







Perspective

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Impact of Nyiragongo Volcanic Eruptions on the Resilience to the COVID-19 and Ebola in the Democratic Republic of the Congo

Emery Manirambona ^{a*}, Emmanuel Uwiringiyimana ^a, Shuaibu Saidu Musa ^b, Samuel Niyonkuru ^a, Dawa Gyeltshen ^c, Yusuff Adebayo Adebisi ^d, Don Eliseo Lucero-Prisno III ^e



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Correspondence: Emery Manirambona, College of Medicine and Health Sciences, University of Rwanda, Kigali, Rwanda.
Email: manemery1@gmail.com

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Authors' contributions

The participation of each author corresponds to the criteria of authorship and contributorship emphasized in the [Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly work in Medical Journals of the International Committee of Medical Journal Editors](#). Indeed, all the authors have actively participated in the redaction, the revision of the manuscript, and provided approval for this final revised version.

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Conflict of interest

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^a College of Medicine and Health Sciences, University of Rwanda, Kigali, Rwanda.

^b Department of Nursing Sciences, Ahmadu Bello University, Zaria, Nigeria.

^c Eusa Hospital, Ministry of Health, WangduePhodrang, Bhutan.

^d Faculty of Pharmacy, University of Ibadan, Ibadan, Nigeria.

^e Department of Global Health and Development, London School of Hygiene and Tropical Medicine, London, United Kingdom.

ABSTRACT

For decades, the Democratic Republic of the Congo (DRC) has been vulnerable to disasters. The most dangerous Nyiragongo volcanic eruption posed a threat to the country, particularly the city of Goma. The explosions on 22 May 2021 caused unfathomable damages, with loss of lives, properties, and the destruction of homes, displacing thousands of people, with thousands of children being left vulnerable as a result. Furthermore, it charred health and school infrastructures and decimated crops, an issue in the population where the COVID-19 has exacerbated the existing fragile health system. Importantly, these eruptions posed a challenge when DRC struggled to end COVID-19 and Ebola through surveillance, preventive measures, and vaccination. It is doubtless that priorities of the emergency have interrupted the surveillance system, thus increasing exposure to the COVID-19 and Ebola transmission. It is critical to provide basic needs to victims of the Nyiragongo volcanic eruptions in the aftermath of such a disaster. Local and global humanitarian organizations are needed to assist residents in relocating. Furthermore, appropriate and adjusted mitigation strategies will significantly prevent Ebola, COVID-19, and other infectious diseases. In this paper, we discuss the impacts of the volcanic eruption on population health and Ebola preparedness and response in the context of the global COVID-19 outbreak in the Democratic Republic of the Congo.

Keywords: COVID-19, Communicable Disease Control, Disasters, DRC, Ebola, Volcanic Eruptions.

1. INTRODUCTION

Natural disasters have wreaked havoc on humanity's ability to survive throughout history [1]. They have claimed many lives and left survivors with physical and mental problems, as well as moral and material requirements [2]. Africa has not been spared from natural disasters. Cyclones, droughts, agricultural pests, floods, earthquakes, endemic diseases and epidemics, volcanic eruptions, and bushfires have all had multitudinous effects on the continent [3]. The Democratic Republic of the Congo (DRC) has been vulnerable, having been hit by various natural disasters over the years [4], including volcanic eruptions. Nyiragongo is one of the world's most active volcanoes located in the western African Rift Valley and dubbed "the most catastrophic effusive eruption in contemporary history" in 2002 [5]. Located in the eastern DRC's North Kivu region, close to Goma and the Rwandan border, it releases extremely fast and hot lava, making it Africa's most lethal volcano.

Historically, the Nyiragongo volcanic eruptions have destroyed lives. The 1977 eruptions, for example, were the deadliest, with over 600 people killed. In January 2002, a series of explosions around Goma killed roughly 250 people and left 120,000 homeless [6]. The outbursts threatened the DRC's public health, especially in Goma, the closest city to the

volcano. Even though the recent eruptions may have hampered the country's resilience to the COVID-19 Pandemic and Ebola, the effects on the strength to mitigate the two outbreaks are not explored. This article aims to discuss the impacts of the 22 May 2021 Nyiragongo volcanic eruptions on health and their effects on the country's resilience to the COVID-19 pandemic and Ebola and provide facts to propel policymakers into acting quickly and developing preventive measures to avert future catastrophe.

2. DISCUSSION

The DRC has been severely impacted by three major disasters between 2020 and 2021: Ebola Virus Disease (EVD), COVID-19, and Nyiragongo volcanic eruptions. EVD has caused havoc on the country and has proven difficult to contain. As of 3 July 2020, the country had recorded 3481 cases and 2299 deaths [7]. Although the DRC has implemented measures to end EVD, successive EVD outbreaks have claimed lives. For instance, according to the World Health Organisation (WHO), DRC announced a further outbreak on 8 October 2021 in addition to the previous attack in February 2021 following 12 EVD cases in North Kivu Province, six of whom died [8]. The COVID-19 pandemic is another global health threat that has infiltrated the country. The DRC recorded the first COVID-19 case on 10 March 2020, just a few days after discharging the last EVD patient on 3 March 2020. As of 5 October 2021, the DRC had reported 57,197 COVID-19 cases, with 1,087 deaths [8].

To reduce the rate of COVID-19 transmission, the DRC has implemented WHO-recommended containment policies. However, for the country that relies on international trade for 60% of its GDP [9], the lockdown and travel ban measures have significantly dropped its trade from 4.4 % in 2019 to 0.8 % in 2020, according to the World Bank [10]. As a result, the pandemic exacerbated the economy of the world's third poorest population [10], resulting in supply disruptions and an increase in production costs, severely affecting the poor.

While the DRC continued to contain COVID-19 and Ebola through community surveillance, preventive measures, and vaccination, a lethal disaster occurred on 22 May 2021. Mount Nyiragongo's volcanic eruption has been challenging and has resulted in unfathomable damages. The destructive hot lava lake, which moved faster (100km/h), has precipitated a humanitarian crisis upon another crisis. According to a UNICEF report, it damaged over 3,500 houses, causing displacement of at least 234,000 people while four health centers and seven school infrastructures have been charred [11] and 32 people killed [12]. Equally important, it left around 200,000 persons without access to safe drinking water, and crops were decimated. These consequences of Nyiragongo eruptions have been multifid on health and could have caused additional severer effects. For instance, crop damage is an issue where at least one-third of the population faces tough food insecurity challenges [6]. Besides, the lack of health and school facilities could have dampened the country's progress in health and education. Also, inaccessibility to safe water may pose other public health challenges such as contracting cholera [13].

Similarly, thousands of children lacking assistance are vulnerable to nutritional disorders where malnutrition exists in half of the country's children [10]. Furthermore, the volcanic eruption gas release can cause significant adverse health effects in the post volcanic era and trigger a harmful limnic eruption [14].

The impact of the Nyiragongo volcanic eruption on the country's efforts to slow and end the COVID-19 Pandemic and Ebola epidemic has been apparent. It erupted a few days after the DRC's Ministry of Health had declared the end of EVD transmission on 3 May 2021 [15]. However, the country was still in the additional 90 day period of surveillance to ensure no new Ebola cases were detected [15]. There is little doubt that the circumstances that caused massive migration, and a humanitarian crisis increased the exposure to Ebola. Notably, WHO insisted that there was still the risk of EVD outbreak, given the virus is enzootic in DRC and can re-emerge after an epidemic [16].

The repercussions on the curtailment of COVID-19 are real. The management of COVID-19 requires a combination that includes resources allocations, a multisectoral approach, and, most importantly, community engagement. However, most of these efforts shifted to tackling emergencies triggered by volcanic eruptions and their consequences [11]. In the aftermath of the tragedy, compliance to COVID-19 preventive measures has been limited. People who fled the lava flow could not wear masks, and circumstances were hard to practice physical distancing. To further undermine hygiene measures when there was no water access. The lack of compliance to COVID-19 preventive policies has increased the probability of COVID-19 transmission among the population in Goma, compounded by the lack of access to healthcare as the eruption burned the health facilities. Another critical factor is that people in the newly relocated camps are much closer, increasing the transmission rate of SARS-COV-2 [17].

Therefore, the Nyiragongo volcanic eruption impacts have been multifaceted, and it has added to the country's struggle to eradicate Ebola and the COVID-19 [18]. The factors that include massive migration and lack of physical distancing, lack of water access to wash hands, burned healthcare infrastructure [11], lack of testing, vaccination, and healthcare, and shifted focus to handle the eruption's effects have affected the epidemic surveillance system, thus jeopardizing timely detection and response to EVD and the COVID-19.

3. RECOMMENDATIONS

Looking at the Nyiragongo volcanic eruption impacts, there is a need to implement a supporting system for the disaster victims. Humanitarian assistance is crucial in providing immediate support to unaccompanied children and other vulnerable persons by meeting essential needs such as food supplies, clean water, shelter, and other household items [11]. Additionally, victims would benefit from medical care and psychological first aid as the Goma residents could have been traumatized by this threat [19]. The eruptions have been a significant threat for the people in Goma, whose health system is fragile. Therefore, it is critical to design appropriate public health preventive measures such as strict hygiene, mask-wearing, and social distancing to prevent displaced victims from dying from unnecessary deaths resulting from existing epidemics [20]. In light of this, we advocate for further surveillance and prevention of COVID-19 and EVD. There is a need to strengthen the global health security agenda (GHSA). The implementation of relevant measures such as screening for timely diagnosis, contact tracing, care, and vaccination, alongside isolation places, would be helpful to curb epidemics in the displaced community. It is worth noting that given the lack of clean water, Cholera must be monitored and prevented [20].

To sum up, we advocate for an early volcano alert for safety and evacuation for Goma residents. The Goma Volcanological Observatory (GVO) or any other involved agency must be supported and strengthened to reduce the adverse effects promptly. More research, experts in volcanology, and efficient resources are needed to ensure effective monitoring of volcanoes in North Kivu.

4. CONCLUSION

This paper discussed Nyiragongo volcanic eruption's havoc. It has severely affected people who live in Goma, the DRC. Furthermore, it has significantly impacted the surveillance system implemented to end EVD and protective measures devised to curb the COVID-19 pandemic in the country. Therefore, there is a need to set humanitarian mechanisms to aid people affected by the disaster by supplying essential needs. Public health measures including risk communication, infection prevention, contact tracing and testing, alert surveillance system, front workers training, and vaccination must be devised to ensure no more deaths result from the existing epidemics, including but not limited to Ebola and COVID-19. Finally, early alert for possible future volcanic eruptions could reduce damage.

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AUTHORS' CONTRIBUTIONS

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COMPETING INTERESTS

The authors declare no competing interests with this study.

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