

Systematic Review

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Mutual Impacts of the COVID-19 Pandemic and the Recent Earthquakes: A Scoping Review of the Lessons Learned

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Abstract

Objective: The aim of this study was to review the articles dealing with the mutual impacts of the coronavirus disease 2019 (COVID-19) pandemic and the recent earthquakes to elicit the various scopes of the lessons learned including the challenges, the successful measures, and the recommendations.

Methods: To detect the relevant studies published between February 1, 2020, and June 9, 2021, PubMed, Web of Science, Scopus, and Google Scholar were searched. Having considered specific inclusion/exclusion criteria, 18 studies were included.

Results: Seven major earthquakes have occurred concurrently or before the pandemic era in Albania, Croatia, Haiti, Great East Japan, Mexico, Nepal, and Utah. Thematic analysis revealed 5 themes for the “challenges” (management inefficiency, increased life-threatening, economic, socially related, and dual psychological challenges); 4 themes for the “efficient response measures” (health-care services measures, government measures, community-based cooperative activities, and disaster management response); and 3 major themes with 7 sub-themes for the “recommendations” including “the mitigation phase” (identifying probable natural disasters), “the preparedness phase” (preparing necessary equipment), and “the response phase” (mental care response measures, health-care-related COVID-19 measures, economic improvement measures, recognizing community-based capabilities, and government-related boosting measures).

Conclusions: It is suggested that these scopes of the mutual impacts of the COVID-19 pandemic and the earthquakes be studied in systematic reviews.

An Overview to the Contradictory Nature of Coronavirus Disease 2019 and Earthquake Co-occurrence

A concern has aroused since the onset of coronavirus disease 2019 (COVID-19) pandemic regarding the challenges encountered during emergency response in a natural disaster, such as an earthquake, which usually necessitates evacuation, transportation, or mass gathering in the affected areas. The challenges arise when the assemblies may contrast prevention strategies, including physical distancing and home isolation. Staying at a shelter during the COVID-19 pandemic would likely lead to an outbreak. The occurrence of earthquakes coincident with the pandemic may prevent the effective practice of such measures, and consequently cause an increase in the virus spread.^{1,2} In this context, the impact(s) of the virus spread and disaster management phases are mutual because, apart from the problems pertinent to COVID-19 spread caused by the disaster management measures, the infecting nature of the pandemic can undoubtedly affect the speed and efficiency of the measures.

Yet, the mentioned issues are still pertinent to only the response phase of disaster management activities. More complex issues can also be envisaged with respect to mitigation, preparedness, and recovery phases of disaster management plans with regard to the concurrence of COVID-19 and earthquakes. As different earthquakes have occurred from the onset of the COVID-19 pandemic, a plethora of studies might have been conducted having openly or indirectly dealt with different aspects of the mutual influences of the pandemic and the occurred earthquakes. The current study has endeavored to review these articles to elicit the various areas of the lessons learned having been revealed therein.

Synopsis of the Previous Review Studies

The published review studies on the coincidence of COVID-19 and disasters shows that, in a systematic review,³ the types of health-care responses to coincidence of COVID-19 and all

Table 1. Evacuation status under the condition of the COVID-19 pandemic

Surveillance and information-sharing (public assistance)	Starting time of surveillance	In the case of COVID-19, which is regarded as an infection that is spread through contact or droplets, there is a risk of rapid spread from infected persons. Therefore, a system is required that enables postdisaster surveillance to be carried out simultaneously with the establishment of evacuation centers.
	Method of implementing surveillance	Continuous implementation of measures without omissions, even for small-scale evacuation centers and evacuees who are dispersed, is essential.
	Method of sharing information	A system for ensuring that information reaches evacuees, including those who are dispersed or in small-scale evacuation centers, is necessary.
Evacuation center environment and stockpiled supplies (public assistance)	Evacuation space	6m ² per person is required for securing 2 m of social distance. The number of individuals who can be accepted at evacuation centers will be approximately one-third of the number usually accepted, making it more difficult to secure evacuation space.
	Spaces for isolation	Because droplets are the infectious agent, securing space for isolation is the most critical issue.
	Stockpiled supplies	<u>During pandemics, masks and alcohol disinfectants are in short supply.</u> Therefore, evacuees need to bring these items with them.
Community disaster risk reduction and community leadership (self-help and mutual assistance)	Sanitary environment	Hand hygiene that extends beyond conventional practices is necessary and is performed according to individual evacuees' judgments and sense of responsibility.
	Autonomous activity	Self-governance entailing residents' leadership is challenging to implement in the case of dispersed evacuees.

Note: Adapted from Sakamoto et al, 2020.

disasters have been probed. Earthquake events constituted only 1 section of the study. Another review study,⁴ has aimed to propose policies and approaches to manage dual disasters of flooding and COVID-19. The idea of Top-Hazard Approach (THA) has been introduced in a review study,⁵ as a consolidated alternative framework to ALL-Hazards Approach (AHA), arguing that inherently different events require different planning and mitigation tactics. Finally, another study has reviewed the significance of incorporating contemporary management concept into the traditional disaster management cycle due to the current COVID-19 pandemic.⁶ The idea of One Health multidisciplinary approach supported by the Sendai Framework for Disaster Risk Reduction 2015-2030 has been elaborated in a study claiming that a cooperative approach between human and animal health professionals is necessary to be developed.¹

In a review study,⁷ the past occurrences of complex disasters entailing a combination of natural disasters and infectious diseases have been compiled and systematically organized. In this study, the evacuation measures that specifically relate to COVID-19 have been discussed. The adapted version of a more detailed table in this study,⁷ is seen in Table 1 below. Considering the review studies mentioned above, it seems that the idea of reviewing the mutual impacts of the consequences of COVID-19 and the recent earthquakes has not yet been investigated.

Purpose of the Current Review

The present study is, therefore, a scoping review that has attempted to pinpoint the beneficial findings of the studies focusing on the reciprocal impacts of COVID-19 spread and the concurrent earthquakes or those occurred previously but the consequences of which still affect COVID-19 management and spread and are simultaneously affected by the pandemic. The scoping type of review was adopted in this study due to the reasons that: (1) a scoping study usually maps the key concepts underpinning a research area and

the main sources and types of evidence available when an area is complex or has not been reviewed comprehensively before⁸; (2) this type of review provides a mechanism for summarizing and disseminating research findings to policy-makers, practitioners, and consumers who might otherwise lack time or resources to undertake such work themselves⁹; (3) in the current study, this review type can address current matters and approaches related to the concurrence of earthquake and a pandemic and offer new perspectives on the matter or point out areas for further research.¹⁰

Methods

This scoping review was carried out based on a framework including the following 5 stages⁹: Identify the question; Identify the relevant studies; Study selection; Charting the data; and Collating, summarizing, and reporting the results.

Identify the Question

Based on the purpose of the study, the questions seeking for the lessons learned, as the results of the mutual impacts of the COVID-19 and the earthquakes, were determined to be as follows: (1) What was the nature of the *challenges* experienced as the results of the mutual impacts of the earthquakes and the COVID-19 pandemic? (2) What was the nature of the *successful measures* to manage the reciprocal impacts of the 2 disasters? and (3) What is the nature of the *recommendations* offered to remove/alleviate the challenges?

Identify the Relevant Studies

The search strategy was determined to look for studies published between February 1, 2020, and June 9, 2021. The search operators included Boolean operators (AND, OR, and NOT), parenthesis, and truncation and the keywords were the terms associated with

Table 2. Search query used to detect the relevant studies

Search operators	Search terms used
Boolean operators (AND, OR and NOT), parenthesis, and truncation	TS = ((COVID-19 OR Coronavirus OR "Corona Virus" OR "2019 Coronavirus" OR "2019 Coronavirus Disease Crisis" OR Corona-Virus OR SARS-CoV-2 OR SARS coronavirus OR severe acute respiratory syndrome coronavirus 2) AND (Earthquake))

Table 3. Databases used and the number of the studies retrieved

Database	Number of records
PubMed	34
Scopus	15
Web of Science	49
Google Scholar	30
Total	128

"COVID-19," which are usually found online as well as the term "earthquake" (Table 2).

To detect the relevant studies, the databases including PubMed, Web of Science, Scopus, and Google Scholar were searched using their particular searching procedure. A total of 128 studies were retrieved (Table 3).

Inclusion/Exclusion Criteria

The inclusion criteria to maintain the relevant studies to be reviewed were as follows: the studies that were related to the mutual impacts of a particular known earthquake and the COVID-19 pandemic regardless of the exact chronological co-occurrence of the 2 phenomena. In other words, the studies that had embarked on any mutual impact of COVID-19 pandemic and any past or currently occurred earthquake were included in the review process. Gray literature was not included in this review. Moreover, specific study designs were not considered as an inclusion criterion.

The studies with the following features were excluded from the study: (1) the articles that were related to the earthquakes having occurred during the COVID-19 era, but have not scrutinized any impact of one over the other,^{11,12} and (2) studies related to mass disasters during the pandemic.¹³ It is worthwhile to mention that, in our study, as any other scoping study, exclusion of the studies was extended to the final stage of data extraction phase.

Study Selection

A total number of 128 studies found as the result of search query underwent the screening process.

Screening Process

To screen the records found, first, having considered the inclusion and exclusion criteria, the titles and the abstracts of all the records found in Table 3 were reviewed independently by 2 team members to exclude the irrelevant ones. Following their agreement on the included studies, the major researcher performed an in-depth assessment on the articles' full-texts separately to determine their eligibility. The other members re-checked the eligible studies and discussed the inconsistencies until they were all resolved. According to PRIZMA in Figure 1, after removing the duplicates,

applying the exclusion criteria, and assessing the full texts for eligibility, out of the primary 128 records found during search strategy, 18 studies were finally included in the scoping review process.

Charting the Data

Data Extraction

Having read the 18 studies, it was observed that between February 1, 2020, and June 9, 2021, the COVID-19 impacts have been associated with 7 major earthquakes having occurred concurrently with or before the pandemic era. In the selected articles' texts, these 7 earthquakes have been mostly addressed based on their locations, including (alphabetically) *Albania*, *Croatia* (Zagreb), *Haiti*, *Great East Japan Earthquake* (GEJE), *Mexico* (La Crucecita, Oaxaca), *Nepal* (Gorkha), and *Utah* State (Magna city). Table 4 below shows the features of the 7 earthquakes underscored in the reviewed studies as well as the purposes of the 18 selected studies illustrating how any particular study deals with the associated earthquake. Table 4, therefore, provides both a familiarization with the included studies and their associated earthquakes as well as delivering a quick access to the required and basic information necessary to follow the results and the discussion of the present study.

In the next step, a *main data extraction form* was developed (Appendix 1). The articles were classified based on the 7 earthquake locations for which a brief description as well as all the relevant information units of the articles were inserted in the slots of the table. To increase the rigor of the data extraction process, 2 of the researchers of the current study were involved in the search strategy, but all 3 were engaged in the primary data extraction. The major author was in close contact with the other co-authors in an attempt to resolve any ambiguity arising during the process. When an idea required more inspection or contemplation, it was discussed among the 3 authors to reach agreement. The major author, however, rechecked any data extracted by the other 2 and tried to settle consensus whenever necessary.

Results

Collating, Summarizing, and Reporting the Results

Due to the qualitative and discourse analytic nature of the present study, thematic analysis^{14,15} was adopted on the extracted data to derive the codes, categories, and themes. Using the data from the *main data extraction form* (Appendix 1) as well as reading, pondering, and reflecting on the published articles and the extracted information repeatedly, the major author in collaboration with the corresponding author of the present study embarked on the coding process. Due to the large number of table developed on the coding and category-deriving details of individual studies for each earthquake, it was decided that 2 samples of such details, that is, the coding procedure of the extracted data of the articles related to 2011 Great East Japan Earthquake are shown in Appendix 2. All the derived codes have been incorporated in Appendix 3 based on the earthquakes and the articles.

Categories of the Lessons Learned

The next step was reviewing the information available in the tables from a broader scope, that is, maintaining the categorical scopes of all topics in terms of each earthquake. A sample of the process of subcategory and category derivation of the same codes of Japan's Earthquake is also depicted in Appendix 4 to illustrate what was

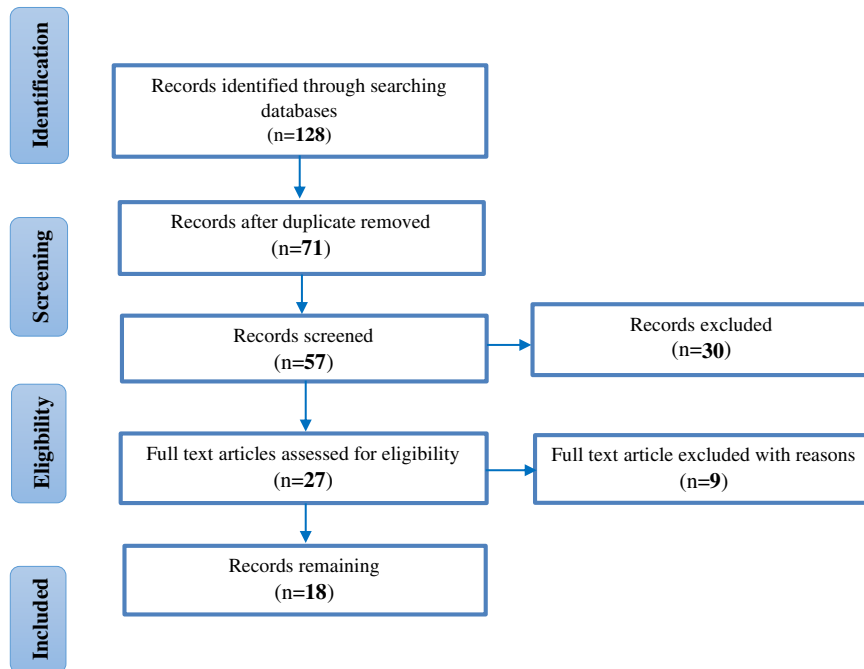


Figure 1. Review selection process and results based on the PRISMA guidelines.

done for the other cases. Through reading, reflecting, and re-reading, the codes of all *Challenges*, *Successful Measures*, *Public Cooperation*, and *Recommendations*, Table 5 (below) was created presenting all categories of the research question topics with respect to each earthquake, together with the frequency of each information category already detected in the studies.

To find the general scopes of all the information found in the current scoping review study that are expected to appear as the answers for the 3 research questions, the information in the major columns of Table 5 were supposed to be induced into broader scopes, that is, appropriate *themes*.

It is necessary to mention that the column of *public cooperation*, which was originally the topic of the fourth research question, was decided by the present authors to be incorporated into the *successful measures* topic due to the proximity of the 2 topics. The research questions were, therefore, reduced to 3 as was observed above in the introductory section. The results of the final round of the thematic analysis, showing the answers of the research questions, can be seen in Tables 6, 7, and 8 below. It should further be noted that following incorporation of the 2 topics mentioned above, it was observed that all successful measures are pertinent to the response phase of comprehensive emergency management (Figure 2). The title of this topic was then changed into *efficient response measures*.

Themes of the Lessons Learned

Research Question 1

What was the nature of the challenges experienced as the results of the mutual impacts of the earthquakes and the COVID-19 pandemic?

To answer the first research question, that is, to discover the nature of the challenges experienced as the result of the mutual impacts of the earthquakes and the COVID-19 pandemic in the selected studies, the 23 categories related to this topic (Table 6) were postulated deeply to find the possible underlying themes.

The researchers of this study, finally, agreed on the emerging 5 themes including, *management inefficiency challenges*, *increased life-threatening challenges*, *economic challenges*, *socially related challenges*, and *dual psychological challenges* (Table 6) together with their frequencies and the related earthquake locations.

Research Question 2

What was the nature of the efficient response measures to manage the reciprocal impacts of the 2 disasters?

Regarding the second research question, Table 7 depicts 4 themes emerging from the 10 categories associated with the topic of *efficient response measures*. These 4 themes are: *health-care services measures*, *government measures*, *community-based cooperative activities*, and *disaster management response*.

Research Question 3

What is the nature of the recommendations offered to remove/alleviate the challenges?

Table 8 provides information to answer the third research question dealing with the nature of the recommendations made in the reviewed studies. The 23 information categories tended themselves to be re-arranged into 3 major themes with 7 sub-themes for the Recommendations including “the mitigation phase” (including, *identifying probable natural disasters*), “the preparedness phase” (including, *preparing necessary equipment*), and “the response phase” (including, *mental care response measures*, *health-care-related COVID-19 measures*, *economic improvement measures*, *recognizing community-based capabilities*, and *government-related boosting measures*) (Table 8).

Discussion

This section elaborates on the most significant scopes (themes and categories) of the lessons learned in the relevant studies concerning

Table 4. Earthquakes' features pertinent to the COVID-19 era and the purposes of their associated selected studies

No	Earthquake features				Purposes of the associated studies	
	Earthquake location	Date of occurrence	Magnitude	Major earthquake features underscored in the reviewed study/studies	Study purpose	Publication date
1	Albania	Nov 26, 2019	6.3	Affected 202,000 people, including 51 victims, 17,000 displaced, 989 million Euros in damage.	To evaluate the long-term impacts of the earthquake and the COVID-19 events in the Albanian economy. ²⁰	2020
2	Croatia (Zagreb)	March 22, 2020	5.5	Despite extensive damages, Croatia has survived due to well-organized public health system and coordinated outbreak response.	[To illustrate the dual management of the pandemic and the earthquake by the health-care system*]. ²¹	2020
3				The health disruption experienced by the high-risk cardiovascular patients due to the COVID-19 and the earthquake	To report how outpatient cardiovascular rehabilitation in Zagreb was adapted to the emerging conditions due to the COVID-19 pandemic and the large earthquake. ²²	2021
4				The exacerbation of existing mental health disorders and contribution to "new" stress-related mental health disruptions and disorders	The dual mental pressures of COVID-19 and earthquake. ¹⁹	2020
5				The concurrence of meteorological and geological hazards interacting with COVID-19 impacts which will challenge the resilience of societies and systems	To discuss the issue of the cascading crises during the spread of COVID-19 pandemic. ²³	2020
6				The psychotic disorders during the time of the 2-fold simultaneous trauma; the COVID-19 pandemic and the devastating earthquake in Zagreb	To describe the functioning mode of 2 Day Hospitals for Early Intervention and Psychotic Disorders at Psychiatric Hospital "Sveti Ivan" during the outbreak of the COVID-19 pandemic. ²⁴	2020
7				Mixed impact of the COVID-19 pandemic and the earthquake on traffic flow	To introduce the application of Intelligent Transport Systems (ITS) which can particularly be used in cases of postdisaster occurrences such as flood, fire, or earthquake. ²⁵	2020
8	Haiti	2010	7	Following Haiti earthquake, a cholera epidemic that killed thousands of residents was inadvertently started by United Nations' aid workers.	To enlighten how the lesson learned in Haiti earthquake helped apply COVID-19 risk-reduction strategy during relief measures following Tropical Cyclone (TC) Harold. ²⁶	2021
9	Japan (Great East Japan Earthquake)	2011		After Japan Earthquake, pharmacists worked with local pharmaceutical wholesalers and other professionals to establish a supply system for drugs and sanitary materials	To show that the experience of the 2011 Great East Japan Earthquake (GEJE) will provide helpful information to better define the role of pharmacists in ongoing COVID-19 pandemic and future disasters. ²⁷	2020
10				The residents of Fukuhsima are experiencing COVID-19 pandemic following 2011 Japan disaster, a complex disaster of earthquake, tsunami, and nuclear accident which caused subthreshold PTSD.	To discuss the effects of subthreshold PTSD in a previous disaster on an exacerbation of PTSD symptoms in another disaster. ²⁸	2021
11 12				The effects of 2011 Japan Earthquake and Covid-19 pandemic on industrial supply chains	A public policy analysis of mandatory annual disclosures for listed companies. ²⁹	2021
13	Mexico (La Crucecita, Oaxaca)	June 23, 2020	7.4	During COVID-19 crisis, the earthquake triggered a tsunami which caused intertidal organism mortality.	To describe the details of the rapid response survey of the vertical coseismic deformation, tsunami, geologic effects, and lessons from working in the field during the COVID-19 crisis. ³⁰	2021
14	Nepal (Gorkha earthquakes)	2015	7.6	Nepal's already strained health system was worsened by the damages due to the Gorkha earthquakes; and is inevitably going to be impaired by the current pandemic	To explore how the long-term impacts due to the earthquakes are compounded by the evolving current pandemic. ³¹	2020
15				The fundamental role Nepalese women played in the country's response to the natural disaster.	what lessons we can learn when confronting the country's response to current COVID-19 global epidemic. ³²	2020

(Continued)

Table 4. (Continued)

No	Earthquake features				Purposes of the associated studies	
	Earthquake location	Date of occurrence	Magnitude	Major earthquake features underscored in the reviewed study/studies	Study purpose	Publication date
16				Viewing the 2 crises of 2015 Nepal earthquake and COVID-19 through the lens of politics of governance of crisis	To argue how the earthquake prompted many forms of citizen-centric politics of governance; forms we can witness in the immediate response to the global pandemic. ³³	2020
17				Comparing and contrasting Nepal earthquake in 2015 and the COVID-19 in terms of children or orphanage trafficking	To explain how each emergency has impacted children without parental care or at risk of family separation, with specific reference to orphanage trafficking, volunteerism, child institutionalization and family preservation. ³⁴	
18	Utah	March 18, 2020	5.7	With estimates of \$150 million U.S. in damage and a few injuries but no deaths, the earthquake was impacted by lockdown due to COVID-19, a toxic plume caused by the ground shaking, inclement weather, and a mountain lion.	To provide background on the planning and protocols for the COVID-19, to discuss the actual response; to provide details about the sequence, the design, and installation of the aftershock network, and coordination with partners and stakeholders; and to discuss public communication efforts. ³⁵	2021

*This is an implied purpose; not stated by the authors in the article.

the mutual impacts of the COVID-19 pandemic and the earthquakes.

Significant Scopes of the Lessons Learned by the “Challenges”

It is seen that among the 5 challenges, *management inefficiency* has been discussed more frequently ($f=13$) compared with the other challenges concerning the mutual impacts of COVID-19 and earthquake. These challenges appear to be more pronounced in the Nepal Earthquake because this idea has been debated more frequently ($f=9$) in the articles dealing with Nepal's Gorkha Earthquakes, 2015 (Table 6). The first theme of Table 6 seemingly indicates that, according to the information presented in the selected articles, the frailty of simultaneous management of COVID-19 outbreak prevention and the aftermath of the earthquakes has been due to the “ineffectiveness of health system,” “the government inability to manage the impacts of the pandemic,” “the country's unpreparedness for an infection outbreak” due to involvement with 2015 earthquake response, and “inability to attract humanitarian response” (Table 6). Conversely, concerning Croatia Earthquake (2020), only “reduction of health care availability” has been attributed to management inefficiency challenge (Table 6).

The *increased life-threatening challenges* have been more frequently stated for Croatia's simultaneous entanglement with the pandemic and the earthquake ($f=3$) with respect to “acceleration of morbidity and mortality.” The reason might be due to the chronological concurrence of the 2 disasters during 2020 (Table 4). The *Economic challenges* seems to be more noticeable in Japan because the 2 disasters made “detrimental impacts on the businesses” ($f=4$). From the 9 *socially related challenges*, “travelling challenges” and “impacts of lockdown on rebuilding” have been mentioned 2 times each in the studies related to Mexico and Nepal, respectively. The category of “disruption of COVID-19

prevention protocols” during earthquake occurrence has been addressed by Ishiwatari et al. mainly under the idea of “staying home or going out,”¹⁹ arguing that this contradiction can be removed by the government if the evacuation measures are inevitable.⁴ Then, the requirement of social distancing should be lifted “to avoid direct threats to human life on a large scale.”⁴

The fifth scope of the challenges emerged in our study is the pressing *psychological challenges* including “dual psychological pressures” and “exacerbation of PTSD” during and after the dual disasters of the pandemic and the earthquakes in Croatia and Japan, respectively (Table 6). Psychological aftermath of disasters has frequently been argued in other studies when only 1 disaster had occurred.^{3,17,18}

Significant Scopes of the Lessons Learned by the “Efficient Response Measures”

Table 7 denotes that among the 4 response measure types proved to be efficient, the measures undertaken by the health-care system were more probed in the studies ($f=12$) while all are related to Croatian health-care system. As far as the information presented in the related reviewed studies are concerned, they have shown considerable coordination in their responses, have provided rehabilitation services for CV patients as well as tele-psychiatry modalities.²¹

Community-based activities are usually triggered by the residents' internal motivation. That is why these activities are characteristically implemented fruitfully. Table 6 shows that the public's contribution to efficient response measures during the concurrence of a pandemic and an earthquake is related to their compliance with the preventive measures which was remarkably observed by the residents during Mexico 2020 earthquake and tsunami.³⁰

The idea of focusing on the significance of health system response compared with other responses was also focused in

Table 5. Information categories and their frequencies presented for each earthquake

Earthquake location	Challenges	f	Successful measures/response	f	Public cooperation	f	Recommendations	f		
Albania	Economic decline in Postearthquake period due to COVID-19	2	NA		NA		Ongoing reforms to system of economic governance	1		
							Providing economic basis for loss compensation through social productivity and sustainable economic development	2		
Croatia	Reduction in health-care availability	2	coordinated outbreak response	2	Conscientious public compliance with social distancing and other preventive measures	1	Identification of probable natural disasters and advancing preparation accordingly	1		
	Acceleration of morbidity and mortality	3								
	Lifestyle deterioration of less resilient people	1	Outpatient rehabilitation measures for cardiovascular (CV) patients	7					Provision of psychological first-aid through telemedicine	2
	Dual psychological pressures	2								
	Disruption of prevention protocols	1	Tele-psychiatry modalities	3					Radar detector for real-time traffic data collection in extraordinary situations	2
	Disruption of commuting	1								
Haiti	NA		Not allowing the foreigners to enter the country (Risk Reduction Strategy; lesson learned from the postearthquake cholera epidemic)	1	NA		Strict COVID-19 inspection of the entering national/international disaster-response personnel	2		
			The Government's strict health protocols for all humanitarian cargos (Risk Reduction Strategy; lesson learned from the postearthquake cholera epidemic)	1			Well-publicized, strongly supported masking campaign	1		
			Reducing the chances of inadvertent COVID-19 spread country (Risk Reduction Strategy; lesson learned from the postearthquake cholera epidemic)	1						
Japan	Inefficient engagement of the pharmacists	2	NA		NA		Possible pharmacists' roles during COVID-19 pandemic	5		
	Ineffective supply system distribution	1					Consciousness raising to mitigate the psychological impacts of the 2 disasters	3		
	Exacerbation of initial symptoms of subthreshold PTSD	3					Establishing remote mental care support system	1		
	Detrimental impacts of the 2 disasters on businesses	4					Possible businesses-sustaining measures	4		
	Increased risk of infection transmission in evacuation centers	1					Possible community empowerment measures at evacuation centers	2		
Mexico	Travelling challenges	2	NA		Observing all essential preventive measures	7	NA			
Nepal	Earthquake impacts worsening due to the pandemic	1	Innovations in effective child protection	2	Similar citizen-centric initiatives/politics in both crises	3	Immediate measures to support the health system	1		
	Inefficiency of Nepal's health system	1								

(Continued)

Table 5. (Continued)

Earthquake location	Challenges	f	Successful measures/response	f	Public cooperation	f	Recommendations	f
	Escalation of vulnerability and poverty due to mobility restrictions	1					Recognizing the women's capabilities for local mitigation planning of coronavirus impacts by remembering their key role in Nepal's postearthquake recovery and resilience	2
	Risk of COVID-19 explosion due to poverty	1					Determining citizen-driven local Ombudsman to monitor the responses, use of funds, and recovery measures	2
	Impact of lockdown on economy, health, and rebuilding	4					Community-based civil society campaign to monitor government budget and expenditure, to conduct media scrutiny, focused on the conduct and performance of officials handling the response at national and local level	2
	Government's inefficiency to alleviate the impacts of the pandemic	3					Citizen-driven forms of participatory and accountability politics to reveal governance weaknesses	1
	Nepal, unprepared for an infection outbreak due to being involved with 2015 earthquake	2					Embracing more responsibility by government actors in the absence of international interference	1
	Lack of international humanitarian response	1						
Utah	NA		capability of our duty seismologists to work remotely	1	NA		Prior provision of necessary materials	4
							Providing rapid and accurate information for the public	2
							Providing continuous lines of data from aftershock stations (multi-layered communication network)	1
							Having a plan, practicing it, and updating it!	1

Table 6. Themes derived from the challenges mentioned in the selected studies with their frequencies and the related earthquake locations

No	Categories (derived from the challenges)	f	Related location	Themes of the challenges	f
1	Reduction in health-care availability	2	Croatia	Management inefficiency challenges	13
2	Inefficient engagement of the pharmacists	2	Japan		
3	Ineffective health-care supply system distribution	1	Japan		
4	Inefficiency of Nepal's health system	1	Nepal		
5	Government's inefficiency to manage the impacts of the pandemic	4	Nepal		
6	Nepal, unprepared for an infection outbreak due to being involved with 2015 earthquake response	2	Nepal		
7	Lack of humanitarian response	1	Nepal		
8	Acceleration of morbidity and mortality	3	Croatia	COVID-19-health-related challenges	6
9	Increased risk of infection transmission in evacuation centers	1	Japan		
10	Risk of COVID-19 explosion due to poverty	1	Nepal		
11	Impact of lockdown on health due to absence of effective testing, tracking, and tracing strategies	1	Nepal		
12	Economic decline in postearthquake period due to COVID-19	2	Albania	Economic challenges	9
13	Detrimental impacts of the 2 disasters on businesses	4	Japan		
14	Reduction of rebuilding budget due to lockdown	2	Nepal		
15	Escalation of vulnerability and poverty due to mobility restrictions	1	Croatia		

(Continued)

Table 6. (Continued)

No	Categories (derived from the challenges)	<i>f</i>	Related location	Themes of the challenges	<i>f</i>
16	Lifestyle deterioration of less resilient people	1	Croatia	Socially related challenges	9
17	Disruption of prevention protocols	1	Croatia		
18	Travelling challenges	2	Mexico		
19	Disruption of traffic flow	1	Nepal		
20	Earthquake impacts aggravation due to the pandemic	1	Nepal		
21	Impact of lockdown on rebuilding	2	Nepal		
22	Dual psychological pressures	2	Croatia	Dual psychological challenges	5
23	Exacerbation of initial symptoms of subthreshold PTSD	3	Japan		

Table 7. Themes derived from the categories related to the *efficient response measures* found in the selected studies

No.	Categories (<i>efficient response measures</i>)	<i>f</i>	location	Themes	<i>f</i>
1	Coordinated outbreak response	2	Croatia	Health-care system measures	12
2	Outpatient rehabilitation measures for CV patients	7	Croatia		
3	Tele-psychiatry modalities	3	Croatia		
4	Not allowing the foreigners to enter the country	1	Haiti	Government's measures	4
5	Strict health protocols for all humanitarian cargos	1	Haiti		
6	Innovations in effective child protection	2	Nepal	Community-based cooperative activities	11
7	Similar citizen-centric initiative/politics in both crises	3	Nepal		
8	Public compliance with preventive measures	1	Croatia		
9	Observing all essential preventive measures	7	Mexico		
10	Capability of seismologists to work remotely	1	Utah	Disaster management response	1

Table 8. Themes derived from the categories found in the *recommendations* in the selected studies

No.	Categories (derived from the recommendations)	<i>f</i>	Location	Sub-themes	Major themes	<i>f</i>
1	Identification of probable natural disasters and advancing preparation accordingly	1	Croatia	Identifying probable natural disasters	Mitigation phase	1
2	Radar detector for real-time traffic data collection in extraordinary situations	2	Croatia	Preparing necessary equipment	Preparedness phase	2
3	Expecting more earthquakes	4	Utah			
4	Provision of psychological first-aid through telemedicine	2	Croatia	Mental care response measures	Response phase	32
5	Consciousness raising to mitigate the psychological impacts of the 2 disasters	4	Japan			
6	Establishing remote mental care support system	1	Japan			
7	Strict COVID-19 inspection of the entering national-international disaster-response personnel	2	Haiti	Healthcare-related COVID-19 curbing measures		
8	Well-publicized, strongly supported masking campaign	1	Haiti			
9	Use of pharmacists' potentials during COVID-19 pandemic era	5	Japan			
10	Possible community empowerment measures at evacuation centers	2	Japan			
11	Immediate measures to support the health system to curb COVID-19 pandemic	1	Nepal	Economic improvement measures		
12	Possible business-sustaining measures	4	Japan			
13	Ongoing reforms to system of economic governance	1	Albania			
14	loss compensation through social productivity	2	Albania	Recognizing Community-based capabilities		
15	Recognizing the women's capabilities for local mitigation planning by remembering their role in Nepal's postearthquake recovery and resilience	2	Nepal			
16	Determining citizen-driven local Ombudsman to monitor the responses, use of funds, and recovery measures	2	Nepal			
17	Community-based civil society campaign to monitor government budget and expenditure, to conduct media scrutiny, focused on the conduct and performance of officials handling the response at national and local level	2	Nepal			
18	Citizen-driven forms of participatory and accountability politics to reveal governance weaknesses	1	Nepal	Government-related boosting measures		
19	Embracing more responsibility by government actors in the absence of international interference	1	Nepal			
20	Providing rapid and accurate information for the public	2	Utah			
21	Providing continuous lines of data from aftershock stations (multi-layered communication network)	1	Utah			
22	Having a plan, practicing it, and updating it!	1	Utah			

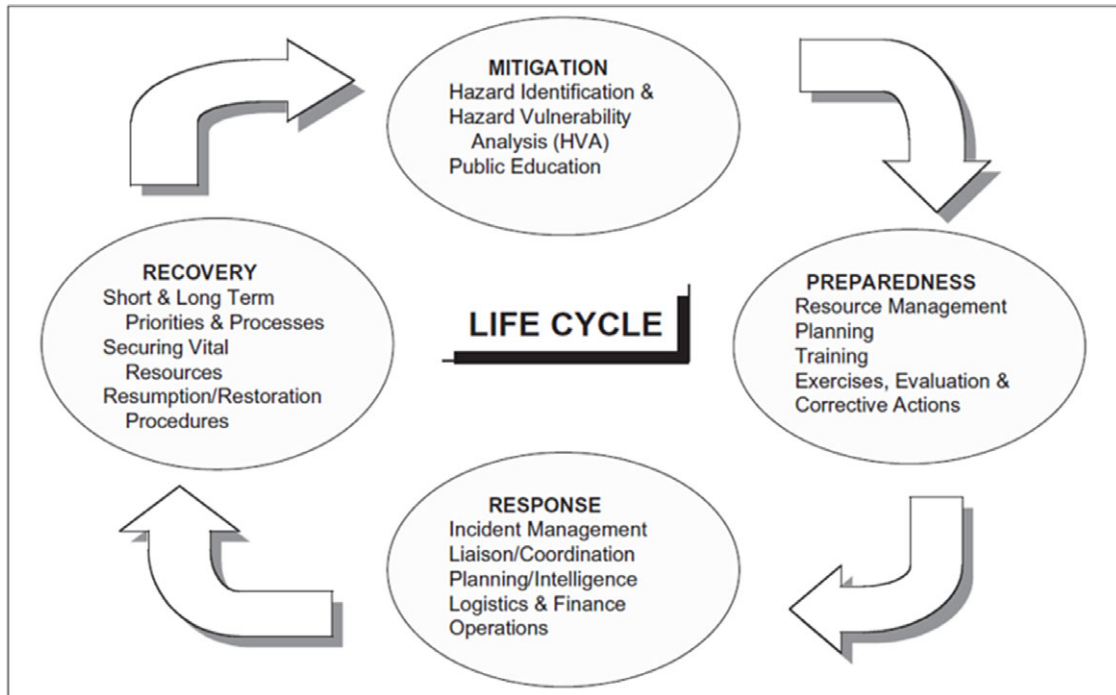


Figure 2. The 4 phases of comprehensive emergency management (Hoyle Sr, 2010).

the study by Sohrabizadeh et al. indicating the required attention which should be paid on the 4 phases of emergency management, on the part of the health system policy-makers and administrators.³

Significant Scopes of the Lessons Learned by the “Recommendations”

The recommendation detected in the selected studies (Table 8) can help prevent the challenges of the mutual impacts of the COVID-19 pandemic and the earthquakes in the 3 phases of Mitigation, Preparedness, and Response. The recommendation categories more frequently dealt with in the articles include: “utilization of pharmacists” potentials during COVID-19 pandemic era’ suggested by Hashimoto et al. because pharmacists proved to be very efficient in a variety of services during the 2011 Earthquake, but during the pandemic era there was a lack of full use of their services. They could have established a supply system for drugs and sanitary materials during the pandemic similar to their services during Great East Japan Earthquake, including “helping insightfully the confused on-sight health care professionals with checking the ingredients of the drugs,” “suggesting available alternatives to prescriptions,” and “raising awareness of the evacuees to observe sanitation in the sites.”²⁷

Conclusion

Table 4 shows that the number of studies carried out on three earthquakes, namely, Croatia (n = 6) and Nepal as well as Japan (both n = 4) have been more than the other four. This shows the influences these earthquakes still have on different aspects of people’s lives or the lessons which people have learned from the negative or positive features of these disasters. As a scoping review study deals with detecting the general scopes of the information presented and not on the details, several systematic reviews are

necessary to be conducted on different aspects of the findings of the present review study. One such study can be investigating the reason(s) behind the fact that from 35 categories offered as Recommendations to enhance the three phases of disaster management cycles, 32 categories are related to the Response Phase.

Supplementary Material. To view supplementary material for this article, please visit <https://doi.org/10.1017/dmp.2022.71>.

References

1. Kanamori H, Baba H, Weber DJ. Rethinking One Health approach in the challenging era of COVID-19 pandemic and natural disasters. *Infect Ecol Epidemiol.* 2021;11(1):1852681.
2. Silva V, Paul N. Potential impact of earthquakes during the 2020 COVID-19 pandemic. *Earthq Spectra.* 2021;37(1):73-94.
3. Sohrabizadeh S, Yousefian S, Bahramzadeh A, et al. A systematic review of health sector responses to the coincidence of disasters and COVID-19. *BMC Public Health.* 2021;21(1):1-9.
4. Ishiwatari M, Koike T, Hiroki K, et al. Managing disasters amid COVID-19 pandemic: approaches of response to flood disasters. *Prog Disaster Sci.* 2020;6:100096.
5. Peleg K, Bodas M, Hertelendy AJ, et al. The COVID-19 pandemic challenge to the All-Hazards Approach for disaster planning. *Int J Disaster Risk Reduct.* 2021:102103.
6. Sawalha IH. A contemporary perspective on the disaster management cycle. *Foresight.* 2020;22(4):469-482.
7. Sakamoto M, Sasaki D, Ono Y, et al. Implementation of evacuation measures during natural disasters under conditions of the novel coronavirus (COVID-19) pandemic based on a review of previous responses to complex disasters in Japan. *Prog Disaster Sci.* 2020:100127.
8. Peterson J, Pearce PF, Ferguson LA, et al. Understanding scoping reviews: definition, purpose, and process. *J Am Assoc Nurse Pract.* 2017; 29(1):12-16.
9. Arksey H, O’Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol.* 2005;8(1):19-32.

10. **Grant MJ, Booth A.** A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Info Libr J.* 2009;26(2):91-108.
11. **Khan SR, Khan SR.** The Allai Valley Earthquake and COVID 19: collective action undermined. In: *Social Capital and Collective Action in Pakistani Rural Development.* Springer; 2021:251-272.
12. **Dariagan JD, Atando RB, Asis JLB.** Disaster preparedness of local governments in Panay Island, Philippines. *Nat Hazards (Dordr).* 2021;105(2):1923-1944.
13. **Sever MS, Ortiz A, Maggiore U, et al.** Mass disasters and burnout in nephrology personnel: from earthquakes and hurricanes to COVID-19 pandemic. *Clin J Am Soc Nephrol.* 2021;16(5):829-837.
14. **Braun V, Clarke V.** Using thematic analysis in psychology. *Qual Res Psychol.* 2006;3(2):77-101.
15. **Braun V, Clarke V.** Reflecting on reflexive thematic analysis. *Qual Res Sport Exercise Health.* 2019;11(4):589-597.
16. **Hoyle JD Sr, Koenig KL, Schultz CH.** Healthcare facility disaster management. In: *Koenig and Schultz's Disaster Medicine: Comprehensive Principles and Practices.* Cambridge University Press; 2010.
17. **Seyedin H, HabibiSaravi R, Djenab VH, et al.** Psychological sequels of flood on residents of southeast Caspian region. *Nat Hazards.* 2017; 88(2):965-75.
18. **Jafari H, Heidari M, Heidari S, et al.** Risk factors for suicidal behaviours after natural disasters: a systematic review. *Malays J Med Sci.* 2020;27(3): 20-33.
19. **Marko C, Košec A, Brečić P.** Stay home while going out—possible impacts of earthquake co-occurring with COVID-19 pandemic on mental health and vice versa. *Brain Behav Immun.* 2020;87:82-83.
20. **Banushi B, Sulaj I.** Economic impacts of an earthquake disaster and Covid-19 in Albania. *Sci Bull Econ Sci.* 2020;19(2):15-22.
21. **Čivljak R, Markotić A, Capak K.** Earthquake in the time of COVID-19: the story from Croatia (CroVID-20). *J Glob Health.* 2020;10(1):010349.
22. **Ivanuša M.** Adaptation of outpatient cardiovascular rehabilitation in Zagreb to the emerging conditions due to the COVID-19 pandemic and the large earthquake in March. *Cardiol Croat.* 2021;16(1-2):55-56.
23. **Quigley MC, Attanayake J, King A, et al.** A multi-hazards earth science perspective on the COVID-19 pandemic: the potential for concurrent and cascading crises. *Environ Syst Decis.* 2020;40:199-215.
24. **Šago D, Martić V, Šmida D, et al.** Telepsychiatry in the time of the COVID-19 and earthquake in Zagreb as Odysseus between Scylla and Charybdis. *Psychiatr Danub.* 2020;32(3-4):478-481.
25. **Tišljarić L, Cvetek D, Muštra M, et al.** Mixed impact of the Covid-19 pandemic and the earthquake on traffic flow in the narrow city center: a case study for Zagreb-Croatia. *Proc Sci Dev Transport (ZIRP), Zagreb, Croatia.* 2020:29-30.
26. **Allen E.** *Tropical Cyclone Harold and Covid-19: Lessons from The 2010 Haiti Earthquake.* Daniel K. Inouye Asia-Pacific Center for Security Studies; 2020.
27. **Hashimoto T, Sawano T, Ozaki A, et al.** Need for more proactive use of pharmacists in the COVID-19 pandemic following lessons learnt from the Great East Japan Earthquake. *J Glob Health.* 2020;10(2):020397.
28. **Hori A, Sawano T, Ozaki A, et al.** Exacerbation of subthreshold PTSD symptoms in a Great East Japan Earthquake survivor in the context of the COVID-19 pandemic. *Case Rep Psychiatry.* 2021;2021:6699775.
29. **Nogami N.** *Mandatory Annual Disclosures for Listed Companies During Crises in Japan: COVID-19 and the Great East Japan Earthquake.* The University of Tokyo; 2021.
30. **Ramírez-Herrera MT, Romero D, Corona N, et al.** The 23 June 2020 M w 7.4 La Crucecita, Oaxaca, Mexico earthquake and tsunami: a rapid response field survey during COVID-19 crisis. *Seismol Soc Am.* 2021;92(1):26-37.
31. **Adhikari B, Ozaki A, Marahatta SB, et al.** Earthquake rebuilding and response to COVID-19 in Nepal, a country nestled in multiple crises. *J Glob Health.* 2020;10(2):020367.
32. **Basnyat K, Tamang D.** 2015 Nepal Earthquake lessons for COVID-19: how to put women at the forefront of the crisis and recovery. *South Asia @LSE.* 2020.
33. **Dhungana N.** 2015 Nepal Earthquake and COVID-19: a comparison of the politics of crisis governance. *South Asia @LSE.* 2020.
34. **Punaks M, Lama S.** Orphanage trafficking and child protection in emergencies in Nepal: a comparative analysis of the 2015 earthquake and the 2020 COVID-19 pandemic. *Institutional Children Explor Beyond.* 2021;8(1):26-37.
35. **Pankow KL, Rusho J, Pechmann JC, et al.** Responding to the 2020 Magna, Utah, earthquake sequence during the COVID-19 pandemic shutdown. *Seismol Soc Am.* 2021;92(1):6-16.