



Public Health Emergency Preparedness and Response to Natural Disaster in Sierra Leone: The Milestone in a Decade

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Abstract: Introduction: The African continent has always been faced with myriads of public health emergencies associated with natural disasters. The level of preparedness for and response to each of the natural disasters, which are most often unanticipated, have been reported to be of varying degrees across the African member states. There is a dearth of knowledge regarding Sierra Leone, which necessitates the need for this study. Objective: The main objective of this study is to unravel the evolutionary trend of Emergency Preparedness and Response (EPR) towards the natural disaster events in Sierra Leone between 2010 and 2020. Method: This is a descriptive survey study involving a quantitative and qualitative approach with data collection from the desk review of secondary sources and key informants' interviews. A semi-structured questionnaire was used to collect primary qualitative data from 77 key informants from multi-sectoral agencies. Data collected were transcribed, coded, and analyzed thematically. Findings were presented in tables, pie and bar charts, and in narrations as appropriate. Results: Three natural disasters (mudslides, flooding, and fire disasters in that order) were perceived by respondents to have occurred most frequently within the decade of the study. Perceived key capacities of Sierra Leone for natural disaster management include coordination and leadership, Public Health Emergency Operation Centre (PHEOC), Epidemiological Surveillance, Risk Communication and Community Engagement (RCCE), Operation Support, and Logistics. While most of these reportedly require improvement, respondents also reiterated the need for strengthening laboratory services and workforce development. On a general note, respondents noted an appreciable evolution of the public health emergency response to natural disasters in Sierra Leone within the decade of study with a perceived need for improvement in the level of preparedness while advocating for more commitments towards formidable recovery measures to be put in place, especially in the communities that are frequently hit by the natural disasters. Conclusion: The varying degrees of the respondents' perceptions of various thematic

areas of this study point to the existence of different statuses in the level of resilience in diverse blocks of the public health emergency response to natural disasters in Sierra Leone. It is hopeful that taking the findings in this study into consideration by relevant stakeholders during policy making in Sierra Leone can serve as the springboard for ensuring a face-lift in the structure and tenacity of the emergency response to the natural disasters in Sierra Leone and the African region, by extension.

Keywords: Public Health Emergency, Preparedness, Response, Natural Disaster, Sierra Leone

1. Introduction

In the last two decades, over 700 natural disasters facilitated by natural hazards have been recorded, which reportedly was greater than double the reported number in early 1980 and 2000 [1]. The myriads of recurring natural disasters have impacted our world significantly, and the attending catastrophes have attracted the attention of many public health stakeholders. The evidence of these has manifested in the various efforts made to strengthen the public health mitigation and response system across many countries, especially in developing nations, to guarantee the protection of the population at risk and those not at risk by extension from the unfolding negative impacts of the naturally and humanly inclined threats [2]. Diverse strategies have been adopted with emphasis laid on improving the effectiveness of the global health level of mitigation, preparedness, and response architecture in connection with natural disaster health security [3]. However, available evidence depicts that the standard guidelines can serve as the compass for public health stakeholders in developing action-inclined policies, which are currently scarcely implemented in most African countries [4].

Researchers have established the fact that Sierra Leone has repeatedly dealt with various natural disasters with highly strained endurance in the last decade. Though there is reported progress, the increasing level of factors that affect the ecosystem negatively with continuous complicating contributions from climate change, poor governance, and uncontrolled poverty have remained the cog-wheel in the system, with a resultant reduction in the outcome of the stakeholders' efforts. In the face of these interconnected challenges, there is also a dearth of information to effect the needed changes [5, 6].

Previous efforts were made to improve the evolutionary trend in the management of natural disasters in Sierra Leone, one of which is the collaborative engagement of researchers, relevant ministries in the country, and public health stakeholders in the fact-finding assessments to unravel the strengths and the weaknesses of the public health system for the purpose of revamping the preparedness and response to the natural disaster in the country [7], with researchers focusing on the investigation around existing risks and hazards to inform the direction of action including effects on the economic buoyancy of the country [8-10].

However, it is noteworthy to state that there is an existing gap in the research conducted as most of them missed updated facts and current knowledge of natural

disaster management contexts in Sierra Leone as captured in The National Disaster Management Agency Act of 2020 [11]. Hence, this study was centred on unknotting the nitty-gritty of the evolutionary trend of and inherent areas for improvements in managing natural disasters in Sierra Leone.

2. Method

2.1. Study Design

The researcher used extensive desk review and in-depth interviews with key informants using a descriptive survey study design hinged on quantitative and qualitative methods. A combination of extensive desk review and in-depth interviews with key informants was adopted using a semi-structured questionnaire developed and pre-tested before being administered by the research assistant to the key informants through virtual and some face-to-face interviews.

2.2. Sampling Technique

Purposive sampling was adopted in this study, and participants were recruited through the different in-country networks. The rationale for using this sampling method was to ensure the right people working in emergency preparedness and response are engaged and could provide the required information for the preparedness and response to natural disaster emergencies in Sierra Leone. Sampling size determination was carried out as follows;

N = sample size, $Z = 1.96$ (static for a level of confidence),
 P = response proportion set at 95% = 0.5 and
 d = 0.05 (precision).

$$n = \frac{Z^2 P(1-P)}{d^2}$$

$$n = \frac{1.96^2 \times 0.95 (1-0.95)}{0.05^2}$$

$$N = \frac{0182476}{0.0025} = 72.99 = 73$$

A 5% attrition was added, making

$$\frac{5}{100} \times 73 = 3.65 = 4$$

$$73 + 4 = 77$$

A total of seven groups were organized, and 11 participants were selected from each of the organizations, making a total of 77 participants.

Table 1. Number of respondents by organizations.

SN	Organization	Number of participants
1	National MOH	11
2	DHMT	11
3	Clinicians	11
4	UN Agencies	11
5	Other partners	11
6	Others Government sectors	11
7.	Communities	11
	Total	77

The participants included the staff of the UN agencies, the national and district surveillance officers, clinicians at national and district hospitals, members of the response pillars laboratory pillars, and risk communication and community engagement (RCCE).

2.3. Data Collection

Data were collected through a semi-structured questionnaire administered through personal in-depth interviews using Zoom meetings considering the public health measures for COVID-19. Respondents were pre-informed through emails, phone calls, and messages seeking their consent to participate and to schedule the interviews. A research assistant was employed and trained to conduct, deliver, and collect the questionnaire to other key informants who might not be reached through Zoom or email. Also, an online survey was created to collect data from respondents who prefer answering by filling out online forms. The online survey form was designed to enable respondents to record audio responses to the qualitative questions, and responses were retrieved from the online database. The cleaned data were exported into QDA Miner version 6 for coding and were thematically analyzed. The outcomes were presented in tables, charts, and narrations.

2.4. Ethical Consideration

The anonymity and confidentiality of the participants were preserved by not revealing their names and identities during data collection, analysis, and reporting of the study findings. In the same vein, the privacy of the interview was carefully managed during virtual data collection and dissemination of findings. All participants recruited for the study completed and signed a consent form. All participants were free to participate or withdraw from the study.

3. Results

3.1. Demographic Information of the Study Participants

Table 1 presents the socio-demographic information of the study respondents. There were 76 respondents, 54 (71.1%) males and 22 (28.1%) females. The respondents with the highest proportion (36.8%) were aged 41–50 years, while those of the age bracket 21–30 ranked the lowest in proportion (3.9%). The respondents' organizational representation is in close range (13.2–15.8), with the UN agency being the highest (15.8%). Those with work

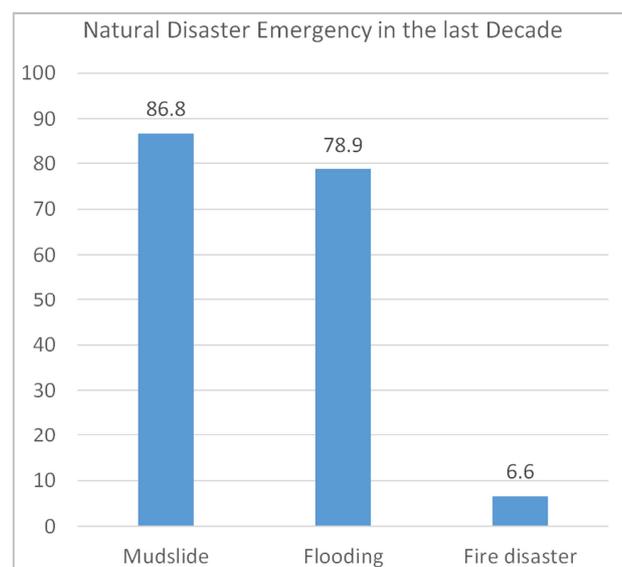
experience within 11–20 years have the highest proportion (40.8%), while respondents with work experience of 1–5 years have the least proportion (10.5%) of representation.

Table 2. Socio-demographic profiles of the study respondents.

Parameter	Frequency	Percent
Gender		
Male	54	71.1
Female	22	28.9
Age category		
21 – 30 years	3	3.9
31 - 40 years	24	31.6
41 - 50 years	28	36.8
51 - 60 years	16	21.1
Above 60 years	5	6.6
Organization		
Clinicians	10	13.2
Community member	11	14.5
DHMT	11	14.5
National MOHS	11	14.5
Other Government Sector	10	13.2
Other partners	11	14.5
UN Agencies	12	15.8
Work experience		
1 - 5 years	8	10.5
11 - 20 years	31	40.8
21 years or more	18	23.7
6 - 10 years	19	25.0
Total	76	100.0

3.2. Public Health Natural Disaster Emergencies in Sierra Leone Over 10 Years

Figure 1 shows the respondents' proportional distribution on the occurrence of the most prominent natural disaster emergencies in Sierra Leone over the past ten years. Over two-thirds of the study respondents mentioned mudslide (86.8%) and Flooding (78.9%) while fire disaster was scarcely mentioned by the respondents as the prominent natural disaster in the country in the last decade (6.6%).

**Figure 1.** Proportional Distribution of Respondents' Feedback on the Most Prominently Occurring Natural Disaster in Sierra Leone in the Last Decade.

3.3. The Key Capacities of Preparedness for Natural Disaster Emergencies in Sierra Leone

Respondents highlighted the following areas as key capacities for emergency preparedness of the public health system to respond to natural disasters.

Coordination and leadership: Most respondents were assertive on the fact that disasters should be properly prepared for and well-coordinated before they occur. They informed that Sierra Leone is appreciably performing in this important pillar as captured in the relevant responses thus;

“The country has a National Disaster Management Agency that responds to natural disasters. All response efforts of public health disasters are said to be directed at the strategic and operation levels by the Office of National Security”. (Respondent A).

“The existence of a Public Health Emergency Operations Center (PHEOCs) makes coordination of emergency disasters through the activation of an Incident Management Systems providing clear roles for the different pillars” (Respondent C).

Respondents further indicated that the country has a multi-hazard preparedness plan well backed with good policy and leadership prowess which is effective towards mobilizing funds through partners as represented in the extracted response-

“The government has flood mitigation preparedness plans to mobilize resources for the implementation of the plan. I also wish to mention that policies and leadership structures are in place with effective channels of information flow with an all-inclusive partnership. The development of a public health ordinance, including enforcement pathways also added value to the whole system.” (Respondent X).

Epidemiology and Surveillance: The emphasis laid by the respondents on the interconnectivity among the effective surveillance/emergency response, information management, and workforce capacity development efforts is palpable. This can be seen in a comprehensive response quoted below;

“A multidisciplinary workforce trained in public health emergency response for rapid deployment to any disaster is very critical to the making of a sound EPR, and this is being with the Rapid Response Teams (RRT) at the National and district levels which should be strengthened with refresher training and logistical standby support. In addition to this, early environmental impact assessment is in place, and specific land set aside for people evacuated in disaster-prone areas” (Respondent D).

Risk communication and community engagement (RCCE): The respondents did not mince words in pointing out the

importance of this pillar which incorporates the roles played by the community members towards preventing, mitigating, preparing, responding and recovering from public health disasters when properly informed and oriented. The overall opinion of the respondents is well summarized in one of the responses, thus;

“Community members should be properly carried along on the mapping of flood and disaster-prone areas with a special focus on communities with high flood-prone areas ensuring that the inhabitants of such areas are well-sensitized ahead of the rains on what they need to do before the rainy season.” (Respondent F).

Operations support and logistics: Ensuring the availability of medical commodities in every part of the country, evacuating people from disaster-prone areas and mechanism to deploy trained and qualified public health emergency response teams are covered by this pillar as opined by the respondents. A cogent response was captured as:

“Critical resources/logistics and a robust supply chain mechanism are in place. The national level and all districts have been equipped with the logistic capacity and this has been very beneficial over years as regards facilitation of resource supply and movements of human and capital resources during emergency responses”. (Respondent AB).

Strengthening the health system: Respondents identified strengthening and building a resilient health system with keen attention to identifying the weak health system pillars and prioritizing for improvement as an important element of preparedness. Among many responses that captured the opinion of the respondents is a direct and succinct response below; *“Although health system structure is in place but needs to be strengthened at all levels in Sierra Leone to respond to disaster as is very critical. I have discovered by experience that if any pillar of the health system is weak, it has the tendency to impact the efficacy of the remaining pillars negatively, knowing fully well that they operate collectively as connected chains and are interdependent of one another”.* (Respondent AF).

3.4. Suggested Areas of Improvement

Respondents' feedback suggested seven areas- Coordination and Leadership, Epidemiology and surveillance, Laboratory services, Case Management, Logistics Support, Risk communication and community engagement, and Workforce Development, for improvement in the management of natural disasters in Sierra Leone. These spanned across different pillars for emergency response as summarized in Table 3 below;

Table 3. Areas of improvement recommended by respondent.

Pillars	Areas to be improved
Coordination and Leadership	<ol style="list-style-type: none"> 1. Strengthen coordination of preparedness and response for all emergencies through the one-health approach strategy 2. Written standard operating procedures for emergency response 3. Institute accountability framework to improve transparency on financial support for emergencies 4. Strategy to mobilize domestic resources to finance preparedness and response 5. Establish a sustainable Public Health Agency/institution that is anchored in law, funded by the government, manned by academically and experienced competent staff

Pillars	Areas to be improved
Epidemiology and surveillance	6. Conduct regular simulation excises to test the readiness level
	7. Invest in human resource capacity in preparedness and response.
	8. Enforcement of mitigating actions
	9. Establish the Legal framework to effectively monitor, prevent, or respond to a public health emergency
Laboratory services	Establish a national multi-disciplinary all-hazard emergency responders
	1. Government must invest in early case detection through public health intelligence
	2. Empowering responders with the required tools and logistics support
	3. Capacity building surveillance and epidemiological investigation team is critical
Case Management	4. Disaster management, establishment and training of disaster response team
	1. Strengthen the laboratory services nationwide
	2. Invest in training of laboratory scientist
	A well-equipped laboratory for testing potential hazards.
Logistics support	1. Proper management of emergency equipment,
	2. Improve case management by investing in the establishment specializes units for infectious diseases, high dependency units and trauma management units
	3. Capacity building for clinicians to manage the infectious disease and trauma
	1. Establishing logistics hubs to ensure rapid deployment of supplies
Risk communication and community engagement	2. Emergency drugs storage and replenishment at all times
	3. Maintain emergency facilities and equipment
	4. Strengthening public health infrastructure and the ambulance services
	1. Awareness raising of the public
Workforce development	2. Priorities community engagement and strengthen of community structures
	3. Strengthen the health promotion department
	1. Invest in establishing a critical mass of emergency multidisciplinary health workforce
	2. Capacity building of the emergency health workforce
	3. Develop a database of readily available emergency responders
	4. Establish opportunity for specialized training of health workers

3.5. Perception of Respondents on Sierra Leone’s Health System Preparedness for Natural Disaster Emergencies

Out of the 76 respondents, 45 (59.2%) perceived that the public health system in Sierra Leone is prepared (Yes) for any emergencies, 12 (15.8%) responded in the negative (No), and the remaining 19 (25.0%) posited a ‘To some extent’ stance as shown in Figure 2.

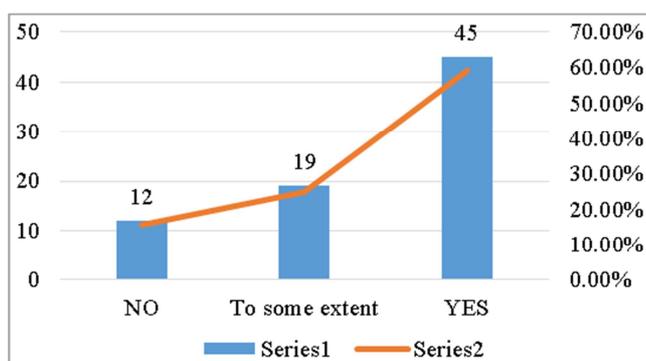


Figure 2. Showing respondents’ perception of Sierra Leone’s public health system preparedness for any emergencies.

3.6. Recovery Measures Taken by the Government and Stakeholders in Sierra Leone During/After Previous Natural Disasters That Occurred in the Past Ten Years

As respondents opined, over the past ten years, the government and stakeholders in Sierra Leone have taken several measures to recover from previous public health emergencies. Most of these steps have aimed at improving the health sector by employing a multi-sectoral approach. Extracted points from the respondents showed that the

government and stakeholders have strengthened the public health sector by focusing on training healthcare workers, establishing public health laboratories for infectious diseases, implementing a rapid response team in all districts, and setting up public health emergency committees at the district level. The overarching response below captured the point in a succinct manner;

“Government and stakeholders have also sought to involve the community in recovery efforts and establish inter-sectoral collaborations through the One Health platform. In addition, they have developed recovery strategies and established a resilient health system.” (Respondent AAA).

“Agriculture and environmental agencies have been a part of the multi-sectoral approach, and the One Health platform has been used to encourage community dialogue and cross-sectoral collaborations.” (Respondent AY).

Regarding policy, the respondents unanimously opined that the government and stakeholders had developed and put in place infection prevention and control policies. Related responses is exemplified by a comprehensive response below;

“Training has been a key focus, with programs aimed at training healthcare workers, emergency room staff, and frontline and intermediate FETP (Field Epidemiology Training Program) staff. Prevention efforts have included raising awareness about public health emergencies, complying with public health guidance on preventive measures, and following up on affected areas or populations to prevent the reoccurrence of emergencies. There has also been a focus on building capacity for risk communication, surveillance, logistics, and case management and providing adequate support for essential commodities.” (Respondent AZ).

Another area identified was infrastructural development: A good number of respondents emphasized this aspect and their perception is as captured thus;

Infrastructure improvements have included the construction of new hospitals and primary health units, the establishment of standard procedures, the formation of standard operating procedures, and the enforcement of hand washing in all facilities. There has also been a focus on improving health service delivery and providing drugs and

equipment.” (Respondent AAK).

Other recovery measures identified by respondents included research, expansion of health services to rural communities, regular engagement with counterparts in neighboring countries, advocacy for field epidemiologists in the frontline and intermediate, strengthening of cross-border relations with Sierra Leone, and improving EOC activities in the country. The responses are summarized into four building blocks in Figure 3 below.

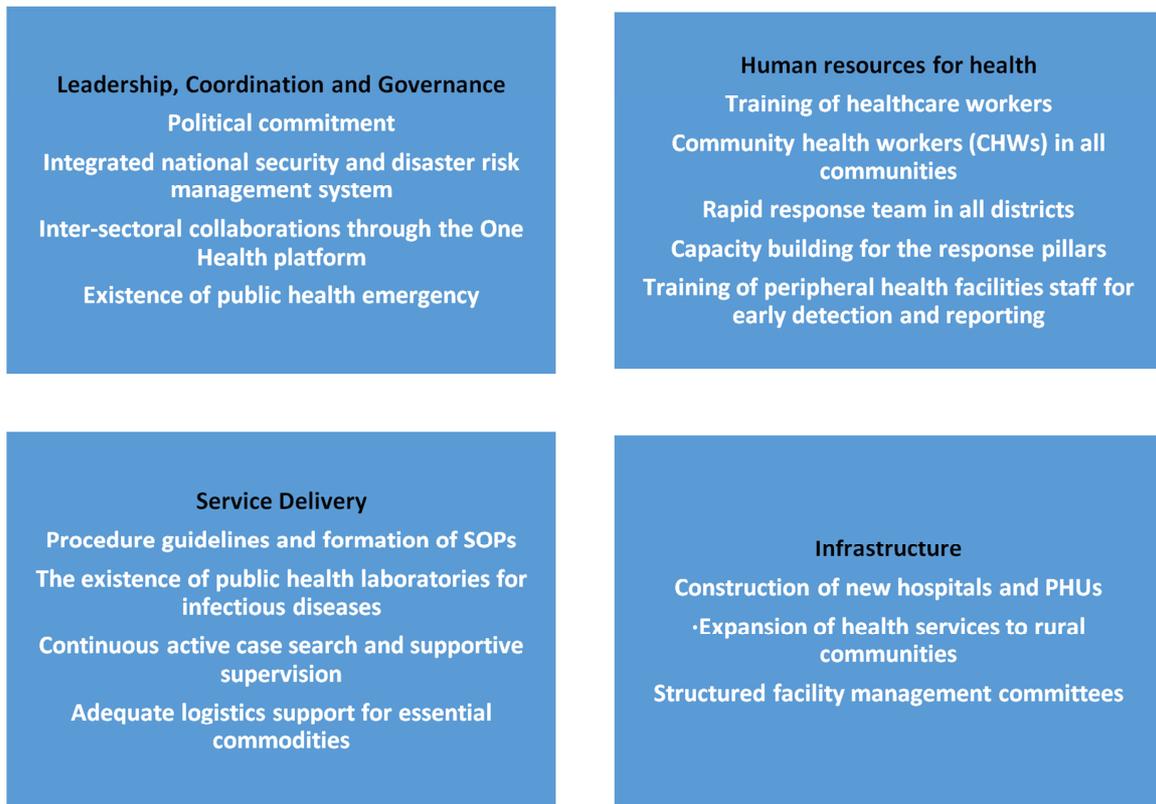


Figure 3. Showing the Summary of Recovery Measures Taken in the Last Decade.

4. Discussion

A distributed proportion of respondents in this study identified three prominent natural disasters- Mudslides, Flooding, and Fire disasters that have occurred in Sierra Leone in the last decade. The high level of poverty, primary precipitating natural disasters, and unsuitable building techniques have been mentioned by researchers to be responsible for recurrent mudslides [12], while increasing flooding has been reported by stakeholders to be increasingly caused by deforestation and poor vegetation management in most west African countries [13].

Among the respondents' submissions on the existence of the capacities of Sierra Leon's public health system towards responding to natural disasters are fairly strong Coordination and Leadership prowess, Epidemiological Surveillance, Risk Communication and Community Engagement (RCCE), and Operation Support and Logistics (OSL). The public health stakeholders and researchers have reported in different

publications the importance of these pillars in responding to natural disasters globally. For example, findings in a study [14] revealed that effective coordination and management positively impact the readiness for response to disasters and that good leadership also has a ripple effect on inter-group collaboration with resultant mediation of response readiness and management preparedness. Also, a research study's findings established that applying a valid framework that facilitates the enablement of public health experts to have access to correct and previously used surveillance approaches to natural disasters can go a long way in saving lives during the event [15].

Furthermore, another study [16] revealed that there are inherent benefits in early warnings when the principles are well packaged in a timely risk communication and community engagement activities, including answering confusing questions clearly in the face of imminent natural disaster. Operations Support and Logistics (OSL) have been established as an important pillar toward effective preparation for, and response to natural disasters. This was

well captured in a study findings that posited that planning for natural disasters with complex information uncertainties should incorporate time-bound logistics and supplies planning with short and long-term goals, including strategizing ways to manage anticipated failures [17]. Hence, the respondents' thoughts in this study as regards the existence and the emphasis on the importance of the mentioned pillars are of esteemed value and in concordance with the tenets of natural disaster management and response. Respondents in this study were unequivocal in recommending areas needing improvement as regards most of the above-mentioned pillars with the inclusion of workforce development. Researchers have re-iterated the need to expand the various elements needed to manage natural disasters in Africa and especially West African countries with considerably high recurrent natural disasters, stressing the need for increased adherence to the relevant policy [18, 19].

Respondents' Perceptions of the Recovery Measures Adopted by the government and other stakeholders during/after the occurrence of the natural disaster spanned across training of healthcare workers, establishment of public health laboratories, institutionalizing Rapid Response Team (RRT), and creation of a Public Health Emergency Committee (PHEC). Scholars have highlighted the various context-specific recovery modalities that can be adopted during or after the occurrence of a natural disaster, including a consideration for the pre-existing socio-economic conditions [20, 21].

5. Conclusion

Natural disasters have occurred in Africa, especially Sierra Leone, in the last decade with its attending direct and indirect public health consequences. In specific terms, the impact of mudslides and flooding, which are the two respondents' most prominently identified natural disasters that occurred between 2010 and 2020, have impacted Sierra Leone in various aspects including the socio-economic spheres. The findings in this study as regards the inherent capacities preparation to respond to these recurrent natural disasters, along with the identified areas for improvement, can serve as points for discussion among stakeholders on how best to better prepare for natural disaster management in Sierra Leone. The respondents' perception of the recovery measures taken by the government and stakeholders during or after the occurrence of natural disasters can be used as a pivot to further give the recovery elements the required face-lists as may be deemed necessary by all the public health emergency stakeholders in Sierra Leone.

6. Recommendations

The following recommendations summarized the multiple recommendations given by the respondents.

1. There is a need to conduct a holistic assessment of the strengths and weaknesses of the management structure

and elements for mitigation and response to natural disasters in Sierra Leone, taking cognizance of all the concerned stakeholders.

2. The findings of the assessment in the suggestion above should be used as points for discussion to formulate the necessary action-inclined activities to fill any identified lacuna and improve the emergency system for more effective management of natural disasters in the country.

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