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The COVID-19 crisis worsens with the occurrence of climate extremes and disasters

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Abstract: Climate change and the associated weather extreme events are a major threat to humanity as it affects agriculture and food security. Climate change disaster is on the increase as the global temperature keeps rising. Sub-Saharan Africa is one of the most vulnerable regions to climate change. The coronavirus (COVID-19) pandemic has been complicated by climate change and related extreme events especially with the imposed lockdown which has affected the global economy. The COVID-19 has killed over 4 million persons with the USA, Brazil and India being the worst affected nations. Thus, the multi-hazard scenario presented by extreme events like drought, flood and cyclones this period of the pandemic worsened its spread as it affected social distancing and personal hygiene as many people are crammed in camps and water become scarce for handwashing. It is suggested for countries to strengthen their emergency department by boosting the staff component, provide adequate technical support and develop detailed plans for multi-hazard preparedness.

Keywords: climate change, COVID-19, climate extremes, disasters, multi-hazards

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1. INTRODUCTION

Climate change and the associated climate extremes is a major threat to agriculture and food security. It has been opined that Sub-Saharan Africa is one of the most vulnerable regions to climate change [1] whereas there is also a steady change in the occurrence of climate extremes of which West Africa is one of the regions to suffer increasing droughts [2]. The change in the occurrences of the climate extremes is attributed to anthropogenic influences [2]. Weather extremes lead to a cyclic debt burden on the developing world [1]. The climate extremes and the disasters will weaken investment and the capacity to attain the 2030 agenda of the Sustainable Development Goals (SDGs).

The COVID-19 pandemic is a biological disaster [3] but also a natural disaster [4] that has dwarfed public reckoning with the climate crisis [5]; with the rising number of cases and casualties increasing daily. The number of cases globally is 191.08 million while the number of deaths is 4.10 million. It is a highly contagious disease and the World Health Organisation (WHO) declared it a global pandemic in March 2020. The worst-hit countries to date are the United States, India, Brazil [6]. The virus is spreading in many countries with high mortalities recorded daily while in some countries especially Oceania and Africa, it is reducing. The reduction might be due to increased use of vaccines and observance of the strict lockdown orders in several countries including a ban on international travel.

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It has been argued that those climate extremes and disasters do lead to a spike in COVID-19 cases recorded in some parts of the world. For instance, the resurgence of the COVID-19 in the eight contiguous hurricane coastal states of the USA in 2020 was associated with hurricanes like hurricane Hanna [3,7] This was because the evacuation of inhabitants from hurricane-prone areas increased the possibility of crowding people in camps or shelters that hardly observed the COVID-19 protocol of social distancing and regular washing of hands. The coastal states affected by the hurricane include Alabama, South Carolina, Florida, Georgia, Louisiana, Mississippi, North Carolina and Texas [7]. Unsurprisingly these states also provided the highest number of new cases in the summer of 2020.

Additionally, due to the strengthening of Cyclone Amphan around the Bay of Bengal, authorities evacuated about 2.2 m people in Bangladesh and 4.3 m in the West Bengal and Odisha states of India that were accommodated in over 15,000 shelters to maintain COVID-19 protocol [3,8]. The Cyclone Amphan which was accounted for one of the strongest storms claimed 80 lives due to prompt intervention and mitigation. The gain due to the prompt intervention and evacuation was lost by a spike in the new covid-19 cases in Kolkata India and other storm-affected areas. Thus, climate extremes have played a significant role in increasing the spread of COVID-19. Furthermore, it is also reported that flooding increases the risk of COVID-19 while hindering their ability to mitigate the dual impacts of flood and COVID-19 [9]. Flooding also exacerbated the management of the COVID-19 as authorities were struggling with how to maintain social distancing especially in informal settlements [5].

Also, due to droughts in several countries in Southern Africa including Zimbabwe, there was difficulty in assessing potable water last Autumn following severe droughts that ravaged that region of Africa [5]. With the absence of water to maintain personal hygiene, it became extremely difficult to contain the spread of COVID of which one of the mitigating actions is regular washing of hands. Droughts in the developing world cause malnutrition, impelled migration, conflicts and instability [10,11] and drought and flood occurrences are likely to increase in frequency due to climate change [5,12–14]. The compounded effects of the pandemic and droughts on agriculture and food supply have been emphasized [14].

This corroborates Phillips et al. [5] assertion that storms, flooding and droughts are among the clearest sources of displacement and disruption in the pandemic. About 70 countries were affected by flood in 2020 where many were displaced and put in camps where social distancing was rarely observed [5,13]. Such a situation would complicate the spread of the novel COVID-19 virus thereby, jeopardizing the effort to curtail its spread across the globe. Hence, its spread might accelerate under such circumstances. Therefore, the question is how do we manage the crisis of COVID-19 in the event of weather extremes? It is a difficult question to answer, however; efforts are required of every stakeholder to mitigate climate change which is the root cause of both the pandemic and extreme events especially its intensity and frequency of occurrence. Another critical quality to managing the crisis is building resilience [13] where resilience entails 4 Rs. These Rs are Robustness that entails the ability of a system to resist hazard-induced stresses, redundancy which is the ability of a system to provide uninterrupted services in the event of a disaster, the resource fulness that covers the utilization of resources or materials to establish, prioritise, and achieve goals and rapidity - the ability to return the system to its pre-hazard state as quickly as possible [13].

The assessment of resilience is quantitatively done using system dynamics simulation that has been enhanced by GIS. Thus, it has been asserted that resilience is a proactive means of disaster management [13] and so is the most desirable and effective means of disaster management as it minimizes loss to the barest minimum. The methodology has been used in infrastructure management affected by hurricanes and flooding [15] which can be extended to other extreme events and COVID-19 [13].

However, there is yet to be a full-scale implementation of these approaches in managing multi-hazards compounded by the COVID-19 pandemic while yet ensuring the maintenance of resilience across the board. The incidences of multi-hazards in the presence of the COVID-19 pandemic have revealed the hidden lapses in emergencies management and poor health systems of several countries across the globe. It has shown that poor developing nations or continents like Africa still has a long way to go in emergency management as its health system and education need more funding to meet world standard that can stand emergencies of similar magnitude in the future. Additionally, internet access should be boosted in order to

promote virtual learning across developing nations and funding made available to researchers to find a real cure for the coronavirus.

Thus, the study is divided into 5 subsections with an introduction as subsection one. Subsection two is the literature review, subsection three is the methodology, subsection four is the occurrence of COVID-19 and other disasters. Subsection five discusses management measures for the multi-hazards and finally, the last subsection is the conclusion.

2. LITERATURE REVIEW

The current rate of spread of COVID-19 is fast and threatens public health globally [16]. Yet, it is worsened by a simultaneous occurrence of natural disasters that may lead to an astronomical rise in casualties. Health systems have been overwhelmed in so many countries such that any concurrent incidence with natural hazards portend greater risks with many citizens requiring help, therebycreating a dangerous feedback loop [16,17]. Such concurrence has disrupted lockdown measures in several countries like Croatia in late march 2020, Bangladesh, Greece and others [16–18].

The pandemic has disproved or in part cast doubt on the current paradigm in disaster planning and management indicating that all hazards share commonalities which permits a certain level of generalization and can be studied under the framework of; 'All-Hazards Approach' (AHA) [19]. Thus, they suggest a different approach to managing the pandemic as it is a unique disaster. They recommend that a consolidated alternative framework that is known as the 'Top-Hazards Approach' (THA) arguing that inherently different events should be approached via different planning and mitigation tactics [19].

Thus, it has been suggested that national and international policies should address contingency plans that target improving prevention, preparedness, mitigation, response and rehabilitationto new emergency events [16]. However, Appleby-Arnold et al. [20] and van Bavel et al. [21] add that to enhance intervention and minimize casualties, there should be a development of 'a culture of preparedness' which will require a change of attitude and behaviour. Also, personal emergency plans should be set up with family and friends by discussing emergency contacts, meeting points using simple reminders like a picture on mobile phones, pasted on a fridge or in a purse [20].

In addition to behaviour, yet another dimension has been added to managing COVID-19 especially in the multi-hazard era and this is the psychological aspect [22,23]. For instance, they add that mask in itself makes no much sense if people do not wear them and worn in the proper and recommended way [22].

Finally, the incidence of multi-hazards in the presence of the COVID-19 pandemic was a double or multi-disaster scenario that affected the locations of occurrence. It challenged authorities and health workers and strained the health system beyond its carrying capacity and led to higher deaths in some locations [7,18]. Hence, it is uncertain the best approach or dimension to take in handling emergencies under multi-hazard incidence involving a pandemic like COVID-19. It beckons on scientists to work assiduously to develop a cure for the COVID-19 in addition to the already developed vaccines. Again social and behavioural scientists should develop the best management approach for such and related emergencies in the future. Also, health systems should be improved drastically especially in the developing world.

Regional incidences of COVID-19 and hydrometeorological hazards

The global recorded deaths due to the coronavirus pandemic stand at 4.10 million deaths [6]. The number of deaths and cases vary by region as shown in Figures 1 and 2 with Oceania having the lowest number of cases and deaths.

Europe

The scenario in Europe is dreadful as it spread like wildfire across the continent a few weeks after it was first reported in Italy. It is one of the worst-hit continents. Also, the occurrence of certain extreme weather events compounded the crisis in Europe. For instance, heatwaves during the winter made many people congregate at beaches during the 2020 summer which then led to a second wave of the pandemic as the number of cases soared. Also, there was flooding in January in Girona and Malaga Spain that led to about 13 deaths. In France, over 1,500 persons were evacuated in Eastern Pyrenees due to the rising level of the Agly river. There were also evacuations in Greater Manchester around the same time in England due

to flooding associated with storms Ciara and Dennis. In June 2020 in Ukraine, there were 3 deaths and over 1500 persons were evacuated to temporary accommodation due to flooding in the western region. The June flood also affected the eastern parts of Romania and Moldova [25]. Also,a flash flood hit Zagreb Croatia in July which killed a firefighter and disrupted public transport [26]. In October, another flood hit France's Saint Martin-Vesubie and Breil-sur-Roya killing 7 persons, 9 missing and over 2000 houses damaged [26]. Such scenarios of multi-hazards heightened the risk of COVID-19 transmission to others as the COVID-19 protocol could be breached under such conditions of resettling in temporary shelters due to hydrometeorological emergencies. In July 2021, 2 days' unprecedented rain hit Western Europe resulting in flooding that led to the death of over 120 persons in Belgium and Germany with over a thousand persons missing and property destroyed (Figure 3) [27]. It also affected Netherlands and Luxembourg due to heavy downpours of July 13th and 14th 2021. It has been alleged that it was disastrous due to people's inability to heed early warning signals [27]. This scenario has increased the tendency of cramming more people in temporary shelters that may increase the risk of higher COVID-19 transmission as the COVID-19 protocol of social distancing and frequent handwashing might be compromised. Europe has recorded 55,959,078 cases for which France and Russia have the highest.

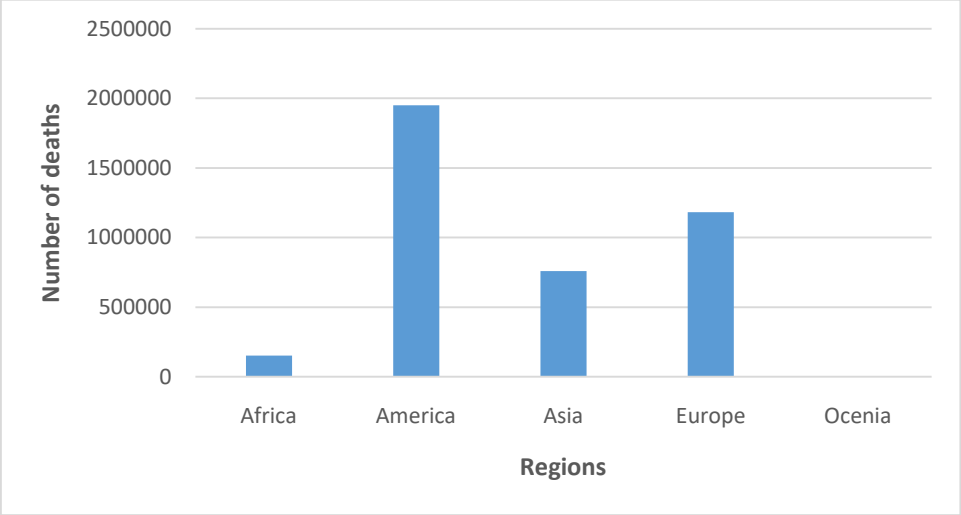

Figure 1. The COVID-19 number of deaths by regions
Source: ECDC [24]

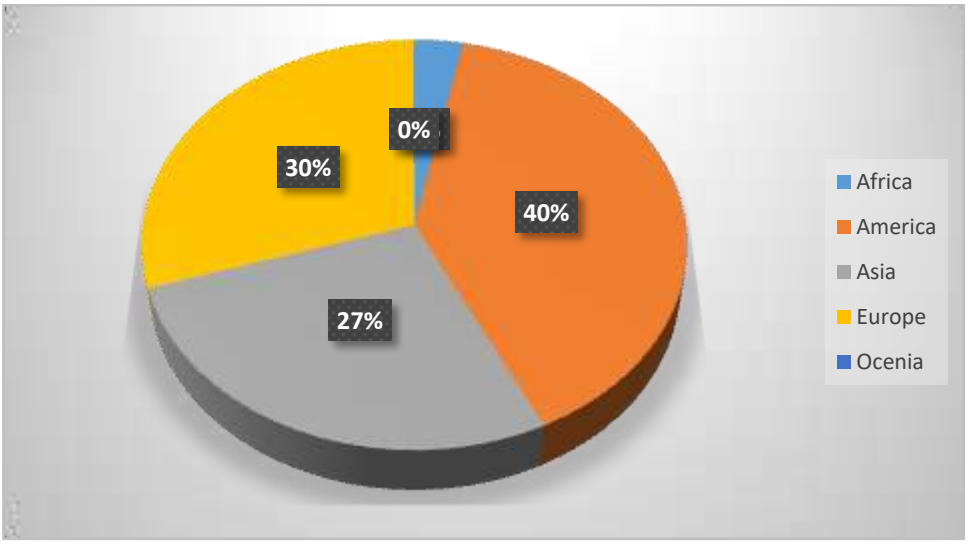

Figure 2. The COVID-19 percentage of cases by regions
Source: ECDC [24]

(a) **(b)**

(c) **(d)**

(e)

Figure 3. Devastating floods in Central and Western Europe (July 13-15, 2021) that affected rural and urban settlements: (**a**) Cars piled up by the floods at a roundabout in Verviers, Belgium; (**b**) Stansstad, Switzerland; (**c**) Devastating floods in the Rhineland-Palatinate region; (**d**) A regional train sits in the floodwaters at the local station in Kordel, Germany; (**e**) Erftstadt (Cologne): major damage after landslides caused by floods

Source: (a) Agence France-Presse; (b, c) HEPTA; (d) Daily Sabah; (e) Rhein-Erft-Kreis.

Oceania

The incidences of multi-hazards during the COVID-19 pandemic in Australia was devastating. By the summer of 2019/2020, there was a record-high increase in temperature in Australia that culminated in

heatwaves, drought and forest fires [27]. However, there was less likelihood for the disasters in the Winter which fortunately made the incidence of COVID-19 later in the year not coincide with the disasters. Damaging floods also affected Canterbury, New Zealand and New South Wales, Australia in March and May/June 2021 respectively [29,30]. Oceania has a total number of 90,540 cases for which Australia and French Polynesia have the highest number of cases.

Asia

Asia especially South Asia is one of the most densely populated regions of the world and are yet exposed to compound risks of COVID-19 and extreme climate events [28]. The nature of rainfall associated with the Monsoon season often leads to severe flooding in the region. For instance, about 1110 people died and nearly 14 million others were affected by the floods of June 2007 in Bangladesh [31]. Also, in 2020 several floods affected so many people in China, Pakistan and others which compromised the COVID-19 protocol as evacuees were crammed in camps and which exacerbated the daily recorded cases in those areas especially India [28,32–34,13,17,9]. Deadly floods in July 2021 swept across Asia killing so many people and displaced others. For instance, 6 were killed in Turkey, India, 2 were killed in South Korea, 10 in Nepal, 15 in Kyrgyzstan and Uzbekistan while several evacuees have been camped in temporary shelters in Indonesia, China and Japan due to floods [30].

However, it must also be stated that the increase in the number of cases is also worsened by the informal economy that dominates in most of the countries in this region that make social distancing a very difficult option to combating the pandemic [35]. Asia has recorded cases of about 51,198,820 for which India and Iran have the highest.

Africa

The spread of the COVID-19 pandemic in Africa has been low in many places except in South Africa and few north African States. Many African countries were lucky to have had a minimal number of cases and deaths due to the pandemic. The rising number of cases in many places were attributable to weather extremes like heatwaves that impelled many to congregate at beaches or unheeded lockdown orders in some places which skyrocketed the number of cases. Moreover, severe floods hit West and East African regions in 2020 that affected over 6 million persons. In July 2021, deadly floods hit Chad costing 5 lives, In May/June, floods in the Ashanti region of Ghana led to 4 deaths while several others were displaced in Kenya, Somalia, Senegal, South Africa, Congo DRC, Uganda and Burundi [30]. In May, Cyclone Jobo caused a flood that killed 22 people in Tanzania and affected 22,000 others [30]. In any case, the situation in Africa is worsened by the dominance of the informal economy characterised by a low-skilled labour force, poor or unavailable internet services among others nearly similar to what is obtained in India [35–37]. Africa currently has recorded 5,961,610 cases of which South Africa and Morocco have higher cases.

America

America especially the USA usually experience hydrometeorological disasters annually, especially during the boreal summer. There are cases of heatwaves that worsen pre-existing health conditions [28]. Towards or preceding the Fall every year are tornadoes and hurricanes that are associated with evacuations and resettlements. Such camps may compromise the COVID-19 protocols of regular handwashing and social distancing and thereby increase the risk of transmission to a much more number of new cases. This actually, happened with the event of hurricane Hanna and Isaias in 2020 which led to a high upsurge of new cases in the US due to breach in social distancing by evacuees [5,7,13]. In June/July 2021, a floodhit the Americas killing 2 persons in Texas USA while so many others were displaced in the USA, Colombia, Venezuela and Mexico [30]. America has recorded 74,299,121 cases which USA and Brazil havea higher number of cases.

3. METHODOLOGY

The paper is a review article. Thus, all materials were obtained from existing published articles related to the topic of discussion. A search at the Science Direct site returned a result of 62,902 while Google Scholar returned 421,000. However, when the search was further refined with ‘COVID-19’ and ‘Natural disasters’, 2,544 results were obtained from Science Direct that comprise 260 review articles, 1,645 research articles, 15 Encyclopedia and 153 book chapters. Google Scholar’s refined search returned

77400 results. Out of these, a total of 42 articles that buttress on the topic under consideration were reviewed from Science Direct and 12 articles were selected from the Google Scholar search that meets the requirements for the current study.

A multi-hazard scenario is when there are concurrent hazard events where natural hazards either of weather extreme or geophysical origin intersect the occurrence of the COVID-19 pandemic in time and space [28]. It is critical to strengthen mitigation measures of COVID-19 to lessen transmission especially as it is projected to last till 2024 [38]. Natural hazards are known to have caused an estimated loss of about 60,000 lives annually worldwide [16,39]. Though the figure is decreasing in recent times [39], emergency management should do more this period of COVID-19 pandemic to reduce the impact of multi-hazards on the populace.

4. COVID-19 AND OTHER DISASTERS

4.1. COVID-19 and hydroclimate extremes

Climate extreme events refer to unexpected and severe weather events that originate from anomalous climate state that negatively and adversely affect a man's livelihood and his environment. It is the occurrence of a value of a weather phenomenon or climate variable far above or below the normal or threshold value within a range of observed values of the variable [2]. Such extreme events include heat waves, drought, cyclones and flooding. Climate change is increasing the intensity, frequency, duration, timing and spatial extent of weather extreme events [1,2]. Climate extremes do also result from natural climate variability such as the El Niño phenomenon.

It has been asserted that mortalities from climate extremes (flood and drought) are decreasing on average but that from cyclones and tornadoes are increasing [28,29]. This might be due to advances in technology, increased computing power and simulations including advances in geospatial techniques and software that permit the proactive measure to disaster management. However, despite such advances, fatalities are worsened in the COVID-19 pandemic era due to difficulty with relocating and resettling evacuees without circumventing the COVID-19 protocol of physical or social distancing [5,13]. The occurrences of hurricanes (tropical cyclones), tornadoes, heatwaves, droughts and floods led to the peaking of pandemic cases in many countries like the US, China, Pakistan, Bangladesh, India, Ethiopia among others [5,7,9,13,14,17,28,32–34,40–43]. Cyclones hit Solomon Island and Fiji in April 2020 which displaced over 159,000 people with 2 deaths. Camping the displaced led to breaking the COVID-19 protocol that could have affected the number of cases in that Pacific region [28].

4.2. COVID-19 and geophysical hazards

Geophysical hazards include Earthquakes, volcanic eruptions and tsunamis. They are very catastrophic events that cost several lives when they strike. The event of earthquakes and tsunamis increase the pressure for temporary accommodation for evacuees who may not observe the COVID-19 protocol of social distancing which do escalate the rate of infections [5,28]. For instance, a 5.3 magnitude earthquake occurred in Croatia, north of the Capital city of Zagreb though, a minor quake, affected the city of about 800,000 persons with nearly 60 persons needing temporary shelters [28]. Camping such people were accompanied by a temporary collapse of social distancing and thus was followed by an abrupt increase in COVID-19 transmission [28,44,45].

The eruption of the Krakatau Indonesia in April 2020 led to an increase in the COVID-19 pandemic on the islands of Java and Sumatra [28]. Also, the eruption of a volcano in Eastern Congo in 2021 led to the displacement of several persons which might have escalated the COVID-19 pandemic in the country. The 5.7 magnitude earthquake in Greece in 2020 compounded the emergencies [18]. The number of infected persons increased in most of the regions affected by the earthquake in addition to fatalities recorded due to the quake [18].

5. MANAGING COVID-19 PANDEMIC IN A MULTI-HAZARD SCENARIO

Immediate actions are required to curtail the spread of COVID-19 in a multi-hazard scenario especially given that the pandemic has peaked in many countries leading to overstressing the health

systems and health workers. The safety of health workers is critical in order to serve the general public better. For instance, it was reported that nearly 20% of the infected persons were health workers in Spain [16]. To minimize imminent natural disasters impact on human health while still limiting the risk of the virus transmission demands that national and international policies address contingency plans targeted at improving preparedness, prevention, mitigation, response and rehabilitation to new emergency events [16,28]. The contingency plans should include establishing safe work protocols and guides to avert new infections through strict intervention measures following international health regulations [46]. Also vital is the identification and analysis of worst-case scenarios via periodic risk assessments and re-design of emergency plans and interventions taking into account social distancing [16]. Pre-crisis planning and concerted efforts from all stakeholders including the authorities in coordinating the impending crisis with effective communication plans, public awareness, engagement and communitysupport [16,36,46].

Additionally, international cooperation is expedient in managing multi-hazards, especially when a highly transmissible disease like COVID-19 is involved. Donor agencies and other international organisations should aid the poor developing nations in managing a health challenge of this magnitude with every logistics necessary to forestall its spread. More so, the scientific community should do more to develop vaccines as they are currently doing and the eventual cure for the virus and also funds should be made available to research centres to pursue this lofty goal to save humanity from the threat of the virus. In addition to improving citizens' awareness of hazards, the role of culture should be integrated into hazard prevention [20]. The 'culture of prevention' they argue will enhance mitigation and resilience to multi-hazards as it increases social inclusion and mutual trust among the citizenry. Such a culture of prevention is vital as it enables and promotes total compliance of the people to measures put in place to reduce or counter the spread of COVID-19 and any other disaster. For instance, before the development of the vaccine, flatten the curve of infection depended solely on the compliance of the people to the imposed restriction of movement or lockdown order and wearing of masks with regular hand washing.

Thus it is asserted that those measures do not reduce or stop the spread by itself unless if implemented by the people [22]. And doing those things like wearing a mask is a 'behaviour' just like staying at home and others are part of the culture and if they are seen by the people as their culture, then they are bound to be obeyed effortlessly. In this way, the spread of the pandemic would be curtailed due to total compliance.

Furthermore, it has been shown that the poor are more likely to break the lockdown restriction than the most affluent [47]. Thus, the management of the COVID-19 can be approached from the role social inequalities play in society. Hence, if more green spaces are provided for recreation or economic palliatives provided to soothe the economic burden of people restricted from work and earning and fully equipped hospitals with sufficient bed spaces are made available and accessible to all and sundry, then the spread of the virus can be contained quickly. This also goes to decongesting many suburbs in developing countries that have high room density due to overcrowding of apartments by occupants. Should more houses be made available to the deprived regions, social distancing will be better adhered to.

Therefore, governments everywhere should endeavour to reduce social inequalities to the barest minimum by providing more infrastructure, better health systems and improve the economy, especially in the developing world. Also, the people should support the authority in crisis management by adopting the 'we' concept where collectivism is the watchword [22]. Thus, it is not about me, it is not all about you, it is about me too and so it is about we [22]. It is about we, if that sense of inclusiveness is assured. Effort should be devoted at improving the lives of the most vulnerable members of the society for the less vulnerable they become, the higher their chances of surviving during emergencies.

More so, in line with the World Health Organisation's (WHO) recommendations outlining the following steps to manage multi-disasters: rapid assessment, prevention of infections, surveillance, control of disease outbreak, disaster management, evaluation in order to control disease spread [48]. Early Warning Systems (EWS) is also critical to managing multi-hazards [48] including communication and a culture of acceptance and implementation. It has been argued that EWS if available can save lots of lives from disasters, however, despite the United Nations (UN) call for the development of EWS following Indian Ocean Tsunamis and the Sendai Framework, only 81 countries have a national strategy for disaster risk reduction [49]. The UN advocate that EWS should comprise knowledge of the risk, its monitoring and

warning service, dissemination and communication, and response capability [48]. New Zealand has demonstrated the usefulness of EWS and her preparedness for disaster risk management in using alert level systems to manage earthquakes, volcanoes and the novel COVID-19 [49].

In addition, resilience is critical to successful disaster risk management such that the people should be resilient in terms of being flood-resilient, earthquake-resilient, pandemic-resilient and climate-resilient [44]. Resilience implies the capacity of a system, community, or society to adapt to potential hazards by resisting or evolving to maintain an acceptable level of functionality or structure [44,50]. However, the resilience and response capability of the community should be built into or integrated with the local adaptation capabilities and culture. Resilient critical infrastructure should be built to support the most vulnerable in times of crisis.

Finally, the concept of human security and dignity should be integrated into new policy for managing multi-hazards during the pandemic [40]. Provision should be made to support the most vulnerable populations and integrate disaster and climate resilience in their livelihood programmes to strengthen their ability to withstand additional stressors or shocks [33].

6. CONCLUSIONS

Climate change worsened by anthropogenic pressure on the earth's resources is impacting the earth severely. The impacts are numerous ranging from the novel coronavirus to extreme events like heat waves, drought, flooding, cyclones and other disasters like increased pollution. It has been pointed out that the earth's temperature is rising far above the pre-industrial revolution era and all efforts should be made to ensure it does not exceed 1.5^{o}C to 2^{o}C to avoid reaching the tipping point in the climate systems [51]. Climate change is already affecting the complexity and uncertainty of the present and future disaster management challenges [13]. With the recent events, scientists and other stakeholders should develop an effective approach to managing multi-hazards in time and space. This is crucial with the experience of the COVID-19 and climate extreme events which compounded management efforts, increased the number of cases and casualties.

According to the UN's Secretary-General, Africa might be the most vulnerable to the coronavirus pandemic just as it is to climate change and the associated extreme events[5]. As Simonovic et al. [11] add that if the uncertainty cannot be completely avoided or eliminated then, it should be communicated to provide a sound basis for planning and decision-making. Thus in this regard, proactive measures should always be advocated for and promoted in disaster and multi-hazard management. There should always be the political will to act on the part of the authority and the people's willingness to respond positively to the communicated early warning signals in order to minimize losses due to multi-hazards. Additionally, regionally cooperation is necessary to mobilise expertise and resources to establish multi-hazard early warning systems [3].

Therefore, governments everywhere, health agencies and disease control experts as well climate and environmental scientists should take immediate actions that will arrest the COVID-19 as well as limit the magnitude and frequency of the occurrences of climate-related disasters [5]. Proactive measures including pre-disaster preparedness and resilience approaches should be integrated into the disaster management of any nation. Additionally, emergency management and support staff should be boosted during the period of multi-hazard events as understaffing would likely exacerbate the disaster and increase the number of casualties due to a shortage of manpower at critical moments. Adequate technical support with funding is critical to ensure good results in disaster management [5]. Hence countries should develop detailed plans for multi-hazard preparedness taking into account regional differences to the vulnerability of climate change and the strength of existing health infrastructure [5]. Also, cooperation among the citizenry and the stakeholders is vital for with collective effort the battle with the pandemic will be won quickly.

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