

remained intact, largely due to Japan's resiliency and law enforcement, especially in construction and earthquake-related technology.¹³

After that, the third world conference on disaster reduction was held to examine the outcome of the years of preparedness which was decided upon after the implementation of the Hyogo framework in 2015, and to formulate a new global framework. At this time, the international community's desire was to continue to make progress with respect to the international cooperation to reduce the risk of disasters based on knowledge, practice, and the implementation of each of the previous efforts. In fact, the achievements that have been gained by this time have come from the IDNDR, the Yokohama Strategy and Plan of Action, the International Strategy for Disaster Reduction, and the HFA. The elements that were proposed in the new framework, after the 2015 program, at the Sendai world summit on disaster reduction, include goals and recommendations. The objective of this DRM framework was to develop at the local, national, regional, and global levels in order to make people, communities and countries resilient.¹⁴ Some of the recommendations presented in this regard included guiding principles, implementation measures, and areas of focus (including public awareness and education, international cooperation, monitoring, reporting, and reviewing). Another important issue discussed at this meeting was how to change the previous measures to the necessary measures based on the new framework. It is worth noting that the points that were specified as the global aims, encompassing reducing disaster losses by 50% by 2025 (or by a certain percentage over a given period); the reduction of disaster-induced economic damages by 2025; and the reduction of disaster-related damages to housing, education, and health services by the year 2025.^{4,5}

Modern DRM

Recently, the general approach to disasters has changed from post-disaster activities to a systematic and comprehensive risk management process, which highlights the importance of preventive activities, including prevention, mitigation, and preparedness. Although DRM was initially focused on responsiveness, evidence suggests that over time, by reviewing and sharing experiences between different communities, many changes have been made to this, and currently, it includes DRR and disaster management.³ DRR as a modern paradigm of DRM, is the last step along this path. It is a relatively new concept in the evolution of the concept of DRM. Today, DRM includes risk-reduction strategies and disaster management is considered a part of a more comprehensive system. This comprehensive system includes a set of measures for preventing, mitigating, responding, and recovering from adverse events. DRR includes preventive and mitigation measures, and disaster management includes response and recovery measures.^{3,15}

Discussion

In this study, we attempted to draw an original picture of DRM to reveal the roots, and dimensions of the concept of DRM, and determine the factors influencing its change from the past to the present. The prevailing conditions of communities during the process of changing the concept of DRM explain why this evolutionary change has occurred. By considering this original picture, managers and stakeholders in the field of DRM can gain advantage of previous experiences and avoid repeating past mistakes.

This review shows that the evolution of the concept of DRM began since the advent of passive defense in the middle of the 20th century, and in subsequent periods, it was proposed in the form of such concepts as civil defense, disaster management, and DRM. It can be said that the notion of civil defense was raised after World War II, and when societies were concerned about chemical warfare and its consequences.⁸ Therefore, in response to the threat posed by air strikes and nuclear strikes, many industrialized nations were to work towards the establishment of precise systems for centralized security of their citizens.⁴

During the 1990s, the first steps for international collaboration in DRM were taken. The UN's global conferences have played a special role in fostering cooperation among different communities. The UN has held 3 important conferences for disaster reduction, under the title, "The World Conference on Disaster Risk Reduction" hosted by Japan in: Yokohama (1994), Kobe (2005), and the Sendai (2015). At the conferences, government officials and other stakeholders from around the world began to discuss how to strengthen sustainable development through risk management and climate change. These scientific meetings led to the development of important global achievements and documents, each of which is considered a milestone in the history of DRM.

In 1994, the Yokohama Summit was held and the representatives of the participating countries, after hours of discussion and sharing DRM experiences, concluded that we need to think about the resiliency enhancement of countries. Following this international event, UNISDR was launched in 1999 to prepare countries to respond to disasters. At that time, the provision of an appropriate response to disasters was the main concern for countries, but this approach gradually changed, so that disaster risk and pre-event periods are now prioritized rather than disaster response and post-event periods, which were more focused on in the past.

In the evolutionary direction of the concept of DRM, an earthquake with the magnitude of 7.3 occurred in Hyogo. Subsequently, the Japanese, who have always been leading in the field of disaster, seriously raised the issue of DRR¹⁶; hence in 2005, the first major international meeting in Japan was held under the title of Hyogo Conference, and the Hyogo Framework was formulated, accordingly. The critique put forward at this meeting was that merely addressing resiliency means focusing on capacity building, which entails that we do not have a deep understanding of DRR. This was when societies came to believe that we are not able to completely eliminate the occurrence of disasters and, in particular, eliminate natural hazards, but, we can be confident that it is possible to mitigate the effects of disasters of any kind.

These communities have come to the conclusion that measures taken to reduce the risk of disasters are not a cost but an investment^{15,17}; therefore, disaster management focusing on the response phase was gradually replaced by DRM with the aim of educating communities about the importance of DRR.

DRM means the sum of 2 important elements, including disaster management and DRR. When the concept of DRM was used, the most important indicator was that disaster risk is to be managed rather than disaster alone. Therefore, we do not necessarily think of the response to a disaster, instead we think of the whole process of a risk management cycle. With this approach, residual risk is reduced, and subsequently the response will be smaller and less costly.

It should be noted that expected outcomes are similar in both Sendai and Hyogo documents. Hyogo documents include several items such as substantial reduction of disaster risk and loss in lives, health, economy, etc. However, the risk reduction has been

considered as a separate document in Sendai to increase the sensitivity of the subject.

Following this change of approach, since the basis of DRM is the understanding of disaster risk, the focus on understanding disaster risk has increased over the interval between Hyogo and Sendai frameworks.¹⁴ Although, issues such as risk identification, risk monitoring and risk assessment have been mentioned in the Hyogo Framework, understanding disaster risk has been seriously addressed in the Sendai document. It can be said that in the 5 priorities of the Hyogo framework, the emphasis was on preparedness, but the 4 priorities of the Sendai document are as follows:

- 1) Understanding disaster risk;
- 2) Strengthening DRM to manage disaster risk;
- 3) Investing in DRR and resilience;
- 4) Enhancing disaster preparedness for effective response, and “Build Back Better” in recovery, rehabilitation and reconstruction.⁵

This document emphasizes that any policy and practice should be based on understanding the concept of risk. In this regard, the Sendai document emphasizes the design of context-band models. If DRM models are tailored to each community in accordance with its conditions, and adjusted to the characteristics of that specific community, then there will be an “understanding of disaster risk.” Obviously, a single model cannot be generalized for all the world’s societies, although its principles are the same. This model is developed if we could capture a picture of the hazards of a community; so it is necessary to identify elements such as vulnerability, exposure, capacity, and hazards in the target community and design a model highly compatible with that specific context. In this way, risk perception is formed and risk informed decision making would be possible. Ideally, DRM is based on the prioritization process. When hazards are identified, they are evaluated for the likelihood of the damage and the impact of the damage they cause. Then, considering vulnerability, exposure, and capacity, hazards are prioritized based on the highest probability and the maximum impact of the associated damage.¹⁸ An important issue is that today, DRM deals with such important vulnerability factors, including political,¹⁹ economic, and sociocultural conditions, fragile infrastructure, lack or weakness of the developed safety policies, inappropriate socio-political organizations, lack of early warning systems, and increased population density, especially around chemical facilities.^{16,20}

Moreover, one of the most important issues that must be considered as a priority in many societies is paying attention to underlying risk factors such as poverty, social capital, gender based violence, sexual harassment, gender inequity, and cultural influential factors. In the management of the tsunami in Japan (2011), 1 of the most important facilitators for emergency managers was the proper behavior of the people, who followed the orders with caution. In other words, social capital in this country has played an important role in the recovery phase, because people’s respect for moral values and solidarity, prevents them from rushing for help and looting available resources. Furthermore, people’s respect for moral values encourages them to prioritize public benefits over personal interests.¹³ The importance of the underlying factors in DRM, especially in response and recovery phases, has also been emphasized in other studies.^{19,21,22} Although mentioned in the Hyogo documents, the importance of cultural influential factors was seriously emphasized in the Sendai summit.

It can be said that at present, DRM approaches are shifting towards community participation, community involvement, and

community ownership. Nowadays, community participation and collaboration is very important, which is the fact emphasized by different international documents. The latest international frameworks for DRM, in particular the Sendai document, emphasize the need for active participation in DRR, as well as the creation of new partnerships between private and public institutions to reduce the current and future risks.²³ DRR considering underlining factors and focusing on participation and community, is important because all included stakeholders and lay people should be involved in the disaster risk cycle.

According to the Sendai framework, the year 2020 seems to be a turning point. On October 13, 2020, which was the International Day for Disaster Risk Reduction, the slogan chosen was: “it’s all about governance.”²⁴ The slogan was chosen at a time when a large number of deaths and ill people could be attributed to COVID-19 infection. This slogan is in line with target E of the Sendai framework that states:

*“Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020”.*⁵

With the realization of this slogan, many disasters can be prevented, provided that there are risk reduction strategies, and new risks are prevented. This requires proper disaster risk governance. Certainly, the events that occurred in 2020 will be remembered for a long time; it is hoped that it will not only be remembered for the disaster created by COVID-19, but also for the beginning and adoption of effective measures and fundamental reforms to manage disaster risk in a systemic way.²

In a message released this year on disaster risk reduction day, the Director-General of WHO, Dr. Tedros Adhanom Ghebreyesus, said: “COVID-19 has reminded us that for all our differences, we’re 1 humanity, and that the only way to build a safer world is together.”

He believes that the COVID-19 pandemic has affected all sectors of the society and economy, highlighting the relationship between human, animal and planetary health; therefore, only with the 1 Health approach, can this problem be solved.²⁵

Referring to the COVID-19 pandemic, the Secretary-General’s Special Representative for DRR, Mami Mizutori, also stated that COVID-19 sheds new light on the systemic nature of danger as we can see today. A public health disaster quickly became a socio-economic disaster on a scale we had never seen before. We have learned from the worst tragedy of the 21st century that if we do not strengthen disaster risk governance to deal with the existing threats, we are doomed to repeat the mistakes of the past months, which resulted in damage to the physical, economic, and social well-being of millions of people. Hence, that is why governments need to develop their national DRR strategies with a clear understanding of the systemic nature of disaster risk. Importantly, these strategies should not remain on paper.²⁶

According to the history of DRM, as well as the experiences that COVID-19 has taught us in the recent months, it seems that fundamental steps should be taken. The global response to COVID-19 offers important lessons and unprecedented experiences that can help to shape future risk reduction policies and take effective measures all around the world.²⁷

Ethics in Disaster

Today, disaster ethics are very challenging and important and have received increasing attention. It includes a wide range of issues, from triage and distribution of resources in situations where they are limited, to the use of advanced techniques such as biological

diagnostic methods and the use of DNA to identify victims of disasters.^{28–30}

Although modern hazards, especially man-made ones, have become very complex, the ethical principles including beneficence, autonomy, non-maleficence, and social justice, governing the behavior of health care providers, are always fixed and unchangeable; therefore, it is necessary to update the elements of disaster ethics in the various stages of DRM in accordance with these events.³¹

Study Limitations

The literature review method used in this study may have prevented us from accessing some relevant contents. Including only English contents may also have resulted in overlooking valuable information available in other languages.

Conclusion

Although DRM was initially focused on responses, currently, this concept includes DRR and disaster management. DRR includes preventive and mitigation measures, and disaster management includes response and recovery measures. It can be said that DRM should be designed at the national level; based on the circumstances of each country, it is not possible to prescribe a single DRM framework for all countries, while the DRR framework can be designed internationally. Therefore, major international documents focus on DRR. It seems that DRM has recently been shifting towards addressing contextual influencing factors as well as local authority improvement; it is now recommended that studies should be conducted to identify the characteristics of various communities, including contextual, cultural, social, economic, and belief factors that influence the design of DRM models, and to create a compatible DRM model based on the local conditions.

References

1. **Centre for Research on the Epidemiology of Disasters (CRED).** The International Disaster Database (EM-DAT) Belgium: CRED. Updated 2009. <https://www.emdat.be>. Accessed August 4, 2021.
2. **Toscano-Rivalta M.** Disaster risk reduction in light of the COVID-19 crisis: Policy and legal considerations. *QIL*. 2020;70:37–57.
3. **Ciotton G, Anderson PD, Heide EAD, et al.** *Disaster Medicine*. 1st ed. Philadelphia, U.S.A.: Mosby Elsevier; 2006.
4. **Coppola D.** *Introduction to International Disaster Management*. 3rd eds. Oxford, United Kingdom: Butterworth-Heinemann (Elsevier); 2015:760 p.
5. **United Nations Office for Disaster Risk Reduction (UNISDR).** *Sendai Framework for Disaster Risk Reduction 2015–2030*. UNISDR; 2015.
6. **Wright N, Fagan L, Lapitan JM, et al.** Health emergency and disaster risk management: Five years into implementation of the Sendai framework. *Int J Disaster Risk Sci*. 2020;11:206–217.
7. **Charles Sturt University Library.** Literature Review: Traditional or narrative literature reviews. Charles Sturt University, Australia; 2021. Available from <https://libguides.csu.edu.au/review>.
8. **Hecker N, Domres BD.** The German emergency and disaster medicine and management system—history and present. *Chin J Traumatol*. 2018;21(2):64–72.
9. **United Nations Office for Disaster Risk Reduction (UNISDR).** *International Decade for Natural Disaster Reduction (IDNDR) program forum 1999: Proceedings 5–9 July 1999*; Geneva, Switzerland: 1999. https://www.preventionweb.net/files/31468_programmeforumproceedings.pdf.
10. **The States Members of the United Nations and other States.** *Yokohama Strategy and Plan of Action for a Safer World: Guidelines for natural disaster prevention, preparedness, and mitigation*. World Conference on Natural Disaster Reduction; 23 May to 27 May, 1994; Yokohama, Japan: IDNDR. https://www.preventionweb.net/files/8241_doc6841contenido1.pdf.
11. **Britannica, The Editors of Encyclopedia.** Kōbe earthquake of 1995. *Encyclopedia Britannica*, 10 Jan. 2021. <https://www.britannica.com/event/Kobe-earthquake-of-1995>.
12. **United Nations Office for Disaster Risk Reduction (UNISDR).** *Hyogo Framework of Action for 2005–2015: Building the Resilience of Nations and Communities to Disasters*. World Conference on Disaster Reduction, 2005; Hyogo, Japan: International Strategy for Disaster Reduction (ISDR). <https://www.unisdr.org/2005/wcdr/intergover/official-doc/L-docs/Hyogo-framework-for-action-english.pdf>.
13. **Zaré M, Afrouz SG.** Crisis management of Tohoku; Japan earthquake and tsunami, March 11, 2011. *Iran J Public Health*. 2012;41(6):12–20.
14. **Aitsi-Selmi A, Murray V, Wannous C, et al.** Reflections on a science and technology agenda for 21st century disaster risk reduction. *Int J Disaster Risk Sci*. 2016;7:1–29.
15. **Cabinet Office, Japan.** *Disaster Management in Japan*. Japan: Cabinet Office; 2015. http://www.bousai.go.jp/1info/pdf/saigaipamphlet_je.pdf.
16. **Katayama T.** Earthquake disaster risk mitigation before and after the 1995 Kobe earthquake. 13th World Conference on Earthquake Engineering; Vancouver, B.C., Canada: Paper No. 5005, August 1–6 2004.
17. **Wisner, B, Blaikie P, Cannon T, Davis I.** *At risk: Natural hazards, people's vulnerability, and disasters*. 2nd eds. England, United Kingdom: Routledge; 2004. 464 p.
18. **Keim M.** Defining disaster-related health risk: A primer for prevention. *Prehosp Disaster Med*. 2018;33(3):308–316.
19. **Prinsloo B, van der Waldt G.** Expanding the disaster risk management framework: Measuring the constructed level of national identity as a factor of political risk. *Jamba*. 2016;8(1):232.
20. **Koenig KL, Schultz CH.** *Disaster medicine: Comprehensive principles and practices, (first ed.)*. Koenig KL, Schultz CH (eds.). Cambridge University Press, New York, U.S.A; 2010.
21. **Alipour F, Khankeh H, Fekrazad H, Kamali M, Rafiey H, Ahmadi S.** Social issues and post-disaster recovery: A qualitative study in an Iranian context. *Int Soc Work*. 2015;58(5):689–703.
22. **Flanagan BE, Gregory EW, Hallisey EJ, Heitgerd JL, Lewis B.** A social vulnerability index for disaster management. *J Homel Secur Emerg Manag*. 2011;8(1):24.
23. **Hochrainer-Stigler S, Lorant A.** Evaluating partnerships to enhance disaster risk management using multi-criteria analysis: An application at the pan-European level. *Environ Manag*. 2018;61:24–33.
24. **World Health Organization.** *The International Day for Disaster Risk Reduction (IDDR) – 13 October 2020*. [https://www.who.int/news-room/events/detail/2020/10/13/default-calendar/the-international-day-for-disaster-risk-reduction-\(idrr\)-13-october-2020#:~:text=The%20theme%20will%20be%20%27risk%20reduction%20strategies%20by%202020](https://www.who.int/news-room/events/detail/2020/10/13/default-calendar/the-international-day-for-disaster-risk-reduction-(idrr)-13-october-2020#:~:text=The%20theme%20will%20be%20%27risk%20reduction%20strategies%20by%202020).
25. **World Health Organization (WHO).** WHO director-general calls for 'ONE HEALTH' approach; 2020. <https://www.undrr.org/news/who-director-general-calls-one-health-approach>.
26. **McClellan D.** Nature-based solutions vital for risk governance: United Nations Office for Disaster Risk Reduction (UNDRR); 2020. <https://www.undrr.org/news/nature-based-solutions-vital-risk-governance>.
27. **United Nations Office for Disaster Risk Reduction (UNDRR).** *Initial Covid-19 engagement strategy*. 2020:1–3. <https://www.undrr.org/sites/default/files/2020-04/COVID19%20Action%20Plan%20EXTERNAL.pdf>.
28. **Weisleder P, Vidaurre J.** Allocating medical resources during a mass casualty emergency: Sometimes it is ok to wait. *Pediatr Neurol*. 2020;110:3–4.
29. **Caenazzo L, Tozzo P, Rodriguez D.** Ethical issues in DNA identification of human biological material from mass disasters. *Prehosp Disaster Med*. 2013;28(4):393–396.
30. **Weinstein E, Gosney JE, Ragazzoni L, et al.** The ethical triage and management guidelines of the entrapped and mangled extremity in resource scarce environments: A systematic literature review [published online ahead of print, 2020 May 27]. *Disaster Med Public Health Prep*. 2020;1–9.
31. **Pingree CS, Newberry TR, McMains KC, Holt GR.** Medical Ethics in Extreme and Austere Environments. *HEC Forum*. 2020;32(4):345–356.