Psychological impact of a volcano eruption – Mount Nyiragongo

Harpreet S. Dhillon[a], Shibu Sasidharan[b]

Departments of [a]Psychiatry, [b]Anaesthesiology & Critical Care, Level III IFH MONUSCO, Goma, DRC

Correspondence to Shibu Sasidharan, MD, DNB, MNAMS, Department of Anaesthesiology & Critical Care, Level III IFH MONUSCO, Goma, DRC. e-mail : shibusasi@gmail.com

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The volcanic eruption is a rather uncommon type of natural disaster and is restricted to certain geographical regions. The psychological distress studied among the evacuees of a volcano in many countries revealed symptoms of anxiety, insomnia, anergia, social dysfunction, and anhedonia persisting even after six months of eruption. A study after a volcanic eruption in Iceland revealed higher incidence of mental distress and post-traumatic stress disorder (PTSD) in exposed versus the non-exposed groups. Insomnia, psychological morbidity, and possible long-term psychological morbidity were reported as the most common symptoms in the high-exposure group (based on the volcano-ash fall). Studies also show the involvement of children's mental health. DRC, being a low-income country lacks the research and does not have strongly researched data regarding the prevalence of psychological morbidity post the volcano eruption. However, the psychological maladjustments after the Mount Nyiragongo eruption in 2002 were reported as the major health consequence as per WHO. This paper analyses the various psychological aspects during and after a volcanic eruption.

Keywords:
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Disasters are an inescapable component of human existence. The natural disasters such as tsunamis, volcanoes, earthquakes, etc. however, differentially impact certain vulnerable geographical locations. There are ~500 million people inhabiting within the potential exposure range of an active volcano worldwide (Hansell *et al.*, 2006). The massive outpouring of lava, burns, heat, heavy metals, volcanic ash, volcanic gases, acid rain, and subsequent seismic activity causing massive earthquakes poses an exceptional psychological impact on the lives of local populace.

Mount Nyiragongo volcano, located on the western branch of the East African Rift valley in Democratic Republic of Congo (DRC), is one of the most active volcano in African continent. It is located 15 km north of Goma city, the capital of North Kivu province with a population of ~06 million. Mount Nyiragongo has a semipermanently active lava lake, which is arguably the largest in the world (Pouclet and Bram, 2021).

Nyiragongo is a unique volcano, by virtue of its close proximity to hazardous gas-laden (CO_2 and CH_4) lake Kivu, leading to alarming concerns about a possible Nyos-type lethal gas burst, if the lava flows into the lake. It has erupted three times till date, the first eruption in 1977 claiming 60 lives. The second eruption on January 17, 2002 had the most destructive impact ever recorded in history for an effusive eruption with the lava engulfing ~15% of the nearby Goma city, eventually pouring into the nearby gas-charged (CO_2–CH_4) lake Kivu, leading to catastrophic concerns about a possible Nyos-type lethal gas burst (Allard *et al.*, 2003).

Mount Nyiragongo eruption of May 22, 2021

The mount Nyiragongo volcano near the city of Goma in the east of the DRC erupted on May 22, 2021. There were 31 reported deaths (13 people died in the road-traffic accidents during evacuation of the city and 24 people burned by the lava), while 40 adults were reported missing (Sasidharan and Dhillon, 2021). Over 3629 houses were ravaged by lava, including three healthcare structures as well as 12 primary and secondary schools. The road as well as airport connectivity was disrupted due to lava impeding the humanitarian assistance. Coronavirus disease 2019 restrictions complicated the other access roads via Rwanda or Uganda hampering the reinforcement teams.

The earthquakes (~200 on June 1–2, 2021) following the volcano eruption were rocking the city with tremors causing cracks in buildings and placing further stress on the already-traumatized population. The Congolese

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authorities ordered evacuation of the city on May 27, 2021, due to the fear of another eruption. There was a displacement of ~3.5 million people in a mass exodus with the potential of causing epidemic of cholera in the nearby town of Sake without adequate shelters. Prices of food and nonfood items in Goma and surrounding areas increased, leading to further food insecurity and economic vulnerability. Cases of theft, looting of shops/malls, and other property left behind by displaced households, have also been reported.

There are several causes of concern such as lack of sophisticated monitoring equipment, the potential impact of a second eruption, and the continuing earthquakes that rattle the area around Goma and Gyseni, as well as ground cracks in and around Goma. As per the Goma Volcano Observatory with assistance, from the Belgian–Luxembourgian consortium (GeoRiskA/AfricaMuseum and the European Center for Geodynamics and Seismology/ National Museum of Natural History, Luxembourg) on June 3, 2021, there exists a possibility of another eruption with catastrophic consequences if the lava erupts within the city or under lake Kivu. In the event of such eruption, the cities of Goma and Giseny would be destroyed and the heat released by lava in the lake would trigger an overturn of the deep lake water rich in dissolved CO_2. This would cause a catastrophic overturn and sudden release of large quantities of CO_2, a so-called limnic eruption. The gas cloud would instantly kill thousands of humans and animals at lower elevations around the lake.

Psychological aspects

There is a wide range (8.6–57.3%) in the prevalence of psychological morbidity post disaster (Udomratn, 2008). The volcanic eruption is a rather uncommon type of natural disaster and is restricted to certain geographical regions. The psychological distress studied among the evacuees of a volcano in Japan revealed symptoms of anxiety, insomnia, anergia, social dysfunction, and anhedonia persisting even after six months of eruption (Ohta *et al.*, 2003). Another population-based study after a volcanic eruption in Iceland revealed higher incidence of mental distress and posttraumatic stress disorder (PTSD) in exposed versus the nonexposed groups (Gissurardóttir *et al.*, 2019). Insomnia, psychological morbidity, and possible long-term psychological morbidity were reported as the most common symptoms in the high-exposure group (based on the volcano-ash fall) (Carlsen *et al.*, 2012). In another study on the long-term health of children following the volcanic eruption, the exposed children were more likely to experience mental symptoms (anxiety/worries, headache, and sleep disturbances), which would persist for up to three years postdisaster (Hlodversdottir *et al.*, 2018). DRC, being a low-income country lacks the research and does not have strongly researched data regarding the prevalence of psychological morbidity post the volcano eruption. However, the psychological maladjustments after the Mount Nyiragongo eruption in 2002 were reported as the major health consequence as per WHO.

The reaction to a disaster follows a predictable pattern in both individual and community. There are four phases – heroic phase, honeymoon phase, disillusionment phase, and restoration phase (Math *et al.*, 2006). The heroic phase follows immediately after the disaster, when survivors in the community usually show altruistic behavior in the form of rescuing, feeding, sheltering, and supporting the community members. Next, the relief agencies arrive at the scene along with media attention, free food, free medical aid, and bloated promises by the local administration for monetary packages and rebuilding of damaged property. There appears a sense of immense relief and faith in the survivors founding the 'honeymoon phase,' which usually lasts for 2–4 weeks. This phase is followed by the exhaustion of resources and relief materials and the support starts weaning, leading to a disillusionment phase. It is during this phase that psychological morbidity starts escalating and mental health support is required.

So, what are the normal human responses of human to a disaster? Grief is the natural response to any loss and is most commonly encountered in the survivors. The other common responses are prolonged/complicated grief, survivor's guilt, overwhelming uncontrolled emotions, fear of becoming mentally ill, and intermittent suicidal ideation/death wishes. These responses need to be dealt with during the psychological first aid by providing validation for these emotions. The common psychiatric disorders after a disaster are adjustment disorders, PTSD, depression, anxiety disorders, psychosomatic symptoms, and substance abuse (Young *et al.*, 1998).

Prolonged grief needs to be evaluated, monitored, and managed adequately because if left untreated, it is significantly associated with major depressive disorder (MDD) in the future. Prolonged/ complicated grief reaction is also an impediment to the return of normal psychological and socio-occupational functioning. The association of

prolonged grief with MDD and PTSD was studied among a sample of civilian war survivors who were exposed to multiple war-related traumatic experiences. The most common traumatic events in the study [forced evacuation under dangerous conditions (86.7%), combat exposure (81.7%), and lack of shelter (78.3%)] were almost similar to the Nyiragongo volcanic eruption. About 38.3% of the study sample fulfilled the criteria for prolonged grief, 55.0% for PTSD, and 38.3% for MDD. Furthermore, a diagnosis of prolonged grief was significantly associated with symptoms of anxiety and sleep disturbances (Morina *et al.*, 2010). These findings highlight the importance of integration of mental health services in the effective predisaster planning and relief measures.

In recent times, disaster mental health services have focused on the preventive aspect in contrast to the older postdisaster relief aspect. This preventive aspect is holistic and encompasses readiness (preparedness), response (instant action), relief (continued rescue work), rehabilitation, recovery (return to normalcy), and resilience (promoting) (Math *et al.*, 2013).

Recommendations

Mental health screening clinics

During a postdisaster scenario, in addition to catering for shelter, food, nonfood items, and protection, the facility for mental health support needs to be established inside the relief camps. The specialists should train the local resources for community-based interventions keeping in mind the local cultural sensitivities. The aim should be to augment psychosocial rehabilitation with focus on stabilizing, venting of emotions and feelings, socializing, and restoration of a sense of safety and security. These clinics can also pick up high-risk cases (e.g. children, female sex, elderly, physically disabled, single, ethnic minority, displaced population, poverty, substance use like smoking, and loss of economic livelihood) and help prevent potential adverse mental health consequences. The mental health professionals need to be cognizant of the local socio–religious–cultural grieving rituals and encourage those practices. The survivors, who do not respond to these measures, should be given the benefit of trauma/grief-focused interventions.

Caring for the healers

The relief workers in a disaster are exposed to considerable stress and run the risk of burnout, compassion fatigue, and vicarious traumatization. It is thus imperative to monitor the psychological status of the disaster-relief workers (McCann and Pearlman, 1990).

Psychological first aid

The survivors of a disaster can exhibit a variety of irrational cognitive, emotional, and physical reactions. The mental health professionals should train the local resources/disaster-relief workers to deliver psychological first aid, which is similar to medical first aid and can be provided by minimally trained nonprofessionals (Reyes and Elhai, 2004). The relief workers should be able to screen high-risk survivors who pose a danger to self/others, disoriented to time/place/person, survivors with significant physical injury/death of the family member, past history of mental illness, etc. After identification and ensuring safety of the high-risk survivors, the relief workers should help them vent out and validate their emotions.

Psychological debriefing

The centers for psychological debriefing should be catered for within the relief camps. The survivors of a disaster should engage in a group discussion 48–72 h after the disaster where they should discuss and share their factual and emotional experiences. It helps in cognitive restructuring of an individual's perception of the disaster event (Watson *et al.*, 2003).

Community-based interventions

The environment and morale of survivors inside a relief camp is pensive and melancholic. A range of community-based interventions utilizing the available resources with ingenuity can help provide a sense of control. These include behavioral scheduling, group discussions, practicing social and religious rituals, providing factual and reliable information, continuing informal education for children (sketching, drawing, and singing), assisting in the relief work, engaging in prayers/relaxation, and sports/games. These informal interventions help bolster the self-esteem and infuse a sense of self-efficacy in the community.

Conclusion

Natural disasters are an unavoidable reality and developing countries like DRC are at enhanced risk due to poverty, scanty resources, illiteracy, corruption, poor infrastructure, lack of trained manpower, and poor knowledge of disaster mental health. However, well-laid-down standard operating procedures for optimal monitoring, preparedness, swift response, rehabilitation, and reintegration can help accelerate the recovery process.

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Conflicts of interest

There are no conflicts of interest.

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