



COMPREHENSION AND POPULARIZATION OF PRECAUTIONS AGAINST MAZUKU RELATED RISK BY THE MEDIAS OF GOMA, DR CONGO

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KeyWords

Risk linked to Mazuku, Popularization of Precautions, Media, Goma City, Volcanic Gases.

ABSTRACT

Mazuku are most often depressions, and less frequently fronts of lava flows where CO₂ accumulates by gravity, which impoverishes the air in oxygen, making it toxic and deadly. This phenomenon is observed in the city of Goma and its surroundings, particularly in the areas along Lake Kivu. The Mazuku sites are characterized by very yellowish vegetation and blackish rock that can help identify them at first glance and stay away. This study focuses on the involvement of the entire population of Goma in preparing for the risk linked to Mazuku, the popularization of precautions and prevention, particularly the media professionals in the city of Goma. This is a question about the latter's understanding of said risk and their involvement in the popularization of protection measures. The initial hypothesis considered that there is no relationship between media professionals' knowledge of the risk linked to Mazuku and appropriate precautions. To achieve its objective, this study used the survey method to collect data and then, the latter were the subject of descriptive and inferential analysis to interpret said data. To collect the different opinions of our respondents, a survey questionnaire designed and encoded using KoboToolbox was used. The collected data were imported into SPSS v22 for descriptive and inferential analysis but also for testing of independence using Karl Pearson's chi-square (X²) formula. The results revealed that the majority of respondents (n=22) know Mazuku as a risk linked to carbon dioxide CO₂, but also a significant number (n=20) consider that it is a gas of unknown origin. In both cases, the majority of respondents recommend staying away from these places, which indicates their understanding of the risk. However, among the respondents (n=26) who know Mazuku as a gas linked to CO₂, there are a few (n=4) who recommend wearing a face mask as a precaution in these places, an inappropriate measure, even dangerous. Among the others who consider Mazuku to be a gas of unknown origin, there are those who recommend (n=2) entering and leaving quickly if necessary. These observations therefore reveal that the media professionals surveyed in this study have the idea of risk but the difference between their perception of risk and knowledge of its origin remains significant. These observations prove that knowledge of the risk linked to Mazuku should be strengthened through an awareness program to improve the popularization of precautions against this risk by the media in Goma.

1. Introduction

Gas emissions constitute one of the seven major volcanic risks, among others, lava flows, fallout of ash and blocks, pyroclastic flows and lahars (mud flows), landslides, tsunamis and gases themselves[1]. The Nyiragongo Volcano and Nyamulagira, two still active volcanoes in the Virunga chain emit several gases including water vapor (H₂), carbon dioxide (CO₂), sulfur dioxide (SO₂), carbon monoxide (CO), hydrogen chloride (HCl) and hydrogen fluoride (HF); and all these gases are harmful to humans, animals and the environment[2], [3]. This study focuses on the city of Goma and its surroundings, which are particularly full of several areas with carbon dioxide (CO₂) emissions, a deadly gas known locally under the name “Mazuku”. The term Mazuku is particular to the Virunga region and refers, according to a local belief, to a “devilish winds” which kill people and animals in several places in the city and its surroundings. Mazuku are most often depressions, and less frequently fronts of lava flows where CO₂ accumulates by gravity, which depletes the air of oxygen, making it toxic and deadly. This phenomenon is observed in the city of Goma and its surroundings, particularly the areas along Lake Kivu. The sites of Mazuku are characterized by very yellowish vegetation and blackish rock that can help identify them at first glance and stay away. CO₂ is a gas heavier than air, at a higher concentration, it becomes toxic and asphyxiating, it irritates the eyes, nose and throat. It is directly fatal at a concentration above 15% [4], [5]. More in-depth observations revealed that exposure to low concentration levels between 2 and 5% of CO₂, Mazuku causes nausea, dizziness, etc. A significantly prolonged exposure at a rate of 4% leads to headaches, feelings of fatigue, loss of consciousness, acceleration of heart and respiratory movements. Exposure to a rate of 10% for ten minutes or more, causes convulsions, coma and death [6]. This aggravates the human vulnerability in the face of this natural disaster which has already caused loss of human lives directly during and after the eruption through lava flows as well as gas emissions including the Mazuku [2], [4], [7], [8]. CO₂ measurements carried out occasionally using the gasometer, the GA5000, help to understand the evolution of the volcanic threat for the City of Goma and its surroundings for appropriate prevention for the population living in these areas already characterized by an increasingly growing population. The GA5000 is an infrared detector with a pump and a gas inlet connected to a plastic pipe. The metal end of the pipe is placed at the precise location where they want to measure the concentration. The pumped gases first pass through a 0.45 μm poly sulfone filter and are then led to an IR analyzer. The results are displayed on the instrument screen [4], [9]. Apart from the measurement of the concentration of CO₂, certain observable aspects make it possible to identify the Mazuku sites such as the coloration of the vegetation from light green to yellowish green (absent in places with a high concentration of 40-50%), coloration of the rock from gray to more blackish, a sensation of heat at surface level and the systematic presence of remains of dead animals (insects, birds, goats, dogs, cows, monkeys, etc.) and even humans. Precautions aimed at reducing the risk consist of informing the population through prevention campaigns and the installation of signs on the sites already identified and allowing them to remain safe from danger[6]. However, given the realities linked to current population growth, more appropriate precautions for this phenomenon become more necessary than ever. Meanwhile, preparation motivation theory considers that people prepare and take protective measures in order to reduce risks based on their perception of the severity of the situation, the likelihood of personal involvement, effectiveness and efficiency of protective measures but also according to the age, the presence of physical or mental limits, fatalism, the tools and resources of the recipient, knowledge of escape routes, analysis of environmental signals concerning the type of events and social signals concerning information received from relatives or friends, television, radio, etc.[10]. This study focuses on the involvement of the entire population of Goma in preparing for the risk linked to Mazuku, the popularization of precautions and prevention, particularly professionals of media in the city of Goma. This is a question about their understanding of the said risk and their involvement in the popularization of protection measures.

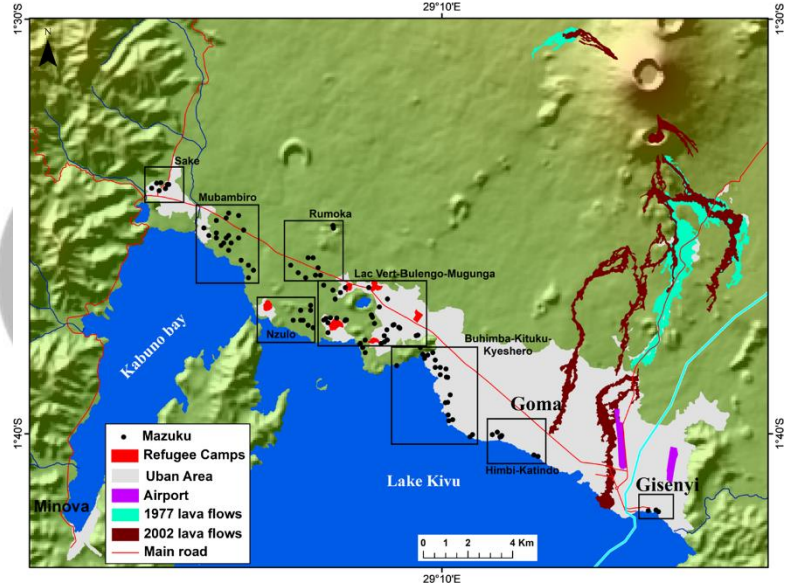


Figure 1. Location of the best-known Mazuku sites in the city of Goma and its surroundings (Balagizi et al., 2018)

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2. Materials and Methods

To achieve its objective, this study utilized a survey for data collection, which were then subjected to descriptive and inferential analysis to interpret the data. Descriptive analysis aims to depict a trend, condition, or attitude of a phenomenon. In a case study approach, this analysis involves describing each unit, person, or individual group based on their activity, specific needs, living situation, history, or experience[11], [12]. The experience of this study involves gathering opinions reflecting the perception of Mazuku-related risk and involvement in disseminating precautions by the media in the city of Goma. Our study population, identified after compiling a list of 60 media specialists in the city, consisted of a representative sample of 50 individuals using simple random sampling technique. This sample size was pre-calculated for a population of 75 individuals, proportionally adjusted as for individuals with a confidence level of 95% and a 5% margin of error deemed acceptable [13], [14]. To collect the various opinions of our respondents, a survey questionnaire was designed and encoded using Kobo Toolbox. Kobo Toolbox is a free and open-source tool designed for collecting field data in humanitarian and challenging environments. This tool has been praised for its ability to rapidly and accurately collect data for various situations[15]. Chuang and his colleagues utilized the tool to assess the community response to disasters in Taiwan. In their research, they acknowledged the tool's role in disaster resilience by providing information for the establishment of community emergency operation centers, humanitarian response, etc. [16]. The collected data was imported into SPSS v22 for both univariate descriptive analysis and bivariate inferential analysis using the Karl Pearson's Chi-square (X^2) test formula. The independence test aims to assess whether certain categorical variables are correlated with specific members of the population as some variables tend to differ within populations[17]–[19].

3. Results and Discussion

3.1. Descriptive Analysis

Table 1. Function of the respondent in the media and type of media

Function of the respondent in the media		
Variable	Frequency	Percentage
Journalist	32	64,0
Editor-in-chief	6	12,0
Producer	4	8,0
Speaker/ine	2	4,0
Responsible of the editorial line	2	4,0
Other	4	8,0
Total	50	100,0
Type of media		
Variable	Fréquence	Pourcentage
Radio	22	44,0
Television	8	16,0
Written Press	2	4,0
Online Press	18	36,0
Total	50	100,0

In light of the aforementioned results (Table 1), it is evident that the majority of participants (n=32), accounting for 64%, are journalists. Radio emerges as the media type with the largest representation in the city of Goma, with 44% (n=22) of respondents working for radio stations, followed by 36% (n=18) who work for online media outlets, and 16% (n=8) for television media.

Table 2. Respondents' Knowledge about Mazuku, Their Reaction, and Recommendations to the Goma Community

Knowledge of the respondent on Mazuku		
Variable	Frequency	Percentage
A risk linked to a gas of unknown origin	22	44,0
A risk linked to evil spirits	0	0
A risk linked to CO2	26	52,0
A supranatural phenomenon	2	4,0
Total	50	100,0
Reaction of the respondent against Mazuku		
Variable	Frequency	Percentage
Alert	42	84,0

Indifference	0	0
Fear	8	16,0
Silence	0	0
Total	50	100,0
Precaution recommended by respondents to the community of Goma		
Variable	Frequency	Percentage
Remain away from those sites	44	88,0
Wear a face mask	4	8,0
Enter and leave quickly when necessary	2	4,0
Do not know what to say	0	0
Total	50	100,0

The above results (Table 2) reveal that the majority of media professionals, comprising 52% (n=26), are aware that Mazuku is a gas associated with CO₂ and primarily of volcanic origin. However, a significant proportion (n=22), accounting for 44% of media professionals, consider Mazuku as a risk linked to a gas, but with an unknown origin, while 4% (n=2) believe it to be a supernatural phenomenon. Regarding the immediate reaction of respondents to Mazuku, most (n=42), or 84%, assert that they immediately alert rather than remain indifferent. However, 16% (n=8) experience fear instead. As for precautions, 88% (n=44) of media professionals suggest staying away from these areas, while 8% (n=4) recommend wearing a mask for protection, and finally, 4% (n=2) suggest entering and exiting quickly when needed. This clearly confirms that erroneous or insufficient knowledge can lead to inadequate reactions and the implementation of inappropriate precautions [20]–[23]. But what is interesting is that all respondents are aware that Mazuku represents a risk that should be taken seriously.

Table 3. Number of Articles Dedicated to Mazuku, Source of Information, and Reliability Assurance Strategy by Respondent's Media

Number of articles/reports/broadcasts devoted to Mazuku on the respondent's Media over the last 12 months		
Variable	Frequency	Percentage
1 to 5	24	48,0
6 to 10	10	20,0
More than 15	4	8,0
None	12	24,0
Total	50	100,0
Main source of information on Mazuku for the respondent's media		
Variable	Frequency	Percentage
Ministry of health	2	4,0
Testimony from the population	14	28,0
Scientific services	32	64,0
Social medias	2	4,0
Total	50	100,0
Assurance strategy on the reliability of information disseminated on Mazuku		
Variable	Frequency	Percentage
Verification of sources	24	48,0
Expert consulting	16	32,0
Cross-checking of information	6	12,0
Fact-checking	2	4,0
Autre	2	4,0
Total	50	100,0

The results presented above (Table 3) reveal that the majority of media professionals, specifically 48% (n=24), have dedicated between 1 and 5 articles, reports, or broadcasts to Mazuku in the past 12 months. Another significant proportion (n=12), comprising 24% of

media professionals, did not devote any articles, reports, or broadcasts to this subject during this period. Additionally, 20% (n=10) have allocated between 6 and 10 articles, while 8% (n=4) have dedicated over 15 articles to this topic. Regarding the source of information on the Mazuku-related risk, this table shows that 64% of media professionals (n=32) obtain their information from specialized scientific services in this field, and 48% (n=24) verify the information at the source.

Tablea 5. Role of Media in Popularizing Precautions Related to Mazuku, Impact on Risk Awareness in the Community, and suggestions for Improving Such Popularization

Role of the media in popularizing precautions related to Mazuku according to the respondent		
Variable	Frequency	Percentage
Inform the public of risks and precautions	34	68,0
Fight against false information and rumors	8	16,0
Promote responsible behavior	2	4,0
All choices above	6	12,0
Total	50	100,0
Impact of the respondent's communication on knowledge of the risk of Mazuku in the community of Goma		
Variable	Frequency	Percentage
Null	0	0
Medium	42	84,0
High	4	8,0
Very high	4	8,0
Total	50	100,0
Suggestions from the respondent to improve the popularization of precautions related to Mazuku		
Variable	Frequency	Percentage
Use simple language adapted to the target	12	24,0
Use visual supports (Infographics, photos, videos)	14	28,0
Programme of sensitization by the medias	16	32,0
In-depth collaboration between authorities and media	8	16,0
Total	50	100,0

The results presented above (Table 4) reveal that the majority of media professionals, 68% (n=34), confirm that the role of the media in dealing with the risk associated with Mazuku is to inform the public about the risks and appropriate precautions, and 20% (n=10) add that it also involves combating false information and rumors while promoting responsible behavior among residents. The remaining media professionals (n=6), or 12%, confirm that it encompasses all of these roles. Regarding the dissemination of precautions against risks associated with Mazuku, this table shows that the majority of media professionals (n=42), or 84%, confirm that the impact is moderate. Furthermore, the majority of our respondents (n=16), or 32%, propose strengthening the awareness program to improve the dissemination of precautions against this risk.

3.2. Inferential Analysis

Table 6. Precautions Recommended by Respondents According to Their Knowledge of Mazuku-Related Risks

Knowledge about Mazuku	Recommended Precautions			Total
	Remain away from those sites	Wear a face mask	Enter and leave quickly when necessary	
A risk linked to a gas of unknown origin	20	0	2	22
A risk linked to CO2	22	4	0	26
A supranatural phenomenon	2	0	0	2
Total	44	4	2	50

Considering the above table, it is observed (through the Pearson's chi-square test; $X^2 = 6.325$; $p = 0.1760 > 0.05$) a significant difference between the knowledge of Mazuku and the appropriate precautions. Therefore, the initial hypothesis that there would be no connection between media professionals' knowledge of the risk and the appropriate precautions cannot be challenged [24]. The majority of

respondents (n=22) recognize Mazuku as a risk associated with carbon dioxide CO₂, while a significant number (n=20) consider it to be a gas of unknown origin. In both cases, the majority of respondents recommend staying away from these areas, indicating their understanding of the risk. However, among respondents (n=26) who identify Mazuku as a CO₂-related gas, some (n=4) recommend wearing a face mask as a precautionary measure in these areas, an inappropriate and potentially dangerous measure. Among those who consider Mazuku to be a gas of unknown origin, some (n=2) suggest entering and exiting quickly when necessary. These observations suggest that media professionals surveyed in this study have an awareness of the risk, but there is a significant difference between their risk perception and their understanding of its origin.

Table 7. Difference in Knowledge and the Number of Articles/Reports/Programs by Respondents on Mazuku in the last 12 Months

Variables	Number of articles/reports/broadcasts devoted to Mazuku over the last 12 months				
	1 to 5	6 to 10	More than 15	None	Total
Connaissance sur le Mazuku					
Un risque lié au gaz d'origine inconnue	12	2	0	8	22
Un risque lié au CO ₂	12	8	4	2	26
Un phénomène surnaturel	0	0	0	2	2
Total	24	10	4	12	50

Upon examination of the above table, it is evident (Pearson's chi-square test: $X^2 = 17.179$; $p = 0.009 < 0.05$) that there is no significant difference between the knowledge and the number of articles/reports/programs dedicated to Mazuku in the last 12 months. Consequently, the initial hypothesis that there is no relationship between the number of articles, reports, or programs dedicated to Mazuku by media professionals and their knowledge of the risk is rejected [24]. The observation of categorical variables reveals that the large number of articles, reports, or programs is distributed among media professionals who are aware of Mazuku as a risk associated with CO₂.

Conclusion

The majority of media professionals recognize Mazuku as a gas linked to CO₂, primarily of volcanic origin. However, a significant proportion consider it a risk associated with a gas, but of unknown origin, with some even perceiving it as a supernatural phenomenon. Regarding respondents' immediate reactions to Mazuku, most express a desire to raise awareness rather than remain indifferent, although some experience fear. Regarding precautions, the majority suggest staying away from these areas, while others recommend wearing masks for protection, a measure deemed inappropriate or even dangerous. Some suggest entering and exiting quickly when necessary, which also carries risks. It is noteworthy that all respondents acknowledge Mazuku as a serious risk that must be taken seriously.

The differential analysis through Pearson's chi-square test revealed a significant difference between knowledge of Mazuku and appropriate precautions. Thus, there is no correlation between media professionals' knowledge of the risk and appropriate precautions. However, there is no significant difference between knowledge and the number of articles, reports, or programs dedicated to Mazuku in the last 12 months. Consequently, there is a significant relationship between the number of articles, reports, or programs dedicated to Mazuku by media professionals and their knowledge of the risk. In other words, the distribution of articles, reports, or programs is largely carried out among media professionals who recognize Mazuku as a risk linked to CO₂. These observations demonstrate the need to strengthen awareness of the risks associated with Mazuku through a sensitization program aimed at improving the communication of precautions to be taken in the face of this risk by the media in Goma.

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