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Community Members' Knowledge, Attitudes and Practices Regarding Thunderstorm Risk Reduction in Rutsiro District Rwanda

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Abstract: **Thunderstorms pose significant public health and disaster risks in Rwanda, making community knowledge, attitudes, and protective practices essential for effective risk reduction. This study assessed community members' knowledge, attitudes, and practices regarding thunderstorm risk reduction in Boneza and Gihango Sectors of Rutsiro District, Western Province, Rwanda. A quantitative descriptive cross-sectional design was employed among 394 community members aged 18 years and above. The sample was proportionally distributed between the two sectors, and participants were recruited through randomly selected community cooperatives and associations. Data were collected using a structured questionnaire in Kinyarwanda, which respondents completed independently where possible, with assistance provided to those who required support due to literacy limitations. Data were analyzed using descriptive statistics in IBM SPSS Statistics Version 25.0. Based on a predetermined operational cut-off of 80%, the findings showed that 55.6% of respondents had good knowledge, 67.3% demonstrated positive attitudes, and 63.7% reported good protective practices. However, important knowledge gaps persisted. More than half of the respondents (53.3%) did not know that all thunderstorms produce lightning, while 44.2% were unaware that lightning can strike the same location more than once. Additionally, 30.7% considered bathing during lightning safe. Access to preparedness information was also limited: 78.7% had not received lightning-warning messages, and only 12.7% had participated in lightning-safety training. These findings indicate that relatively favorable overall attitudes and protective practices coexisted with specific misconceptions and limited exposure to safety information. The study recommends strengthening community-based thunderstorm risk-reduction initiatives in Boneza and Gihango Sectors through targeted safety education, timely and accessible warning messages, and practical training on lightning protection. Community cooperatives and associations could serve as effective channels for disseminating safety information and promoting preparedness. These measures may help address existing knowledge gaps and strengthen community capacity to respond safely to thunderstorms.**

Keywords: **Community Knowledge; Attitudes; Risk Reduction Practices; Thunderstorm Preparedness; Rutsiro District, Rwanda.**

1. INTRODUCTION

Thunderstorms are atmospheric phenomena characterized by lightning and thunder and may be accompanied by heavy rainfall, strong winds, and hail. Depending on their intensity and the level of community preparedness, they can cause fatalities, injuries, damage to buildings and infrastructure, agricultural losses, and disruption of livelihoods. Lightning is particularly dangerous because it can strike people and structures with little immediate warning, making timely information and appropriate protective behaviour essential components of disaster risk reduction. In Rwanda, the effects of storms and lightning have remained a significant concern. Government data reported by the United Nations Development Programme (UNDP, 2022) indicate that storms caused 244 deaths and damaged or destroyed 21,049 houses between 2011 and 2018. These impacts demonstrate the importance of combining structural protection with public awareness, preparedness, and effective risk communication.

At the global level, disaster risk reduction increasingly emphasizes people-centred early-warning systems that connect hazard monitoring and forecasting with effective communication and preparedness action. The World Meteorological Organization (WMO) and the United Nations Office for Disaster Risk Reduction (UNDRR) reported that 119 countries, representing approximately 60% of countries worldwide, had reported the existence of multi-hazard early-warning systems in 2025. Although comprehensiveness improved across all regions, Africa continued to record the lowest regional scores, despite substantial progress since 2015 (WMO & UNDRR, 2025). The presence of a warning system, however, does not necessarily mean that every community receives, understands, or responds appropriately to warnings. This distinction is important for thunderstorms, where the practical value of forecasts depends partly on whether people recognize the danger and know which protective actions to take.

Recent developments in Africa further highlight the need to connect early-warning infrastructure with community-level preparedness. The Africa Early Warnings Forum, held in Addis Ababa in September 2026, reported progress in the number and comprehensiveness of national early-warning systems. Nevertheless, the resulting Addis Ababa Call to Action emphasized persistent gaps in last-mile communication, community access, institutional coordination, and the ability to translate warnings into timely protective action (WMO, 2026). Although these developments address multiple hazards rather than thunderstorms alone, they reinforce the importance of assessing how communities access, interpret, and use risk information. Community members' knowledge, attitudes, and practices are therefore relevant to understanding whether broader improvements in early-warning systems translate into safer behaviour at the local level.

In Rwanda, the consequences of lightning strikes provide direct evidence of the need for sustained prevention and preparedness efforts. On 8 July 2024, lightning killed eight people across Ngororero, Rutsiro, and Musanze Districts during a rainstorm, according to the Ministry in Charge of Emergency Management (MINEMA, 2024). Following the incident, the Ministry urged the public to heed weather warnings and follow recommended safety measures, including seeking shelter indoors and avoiding exposure to water and unprotected outdoor locations during thunderstorms. This incident illustrates that lightning safety remains a practical concern for communities, even where public authorities actively communicate protective guidance. It also reinforces the need to examine whether community members understand and apply such recommendations in their daily lives.

Rutsiro District has received specific attention because of its vulnerability to lightning-related hazards. In 2022, UNDP reported supporting MINEMA in installing 29 lightning-protection systems in 23 critical facilities in the district. The intervention benefited more than 1,000 households and eight schools, demonstrating the role of protective infrastructure in reducing exposure in places where people gather (UNDP, 2022). Although such systems are important, infrastructure alone cannot address every dimension of thunderstorm risk. Community members also need to recognize hazardous conditions, understand the limitations of unsafe shelters, respond appropriately to warnings, and adopt protective behaviours during storms. The effectiveness of local risk-reduction efforts therefore depends on complementing structural interventions with accessible safety information and community preparedness initiatives.

Despite these interventions, the extent to which community members understand thunderstorm risks and apply recommended protective measures cannot be established from information about lightning incidents and infrastructure investments alone. In particular, evidence on knowledge, attitudes, and practices among adults in Boneza and Gihango Sectors is needed to identify misconceptions, assess perceptions of recommended safety measures, and understand reported protective behaviours. This information is important for designing interventions that reflect local needs rather than relying exclusively on general awareness campaigns or the availability of protective infrastructure. Accordingly, this study assessed community members' knowledge, attitudes, and practices regarding thunderstorm risk reduction in Boneza and Gihango Sectors of Rutsiro District, Rwanda. By identifying areas of strength and persistent preparedness gaps, the study aims to inform locally appropriate safety education, warning communication, and community-based disaster risk-reduction strategies.

2. METHODOLOGY

2.1 Research Design

This study employed a quantitative descriptive cross-sectional design.

2.2 Study population

The study population consisted of adults aged 18 years and above residing in Boneza and Gihango Sectors of Rutsiro District, Western Province, Rwanda. According to NISR (2012), Rutsiro District had a population of 324,654 inhabitants, with a population density of 280.2 people per square kilometre.

2.3 Sample Size

The sample size was determined using the Taro Yamane (1967) formula at a 95% confidence level and a 5% margin of error.

$$n = \frac{N}{1 + N(e)^2}$$

Where:

- \(n\) = Required sample size
- \(N\) = Target population (26,660)
- \(e\) = Margin of error (0.05)

Substituting the values:

$$n = \frac{26{,}660}{1 + 26{,}660(0.05)^2}$$

$$n = \frac{26{,}660}{1 + 66.65}$$

$$n = \frac{26{,}660}{67.65} = 394.08$$

Therefore, the study adopted a sample size of 394 participants.

2.4 Data Collection Instrument

Data were collected using a structured, primarily self-administered questionnaire. Literate participants completed the questionnaire independently, while questions and response options were read aloud in Kinyarwanda to participants with limited literacy, and their responses were recorded by the researcher. Standardised wording, question sequencing, and response options were maintained throughout data collection to ensure consistency and minimise interviewer bias and social-desirability bias.

2.5 Ethical Considerations

The study followed Mount Kenya University's research ethics guidelines. Ethical approval and permission from the relevant local authorities were obtained before data collection. Participants were informed about the study and provided consent voluntarily. Their privacy and confidentiality were protected by excluding personal identifiers and using coded questionnaires. All collected information was securely stored and used solely for academic purposes. Sources were properly acknowledged, and data were managed in accordance with the university's research policies.

3. RESULTS

3.1 Socio-Economic and Demographic Characteristics of Respondents

A total of 394 community members participated in the study. Their socio-economic and demographic characteristics included age, sex, living arrangement, marital status, religion, sector of residence, duration of residence in the study area, rural or urban residence, education level and current occupation. These characteristics are presented in Table 1.

Table 1: Socio-Economic and Demographic Characteristics of Respondents (N = 394)

Variables	Frequency (n=394)	Percentage (%)
Age group (years)		
18–25	64	16.2
26–35	228	57.9
36–45	88	22.3
Over 45	14	3.6

Sex		
Male	188	47.7
Female	206	52.3
Living with family		
Yes	273	69.3
No	121	30.7
Marital status		
Never married	101	25.6
Married	211	53.6
Separated	46	11.7
Divorced	17	4.3
Widowed	19	4.8
Religion		
Catholic	174	44.2
Protestant	102	25.9
Adventist	78	19.8
Muslim	34	8.6
Other	6	1.5
Sector		
Boneza	201	51.0
Gihango	193	49.0
Duration in the area		
1–2 years	109	27.7
3–4 years	112	28.4
5 years and more	173	43.9
Place of residence		
Rural	301	76.4
Urban	93	23.6
Education level		
No formal schooling	88	22.3
Primary school	188	47.7
Technical school	40	10.2
Secondary school	69	17.5
Tertiary level	9	2.3

Current occupation		
Unemployed	51	12.9
Farmer	175	44.4
Student	49	12.4
Business/merchant	92	23.4
Employed (government/NGO)	27	6.9

Source: Primary data, 2023.

Table 1 shows that the majority of respondents were aged 26–35 years (57.9%). Female respondents accounted for 52.3% of the sample, while males accounted for 47.7%. Most respondents lived with their families (69.3%), and slightly more than half were married (53.6%). Catholics constituted the largest religious group (44.2%). Boneza accounted for 51.0% of respondents and Gihango for 49.0%, reflecting the proportional sector allocation used in the sampling procedure. More than two-fifths of respondents had lived in the study area for at least five years (43.9%), and more than three-quarters resided in rural areas (76.4%). Primary education was the most commonly reported education level (47.7%), while farming was the largest occupational category (44.4%).

3.2 Presentation of Findings

3.2.1 Knowledge of Thunderstorms

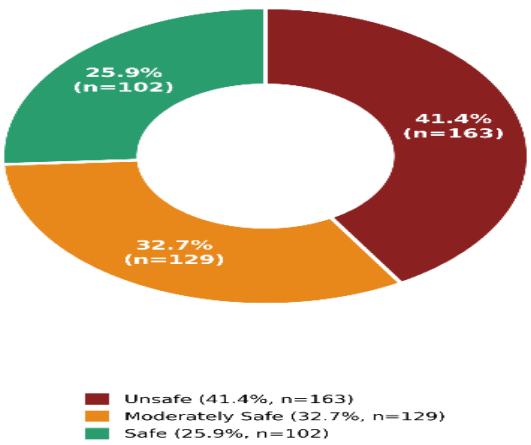
Respondents' knowledge of thunderstorms was assessed using 14 scored questions covering thunderstorm occurrence, effects, warning information, and recommended safety measures. The study also examined how safe respondents considered their residential areas during thunderstorms, whether they had received thunderstorm-related information, and the sources of that information. These additional aspects were analysed separately and were not included in the overall knowledge score.

(a) Perceived Safety of the Residential Area

Respondents were asked to rate how safe they considered their residential areas during thunderstorms on a five-point scale, ranging from very unsafe to very safe. For easier presentation, the responses were grouped into three categories: unsafe, moderately safe, and safe.

The findings showed that 41.4% of respondents considered their residential areas unsafe during thunderstorms, while 32.7% rated them as moderately safe. Only 25.9% considered their areas safe. This suggests that concerns about residential safety during thunderstorms were common among the respondents. Perceived safety was examined separately as an indication of how respondents viewed their exposure to thunderstorm risks and was not included in the overall knowledge score.

Figure 1: Respondents' Perceived Safety and Vulnerability of Their Residential Areas to Thunderstorms



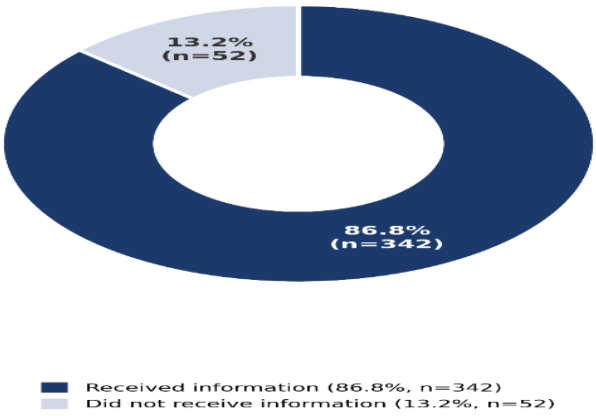
Source: Primary data, 2023.

(b) Receipt of Thunderstorm-Related Information

Respondents were asked whether they had previously received information about thunderstorms and related safety measures. Out of the 394 respondents, 342 (86.8%) said they had received such information, while 52 (13.2%) reported that they had not.

Although most respondents had received information about thunderstorms, this does not necessarily mean that the information was accurate, detailed, timely, or well understood. For this reason, their actual knowledge was assessed separately using the 14 scored questions.

Figure 2: Proportion of participants who received thunderstorm-related information (N = 394)



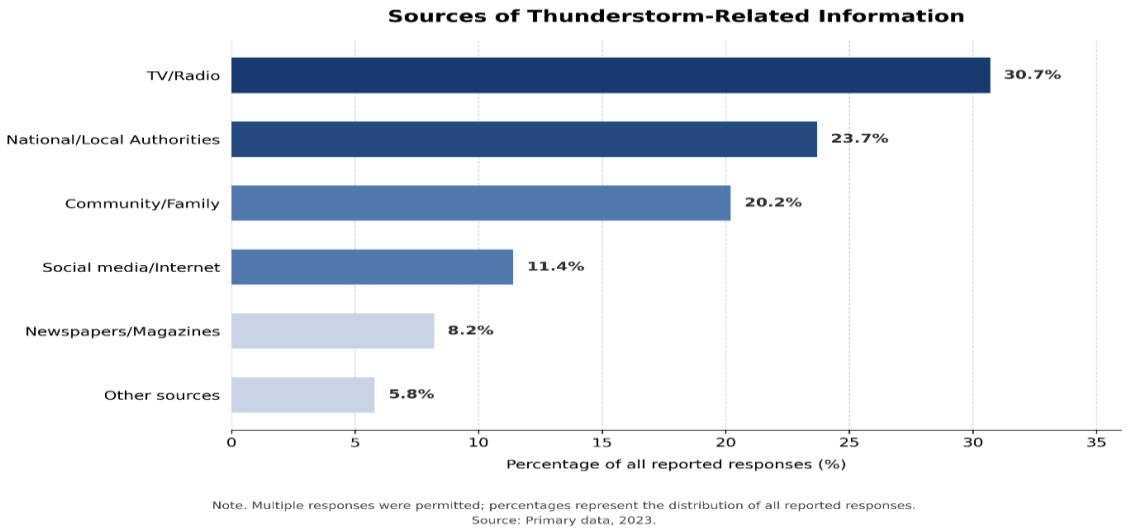
Source: Primary Data, 2023

(c) Sources of Thunderstorm-Related Information

Among the 342 respondents who had received information about thunderstorms, several sources were reported. Television and radio were the most frequently reported sources, accounting for 30.7% of all responses. National and local authorities followed at 23.7%, while community members and family members accounted for 20.2%. Social media and the internet represented 11.4%, newspapers and magazines 8.2%, and other sources 5.8%.

These findings show that television and radio were the leading reported channels for sharing thunderstorm-related information, followed by information from authorities and community networks. The distribution of the reported information sources is presented in Figure 3.

Figure 3: Distribution of reported sources of thunderstorm-related information among respondents who had received information (n = 342; multiple responses permitted).



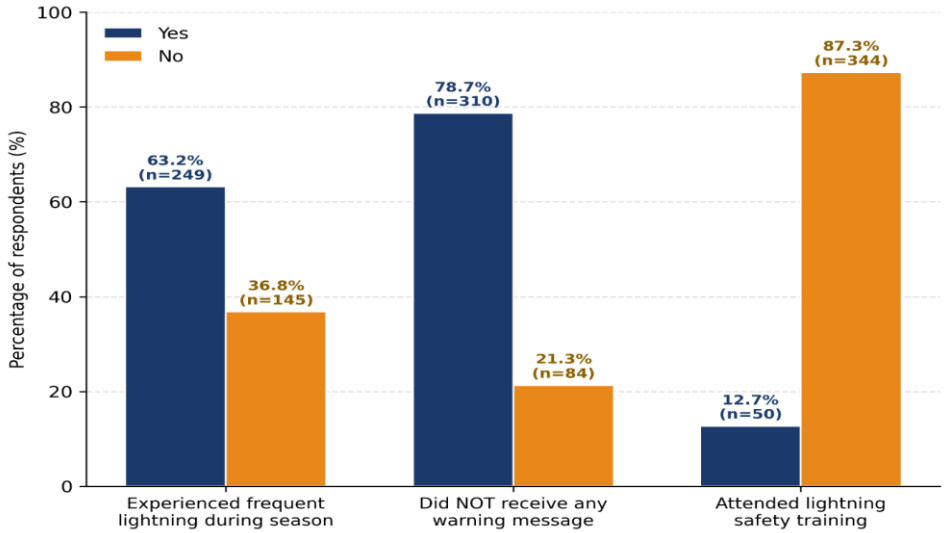
Source: Primary data, 2023.

(d) Lightning Experience, Warning Messages and Safety Training

Figure 3 shows respondents' experiences with lightning, whether they had received lightning-warning messages, and whether they had attended lightning-safety training. Nearly two-thirds (63.2%) reported experiencing frequent lightning during the thunderstorm season. However, most respondents (78.7%) said they had never received a lightning-warning message, and only 12.7% had attended lightning-safety training.

It is important to distinguish between receiving general information about thunderstorms and receiving specific lightning-warning messages. Respondents may have been informed about thunderstorms without receiving warnings about an approaching lightning event. These three aspects were therefore analysed separately as contextual indicators and were not included in the composite knowledge and risk-awareness score.

Figure 4: Reported Lightning Experience, Warning Messages, and Safety Training Among Respondents (N = 394).



Note. Percentages were calculated using N = 394.

Source. Primary data, 2023.

(e) Knowledge of Thunderstorm Risks and Safety Measures*:* Respondents' knowledge was assessed using 14 scored items addressing thunderstorm risks, causes, consequences and recommended safety measures. Each response corresponding to the predetermined scoring key received one point, while an alternative or unselected response received zero points. Possible scores ranged from 0 to 14. Using the predetermined 80% operational criterion, respondents who scored 12–14 points were classified as having good knowledge, while those who scored 0–11 points were classified as having inadequate knowledge. This classification was an operational measure developed for the study and was not presented as a validated meteorological knowledge scale.

Table 1: Knowledge of Thunderstorm Risks and Safety Measures (N = 394)

Item	Knowledge-consistent or expected response, *n* (%)	Other response, *n* (%)
Perceived thunderstorms as a disaster problem in the area[1]	286 (72.6)	108 (27.4)
Recognised the principal local consequences of thunderstorms, including frequent occurrence, deaths, injuries and property damage[1]	245 (62.2)	149 (37.8)
Perceived that the community had the capacity to cope with thunderstorms[1]	202 (51.3)	192 (48.7)
Identified April–June as the period of highest thunderstorm frequency in the study area[2]	224 (56.9)	170 (43.1)

Recognised thunderstorms as natural meteorological phenomena	206 (52.3)	188 (47.7)
Perceived that thunderstorm frequency had increased over time[1]	281 (71.3)	113 (28.7)
Perceived that thunderstorm-related deaths had increased over time[1]	243 (61.7)	151 (38.3)
Knew that all thunderstorms produce lightning	184 (46.7)	210 (53.3)
Knew that lightning can strike the same location more than once	220 (55.8)	174 (44.2)
Recognised the danger of using corded electrical equipment during lightning[3]	198 (50.3)	196 (49.7)
Recognised that bathing during lightning is unsafe because of contact with plumbing	273 (69.3)	121 (30.7)
Identified an enclosed hard-topped vehicle or substantial building as appropriate lightning shelter[3]	230 (58.4)	164 (41.6)
Identified seeking substantial enclosed shelter, rather than sheltering under a tree, as the appropriate action outdoors	216 (54.8)	178 (45.2)
Knew that a lightning victim does not retain an electrical charge and can safely receive first aid[3]	212 (53.9)	182 (46.1)

Source: Researcher surveys, primary data, 2023.

Note. Percentages were calculated using $N = 394$. "Other response" includes incorrect and unselected responses. Items marked [1] reflect respondents' perceptions rather than independently verified factual knowledge. Item [2] requires support from local climatological records. Items marked [3] should be reported using the wording of the original questionnaire; the descriptions shown here reflect established lightning-safety guidance.

Source. Primary data, 2023.

Table 1 presents respondents' answers to the individual knowledge items. The highest proportion was recorded for recognition of thunderstorms as a disaster problem in the area (72.6%), followed by awareness that bathing during lightning is unsafe (69.3%). Approximately 62.2% identified the principal reasons thunderstorms were considered a serious local problem.

Knowledge gaps were identified in several areas. Fewer than half of the respondents (46.7%) knew that all thunderstorms produce lightning. Slightly more than half (55.8%) knew that lightning can strike the same location more than once, while 54.8% identified appropriate protective action when outdoors. These item-level findings help identify particular subjects that may require greater emphasis in community safety education.

3.2.2 Attitudes Towards Reduction of Thunderstorm Effects

Five items assessed respondents' attitudes toward recommended thunderstorm risk-reduction measures. Participants were instructed to select all statements that applied to them. The findings are presented in Table 2.

Table 2: Attitude Items Towards Reduction of Thunderstorm Effects (N = 394)

Item	Positive response (n)	Negative response (n)
Should listen to and follow daily weather forecasts before planning outdoor activities	318 (80.7)	76 (19.3)
Should raise thunderstorm-prevention awareness within the family and community	188 (47.7)	206 (52.3)

Should participate in thunderstorm-prevention campaigns or training activities	350 (88.8)	44 (11.2)
Should wait at least 30 minutes after the last thunder before resuming outdoor activities	154 (39.1)	240 (60.9)
Should stay away from tall trees, electrical poles, mobile towers and metal poles during lightning	277 (70.3)	117 (29.7)

Source: Researcher surveys, primary data, 2023.

Note. Participants were permitted to select all statements that applied. Selection of a recommended statement was coded as a positive attitude response, while non selection was coded as zero according to the predetermined operational scoring key. Nonselection should not necessarily be interpreted as explicit disagreement because participants were not asked to indicate agreement or disagreement on a Likert-type scale. Percentages were calculated using $N = 394$. *Source.* Primary data, 2023.

Table 2 presents respondents' selections of the five attitude statements. Participation in thunderstorm-prevention campaigns or training activities was the most frequently selected statement (88.8%), followed by listening to and following daily weather forecasts before planning outdoor activities (80.7%). Staying away from tall trees, electrical poles, mobile towers and metal poles during lightning was selected by 70.3% of respondents.

Less than half of the respondents selected raising thunderstorm-prevention awareness within their families and communities (47.7%). Waiting at least 30 minutes after the last thunder before resuming outdoor activities was the least frequently selected statement (39.1%). These results suggest generally favourable attitudes toward training and weather monitoring but comparatively weaker endorsement of family or community awareness activities and the recommended 30-minute waiting period.

3.2.3 Practices Towards Reduction of Thunderstorm Effects

Six items assessed respondents' self-reported protective practices during thunderstorms. Participants were instructed to select all practices that applied to them. The findings are presented in Table 3.

Table 3: Self-Reported Practices Toward Thunderstorm Risk Reduction (N = 394)

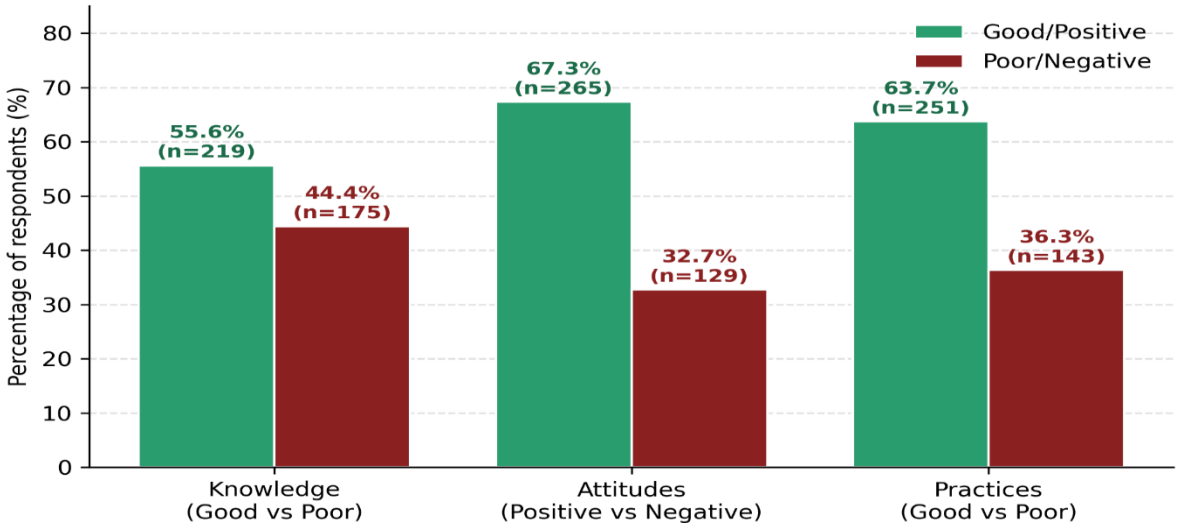
Item	Correct response (n)	Incorrect response (n)
Avoids open spaces during lightning	280 (71.1)	114 (28.9)
Stays away from windows and balconies when indoors during lightning	275 (69.8)	119 (30.2)
Avoids touching metal faucets, railings, pipes during lightning	231 (58.6)	163 (41.4)
Avoids all electronic devices (mobile, laptop, TV, refrigerator, etc.) during lightning	265 (67.3)	129 (32.7)
Maintains 15–30 m distance from others in open spaces during lightning	203 (51.5)	191 (48.5)
Seeks shelter in a building or concrete structure during lightning	218 (55.3)	176 (44.7)

Source: Researcher surveys, primary data, 2023.

Table 3 presents respondents' self-reported thunderstorm-protection practices. Avoiding open spaces during lightning was the most frequently selected practice (71.1%), followed by staying away from windows and balconies when indoors (69.8%) and avoiding electronic devices (67.3%). Avoiding contact with metal faucets, railings and pipes was selected by 58.6% of respondents.

Seeking shelter in a building or concrete structure was selected by 55.3% of respondents, while maintaining a distance of 15–30 metres from others when caught in an open space was the least frequently selected practice (51.5%). Overall, the findings indicate variation in the reported use of protective practices. However, because the practices were self-reported, the results represent respondents' reported behaviour and not directly observed compliance during thunderstorms.

Figure 5: Knowledge, Attitude, and Practice Classifications Among Respondents (N = 394)



Source: Primary Data, 2023

Figure 5 compares the overall classifications across the three study domains. Of the 394 respondents, 219 (55.6%) were classified as having good knowledge and risk awareness, 265 (67.3%) as having positive attitudes, and 251 (63.7%) as reporting good protective practices. These classifications were based on the study's predetermined 80% operational criterion and should be interpreted alongside the individual-item findings.

4. DISCUSSION OF FINDINGS

This study assessed community members' knowledge, attitudes, and practices regarding thunderstorm risk reduction in Boneza and Gihango Sectors of Rutsiro District, Rwanda. Based on the predetermined operational criterion of 80%, 55.6% of respondents demonstrated good knowledge, while 67.3% had positive attitudes and 63.7% reported good protective practices. Although these findings indicate encouraging attitudes and practices among a considerable proportion of respondents, the relatively lower level of knowledge highlights persistent gaps in community preparedness. Misconceptions about lightning, limited participation in safety training, and inadequate receipt of lightning-specific warnings were particularly evident.

The findings revealed a difference between exposure to general thunderstorm information and access to specific lightning-safety communication. Although 86.8% of respondents reported having received general information about thunderstorms, 78.7% had not received lightning-warning messages, and only 12.7% had participated in lightning-safety training. This suggests that general awareness does not necessarily translate into access to timely warnings or practical safety education.

Effective risk reduction requires not only awareness of thunderstorms but also an understanding of appropriate protective actions before, during, and after lightning events. However, since the study did not assess the content, frequency, or quality of information received, the extent to which existing communication addressed practical safety needs cannot be established.

Specific knowledge gaps were also identified. More than half of the respondents (53.3%) did not know that lightning can occur with every thunderstorm, while 44.2% were unaware that lightning can strike the same location repeatedly. Furthermore, 30.7% considered bathing during lightning safe, indicating a potentially important misconception regarding exposure to electrical hazards during thunderstorms. These findings demonstrate the need for targeted community education that addresses common misunderstandings and promotes practical protective measures. They also highlight the importance of interpreting the overall knowledge classification alongside individual responses, particularly because some questionnaire items assessed perceptions of local conditions rather than factual knowledge alone.

Regarding attitudes, the findings demonstrated strong support for preventive education and access to weather information. Most respondents (88.8%) selected participation in thunderstorm-safety training as an important risk-reduction measure, while 80.7% identified following weather forecasts as a relevant protective action. These responses indicate considerable recognition of the importance of preparedness and access to weather information. However, fewer respondents selected

raising awareness among family and community members (47.7%) and waiting at least 30 minutes after the last thunder before resuming outdoor activities (39.1%). This variation suggests that respondents may recognise the general importance of preparedness without necessarily being familiar with specific recommended safety practices. The strong endorsement of training, despite the low reported participation in previous training activities, also points to an opportunity for strengthening community-based safety education. Nevertheless, the reasons for limited participation were not investigated. In addition, because respondents could select multiple answers, non-selection of a particular measure should not automatically be interpreted as disagreement with it.

The findings on protective practices showed that avoiding open spaces (71.1%) and staying away from windows and balconies (69.8%) were among the most frequently reported actions during thunderstorms. These responses suggest that many respondents recognised the importance of reducing exposure to potentially dangerous locations. However, fewer respondents identified seeking shelter in a substantial enclosed building (55.3%) or maintaining distance from other people when outdoors (51.5%). This variation indicates that the adoption of protective practices was not uniform across all recommended safety measures.

The findings also require careful interpretation in relation to the wording of the questionnaire. For example, the instrument did not clearly distinguish substantial enclosed buildings from open concrete structures, although these provide different levels of protection against lightning. Similarly, it did not differentiate between plugged-in electrical equipment and battery-operated devices. The reported separation distance of 15–30 metres should therefore not be interpreted as a universal safety standard. Furthermore, since the findings were based on self-reported practices, they may have been influenced by respondents' recall and the tendency to report socially desirable behaviours. Consequently, the results describe reported protective practices rather than independently observed behaviour.

Taken together, the findings demonstrate that positive attitudes and reported protective practices coexisted with important knowledge gaps and limited access to specific lightning-safety information. The KAP framework provides a useful basis for examining these three dimensions separately; however, the descriptive design does not establish causal relationships between knowledge, attitudes, and practices. The findings should therefore be interpreted as an overview of community preparedness rather than evidence that one KAP dimension directly determines another.

For Boneza and Gihango Sectors, strengthening community preparedness requires more consistent communication of lightning warnings and practical safety information. Television and radio, national and local authorities, and community and family networks were among the reported information sources, accounting for 30.7%, 23.7%, and 20.2% of source responses, respectively. These findings suggest potential channels for disseminating safety messages. However, the percentages represent the distribution of reported information sources and should not be interpreted as the proportion of the population reached through each channel. Their effectiveness and suitability should therefore be assessed in consultation with local communities before implementation.

Overall, community awareness initiatives should prioritise the misconceptions identified in the study, particularly the occurrence of lightning during thunderstorms, repeated strikes at the same location, bathing during thunderstorms, and the selection of appropriate shelter. They should also reinforce the recommendation to wait at least 30 minutes after the last thunder before resuming outdoor activities. Combining accessible warning messages with practical demonstrations and regular community-based training could help address the identified preparedness gaps and strengthen local capacity to reduce thunderstorm-related risks.

5. CONCLUSION

The study concludes that community members in Boneza and Gihango Sectors had varying levels of knowledge, attitudes, and practices regarding thunderstorm risk reduction. While more than half of the respondents demonstrated positive attitudes and good protective practices, knowledge was relatively limited, with only 55.6% meeting the study's criterion for good knowledge. Gaps were particularly evident in understanding lightning occurrence, the possibility of repeated strikes at the same location, appropriate safety measures during thunderstorms, and the recommended waiting period before returning to outdoor activities. Limited participation in lightning-safety training and inadequate access to specific lightning-warning messages also indicated weaknesses in community preparedness.

As the study was descriptive, the findings provide an overview of participants' knowledge, attitudes, and practices without establishing causal relationships or associations between these factors and sociodemographic characteristics.

Overall, the findings point to the need for stronger community awareness, practical safety education, timely warning communication, and improved access to safe shelter. Addressing these areas could enhance community preparedness and reduce vulnerability to thunderstorm-related risks in Boneza and Gihango Sectors.

6. RECOMMENDATIONS

The authorities in Boneza and Gihango Sectors, in collaboration with district disaster-management officers, should organise regular community awareness sessions on lightning safety. These sessions should focus on addressing common misconceptions about lightning, repeated strikes at the same location, bathing during thunderstorms, safe shelter, and electrical precautions. This is particularly important given that only 12.7% of respondents had previously attended lightning-safety training.

The Rwanda Meteorology Agency, together with district and sector authorities, should strengthen the communication of lightning warnings to local communities. Since 78.7% of respondents reported not receiving lightning-warning messages, efforts should focus on identifying communication gaps and ensuring that warnings reach residents in a timely and understandable manner. Television, radio, local authorities, and community and family networks should be considered as potential channels for sharing safety information, based on their reported use by respondents.

Community awareness activities should also emphasise the importance of waiting at least 30 minutes after the last thunder before returning to outdoor activities. Families and community leaders should be encouraged to share this information and promote safe behaviour during thunderstorms. Greater community involvement in safety education could help improve preparedness and reduce exposure to lightning-related risks.

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