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ORIGINAL PAPER

Communication of flood early warnings and community response: the case of Sinop-Kastamonu, Türkiye

Fatma Gündüz[1] · **Samet Dinçer**[2]

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Abstract
A flood disaster occurred in Türkiye in 2021. Due to the flood, Sinop-Ayancık and Kastamonu-Bozkurt were seriously affected and experienced physical, social, and economic losses. The research aimed to reveal how individuals experiencing flood disasters received early warnings, how they behaved after the warnings, and the lessons learned by evaluating early warnings in the context of societal capacity. Phenomenological design, one of the qualitative research methods, was used in the study. Interviews were conducted with 15 individuals from the affected region. The data obtained were analyzed with the MAXQDA 2020 program. As a result of the analysis, it was determined that individuals were aware of the hazards in their province and that they knew its disaster history. On the other hand, although there were individuals who heeded the early warnings, there were also people who ignored the warnings. There were losses, deaths and injuries due to the flood disaster. It was determined that, after the lessons learned, individuals took the warnings into account and evacuated correctly. The accessibility and reliability of early warning systems to society are of vital importance for societal capacity. It is recommended that early warning systems and societal capacity be developed in disaster risk management.

Keywords Flood · Early warning · Communication · Community respond · Disaster risk management

1 Introduction

As a result of climate-related atmospheric changes, extreme weather events occurring with increasing frequency can cause floods in the living spaces of individuals and communities (Bolan et al. 2024). When natural or man-made hazards turn into disaster risks, they cause

✉ Fatma Gündüz
fgunduz@sinop.edu.tr

Samet Dinçer
sdincer@sinop.edu.tr

[1] Department of Property Protection and Security, Boyabat Vocational School of Higher Education, Sinop University, 57200 Sinop, Turkey

[2] Department of First and Emergency Medicine, Duragan Vocational School of Higher Education, Sinop University, 57700 Sinop, Turkey

damage to important economic parameters such as countries' existing infrastructure, building stocks, and production capacities. These disasters can also negatively affect the development of countries by causing loss of life (Wu et al. 2024). Therefore, it is very important to actively use effective early warning systems (EWs) to minimize material damage, injuries, and loss of life caused by floods and inundations. Utilizing today's technological achievements will ensure that the living spaces of societies are safe (Zhong et al. 2021).

As a result of accelerating climate change, the frequency of extreme weather events is increasing. Precipitation regimes are becoming increasingly difficult to predict. Rainfall intensity, soil saturation with water in the rainfall area, and soil erosion due to deforestation cause an increase in the frequency of floods and overflows (Bolan et al. 2024). At the 2024 Conference of the Parties (COP29), an important international meeting on climate change and its effects, it was emphasized that decisive and effective measures should be taken to cope with the rapid changes in the atmosphere. It was also stressed that financial support should be provided in this fight. It was also emphasized that the active participation of local communities, women, and young people in the climate policies planned to be implemented is important (Moosmann et al. 2024).

Thanks to advancements in technology, Early Warning Systems (EWs) are used in many countries to warn society and institutions in advance about natural events that have the potential to turn into disasters (Alahmari et al. 2024; Sorensen 2000). "Early Warnings for All", initiated by the United Nations in 2022, is an important approach that ensures the protection of every individual on Earth from dangerous water, air, and climate-related events until the end of 2027 (WMO 2024). According to the Sendai Framework action plan, strategies are presented for developing early warning systems, making early warning predictions and observations, and increasing capacity. The primary goal is to ensure that early warning is delivered and disseminated to every individual in society by 2030, and to strengthen information and communication channels (UNISDR 2015). To ensure the effectiveness of the early warning systems used today to protect against floods, the affected community must receive the warnings in a timely manner, and the public must be able to take action to avoid danger in line with the warnings (UNDRR 2023). Early warning systems aim to minimize loss of life and material damage by detecting the risks that societies may encounter in advance. At the same time, they provide timely intervention by ensuring that information about identified dangers is disseminated quickly and effectively (Lassa 2008; Ringo et al. 2024). While the effectiveness of early warning systems plays a critical role in informing societies about potential dangers in a timely manner, it is crucial to evaluate how these systems are perceived by the target audience and how they react to these warnings (Sufri et al. 2020). The results of a study conducted by Cools et al. in geographically diverse regions emphasize the importance of early warning systems and show that the effectiveness of these systems can be increased (Cools et al. 2016). In another study aiming to increase the resilience of societies against flood disasters, some issues were highlighted. These include the need to strengthen communication between vulnerable groups and local governments, the development of individuals' capacity to take action, and the active involvement of all segments of society in this process (Perera et al. 2020). A study carried out in Japan revealed several problems that hinder the effective use of early warning systems. These problems include inadequate human and financial resources, gaps in risk assessment and data collection processes, and difficulties in reaching vulnerable groups (Cao et al. 2024). The United Nations "Early Warning for All" initiative

has gained renewed importance in recent years to make early warnings more effective at the international level (UNDRR 2023). In this framework, four main categories have been identified. These are: disaster risk information and management; observation and forecasting; dissemination of warnings and communication; preparedness and response capacity, (UNDRR 2023). Early warning systems are an important mechanism that informs society before disasters, ensures disaster preparedness, and minimizes loss of life and property. The delivery of early warnings to society and the acquisition of correct behaviors are important for disaster resilience.

Türkiye faces risks from flood disasters and experiences physical, economic, social, and environmental losses. Flood disasters in Türkiye have mostly occurred in the spring, summer, and winter months. Fifty-two percent of flood disasters are in the Black Sea Region, while flood disasters also occur in the Mediterranean and the Marmara Regions (Özcan 2006). When flood disasters in Türkiye are examined, the event that occurred in Düzce in 1961, due to heavy rainfall that continued for three days, was recorded as the biggest one in the history of the republic (Tekin 2022). The flood disasters that occurred in Düzce in 1995, 1997, 1998, and 2019 had devastating effects (Düzce IRAP 2021:47). In 2015, a flood disaster centered in Hopa occurred in Artvin province as a result of excessive rainfall. Eight people died, and 3294 people were affected by this disaster (Eryılmaz and Kayış 2017; Yılmaz and Usta 2019). As a result of the flood disaster that occurred in Trabzon province in 2019, 9 people died and many buildings were damaged (Avci et al. 2023). In 2020, a flood occurred in Giresun province due to excessive rainfall, and 11 people died, and 47 people were injured. Along with the flood disaster, a landslide also occurred (Disaster and Emergency Management Presidency 2022a). In the flood disaster that occurred in Şanlıurfa province in 2023, 16 people died, and there was serious material damage (İrcan and Duman 2024).

The devastating event that occurred in Türkiye on August 11, 2021, and was known as the Western Black Sea flood disaster, particularly affected the provinces of Sinop and Kastamonu, causing serious loss of life and major material damage (Bilgen et al. 2022; Çoruh et al. 2022). In the flood disaster in the Western Black Sea, 82 people died and 364 received medical support (Disaster and Emergency Management Presidency 2022b). Among the regions that experienced the greatest destruction in the Western Black Sea flood disaster in 2021, the Ayancık district of Sinop and the Bozkurt district of Kastamonu stood out. Kastamonu Bozkurt district suffered the most damage as it received the highest rainfall, measured at 453 kg per square meter. It was reported that 2483 individuals were rescued from the flood waters (Disaster and Emergency Management Presidency 2022b; Yuceturk 2025). It has been stated that Sinop Ayancık district is vulnerable to floods and inundations (Sinop IRAP 2021:72). In Sinop Ayancık, floods occurred due to excessive rainfall, and significant material losses were experienced in residences, workplaces, vehicles, infrastructure facilities and bridges (Disaster and Emergency Management Presidency 2021; Turkish State Meteorological Services 2022:64). For this reason, these two regions were selected as the sample areas of the research. The research aims to evaluate the behavior of individuals exposed to flood disasters, their responses to early warning systems, their flood experiences, and the effects of early warnings in the context of societal capacity.

2 Method

In this study, the phenomenological design, one of the qualitative research methods, was used. The study was based on the descriptive phenomenology approach pioneered by Husserl (Patton 2018:209–210). Qualitative research allows for interpreting people's experiences, in line with the meanings they attribute to these experiences by evaluating the facts and events examined in their own context (Savela 2018; Pilcher and Cortazzi 2024). A semi-structured interview form was prepared by the authors based on the literature. It was sent to experts working in the field of Disaster Management (7). The experts evaluated the questions that were sent, and the interview form was finalized in line with the suggestions. The first interview form sent to the experts included 11 questions. After the expert opinions were gathered, the number of questions was updated to 9, and the interview form was finalized. Before starting the research, necessary approval was obtained from Sinop University Human Research Ethics Committee (E-57428665-050.04-66194 and 13/06/2024).

The population of the study consists of individuals aged 18 and over living in the Kastamonu Bozkurt and Sinop Ayancık districts, which were affected by a flood disaster in the Western Black Sea Region. Individuals who did not have communication problems, were not disabled, and volunteered to participate were included in the study. Exclusion criteria were defined as disability, age under 18 years, and having communication problems. Purposive sampling methods were used in this research. There is no common rule for determining the sample size for investigating phenomena in qualitative studies. Although it varies according to different sources, it is standard practice to repeat data collection in the sample group and terminate sampling when no new findings are achieved (Hennink and Kaiser 2022). A total of 15 volunteer individuals living in Ayancık and Bozkurt, two districts in the neighboring cities of Sinop and Kastamonu that were heavily affected by the flood, participated in the research. Data saturation was used as the basis for determining the sample size of the research. When the 12th participant was reached in the study, data saturation was achieved. To confirm that the data were repetitive, three more participants

Table 1 Demographic information of participants

Participant	Education	Age	Region of living
P1	Elementary School	68	Kastamonu-Bozkurt
P2	University	45	Sinop- Ayancık
P3	Elementary School	70	Kastamonu-Bozkurt
P4	Elementary School	66	Kastamonu-Bozkurt
P5	High School	55	Kastamonu-Bozkurt
P6	Elementary School	68	Kastamonu-Bozkurt
P7	Elementary School	72	Kastamonu-Bozkurt
P8	University	27	Sinop- Ayancık
P9	High School	33	Kastamonu-Bozkurt
P10	High School	55	Sinop-Ayancık
P11	High School	60	Sinop-Ayancık
P12	University	49	Sinop-Ayancık
P13	High School	42	Sinop-Ayancık
P14	High School	52	Kastamonu-Bozkurt
P15	High School	54	Kastamonu-Bozkurt

were interviewed; the data collection process in the study was terminated. Participants were reached using social media platforms and through headmen in the region. To establish an atmosphere of trust with the participants, the purpose of the research was explained in the first meeting, and appointments for the interviews were scheduled. Data were collected by face-to-face interviews with some of the participants and telephone interviews with others. The interviews were recorded. The data were coded as P1-P15 to anonymize participants and hide information. The interviews were collected between 30/06/2024 and 30/08/2024. The interviews lasted 210 min (see Table 1).

In the data analysis, each interview text was read line by line and coded. Within the scope of the coded research findings categories and themes were extracted from common codes. First, inductive descriptive analysis was performed through word-by-word open coding. Then, inductive content analysis was performed with the obtained categories and codes. The research was reported taking into account the "Consolidated Criteria for Reporting Qualitative Research" (COREQ) developed by Tong et al. (2007). To ensure validity (credibility) in the research, confirmations from participants were obtained, and quotes from them were given directly in the findings section. The themes were finalized by reaching a consensus among the coders. To ensure validity, information about the participants was provided, and inclusion and exclusion criteria were determined. The statements made by the participants during the interviews were summarized, and then feedback was received from the participants on their accuracy. In addition, the inclusion of direct participant quotes in the presentation of the findings increases validity by demonstrating that the findings do not reflect the subjective feelings of the researchers. In order to ensure reliability in the research, the researchers clearly stated the stages of data collection, analysis, and interpretation. Expert opinions were sought in the creation of the semi-structured interview form. The interviews were recorded. The reliability of the research was supported by these approaches. The MAXQDA 2020 program was used in the analysis of qualitative data. Researchers have expertise in disaster management. In the conduct of the research, both researchers participated in the interviews, audio recordings were made, and notes were taken. In the analysis of the research data, code consensus was achieved and the themes were finalized.

The research data were evaluated in the context of the basic parameters determined by the United Nations within the framework of "Early Warning for All" as well as disaster risk and crisis communication (UNDRR 2023).

The research data were analyzed within the framework of the following questions;

- What is the awareness of individuals living in Kastamonu-Bozkurt and Sinop-Ayancık against flood disasters?
- How and through which actors were early warnings delivered before the flood disaster?
- What are the behaviors of individuals after early warnings were delivered?
- What are citizens' response capacity and lessons learned from their experiences during and after the flood?

Figure 1 shows the location of Bozkurt and Ayancık districts in Türkiye, which are the focus of the research area. The main reason why this region was chosen as the research subject is that it was the area most severely affected by the largest flood disaster Türkiye has recently experienced.

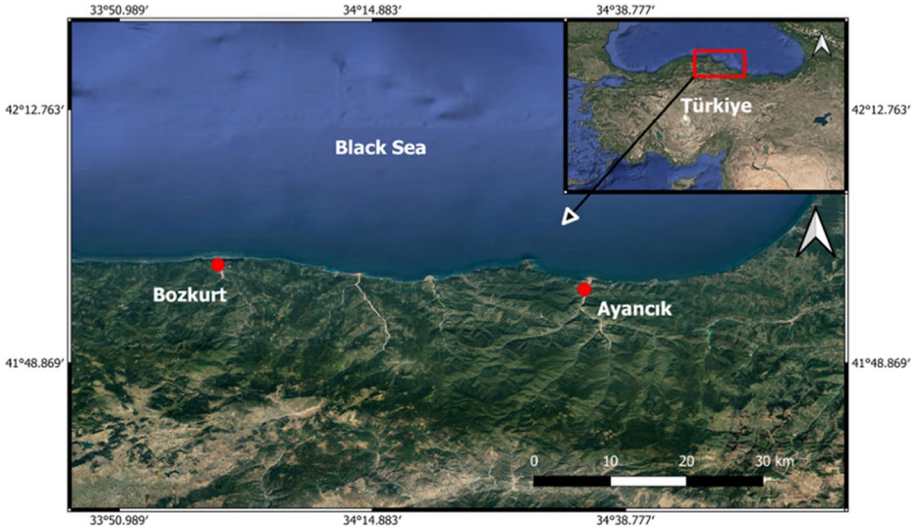

Fig. 1 Location of Bozkurt and Ayancık districts

3 Findings

The findings of the research on flood early warnings and community behavior were examined under four different themes. The theme of flood risk knowledge and awareness was evaluated in the sub-themes of flood risk awareness, disaster in the past and hazard knowledge. The theme of dissemination of early warning and society's behavior was evaluated in the sub-themes of behavioral responses after early warning, delivery

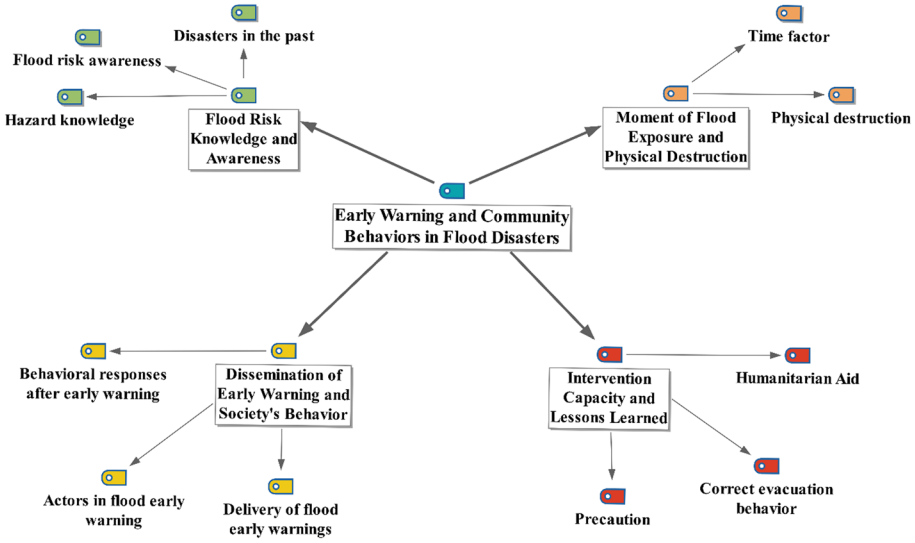

Fig. 2 Themes and sub-theme of early warnings and community behaviors

of flood early warnings, and actors in flood early warning. The moment of exposure to flood disaster and the theme of physical destruction were evaluated in the subthemes of physical destruction and time factor. The theme of intervention capacity and lessons learned was evaluated in the sub-themes of humanitarian aid, correct evacuation behavior, and precaution (see Fig. 2).

3.1 Theme 1: Flood risk knowledge and awareness

Participants made assessments regarding hazard knowledge, disasters experienced in the past, and the awareness of flood risk triggers. It was observed that the participants had flood information about the district, and mountainous areas in which they live. The dangers related to the region are known. Participants expressed their views on the transformation of hazards into flood disaster risks. It has been observed that the local people are aware of the dangers of floods and landslides and that they have knowledge of the disaster history of the region. In this context, P5 from Kastamonu province expressed his awareness of the dangers that may develop after landslides and excessive rainfall in the region he lives in as follows: P5 "There are areas where there will be landslides if it rains a lot. For example, there are areas where there will be landslides if it rains for 2–3 consecutive days".

On the other hand, P1 from Kastamonu province expressed his opinion on the dangers triggering flood disasters as follows: P1 "There was a risk of floods due to heavy rain, and the mountains overflowed. All the streams overflowed from the heights."

3.2 Theme 2: Dissemination of flood early warning and community behavior after early warning

Evaluations were made regarding the transmission of flood early warnings, actors involved, and behavioral reactions following the warnings. Participants were defined as entities involved in flood warnings for the society, including the municipality, district governorship, social media accounts, Disaster and Emergency Management Presidency (AFAD), headmen, municipal police, police, and internet news. Participants stated that warnings were delivered using the municipality's vehicles, announcements were made from social media accounts, notifications were presented via SMS, and warnings were given through loudspeakers in police vehicles. Warnings, especially after sudden and heavy rainfalls, were given; however, some people went out for health care needs and shopping. On the other hand, some people were seen taking their vehicles to higher places.

On the other hand, it has been observed that problems exist in accessing early warnings in villages and locations remote from the district center. It was stated that people, especially those who do not have internet access or do not use a phone, may encounter problems accessing warnings. Some people stated that citizens on the banks of the stream were waiting to take photos while warning citizens to escape. P6 expressed this experience as follows: P6 "It rained and the flood was coming. They said everyone should move their cars. In the past, floods would reach the bridge. Now this was something different. People were taking selfies and photos on the bridge. We were shouting to chase them from the other side of the bridge."

P12, who shared his experience from Sinop province, stated that a warning was made for excessive rains and that they were caught in the flood disaster at night: P12 "We heard

about the flood at night. We had received news days before that there would be very heavy rainfall. However, we did not think of a flood."

P3 expressed his experience regarding conveying the flood warning to citizens as follows: P3 "The municipality and the police constantly made announcements to evacuate using their cars."

P2, who shared his experience from Sinop province, stated that the early warning for the flood was given during the day, but they were exposed to the flood at night as follows: P2 "The municipality issued a warning; but of course, it was not in the middle of the night but during the day It was impossible to communicate because of the flood. There were problems on the village roads. It did not happen at night because it is assumed that no one expected the intensity of the incident to increase that much."

Sharing her experience from Kastamonu province, P9 expressed the destruction caused by the flood warning as follows: P9 "The flood warning in Bozkurt was issued in the following manner. They said that those who have cars on the banks of the stream should pull their cars up to higher ground. For example, it is reported that several individuals died for this reason. He entered his car, and while attempting to save it from the flood, he was swept away. For example, many people died in such circumstances."

When the behavioral reactions of the society after early warning were evaluated, it was determined that they exhibited climbing to high places, warning and guiding other citizens, not knowing what to do due to panic, deciding to shelter in place/stay at home, and disregard behaviors.

Sharing his experience, P1 stated that he warned his friends and brother living in the village that the flood was coming. P1 "I warned a few friends in the village. I had a brother. I asked everyone to inform me when the floods increased floodwaters came from the mountains and flowed along the main roads."

P7, who stated that he had never experienced such a flood before, mentioned that there was no rain, that the flood occurred quickly, that he did not pay attention to the warnings. P7 "Now, if we had taken those warnings into account, there would have been no casualties. However, since this specific event has not happened before, it is quite normal for people not to give it attention. We are unprepared because we have never experienced anything of this nature. There was no precipitation and no winter. The weather was exceptionally gloomy. So, all that happened was a 5–10-min event."

3.3 Theme 3: Moment of exposure to flood disaster and physical destruction

It was determined that the time factor significantly impacts exposure to flood disasters. While the flood occurred in Bozkurt district during the day, it struck Ayancık district at night. However, warnings regarding sudden and excessive rainfall were continuously issued in both districts. Since the flood disaster occurred at night in Ayancık district, participants stated that they were at home and were suddenly exposed to the flood. Some citizens went out to raise their vehicles to higher elevations in the Bozkurt district, but some participants stated that they could not go out to save their vehicles because there was a sudden flood in the Ayancık district. It was determined that due to the flood disaster, there were electricity and water outages, telephone networks became unusable, some bridges collapsed, transportation routes were closed, and buildings were demolished. It was observed that, along with this physical destruction, there was a loss of human and animal life (human and animal deaths), as well as injuries and material losses. A participant in the Ayancık district,

where the flood disaster occurred at night, describes his situation as follows: P2 "Since it was night, everyone was at home. No one had gone out. Everyone was sleeping, so none of them knew. Since it was night, no one was with us. Our cars were parked. There was no opportunity to steal citizens' cars in our district."

P8 from Sinop province expressed her views regarding the physical destruction caused by the flood as follows: "The entrance and exit were closed…Both bridges were destroyed." P9, who shared her experience from Kastamonu province, stated that "There is another bridge like this in Bayramgazi (Bozkurt) village. It has started to collapse. They even told us not to go there."

It was determined that helicopter-supported evacuations and aid took place during the flood disaster response due to the destruction of the village connection roads, and that the aid was delayed, because of the damaged access roads. it was reported that the people supported each other. Participants stated that after their experiences, they paid attention to the warnings, acted cautiously, and demonstrated the correct evacuation methods when the warning was given. The participant explained that she took the warnings given after the disaster she experienced into consideration as follows: P9 "For example, last week there was rain for a few days. A warning was made from all the mosques in the village. An announcement was made by the district governor's office saying there was a possibility of flooding. We take the warnings into consideration." Another participant stated that they acted consciously and carefully as follows: P2 "Now, people who are more careful, the people who experienced this disaster. We have become conscious, we want to move our vehicles to a safe area in a more controlled manner when there are too many warnings."

4 Discussion

In the study, it was observed that the participants were aware of the dangers such as floods and landslides in their region. Additionally, it was determined that participants understood that these threats evolved into disaster risks. A society's success in disaster management depends largely on risk perception (Zhong et al. 2021). Individuals with low risk perception may display inadequate attitudes about being prepared for disasters and acting correctly in such situations. This may lead to an increase in the effects of the disaster (Dhar et al. 2023). There are many factors that determine society's perception of risk towards disasters. Among these factors, personal experiences, level of education, media influence, cultural differences, and the frequency of disasters have an important place (Al-Dahash et al. 2022; Çelik and Kılıç 2023). While these factors are among the basic elements that shape the risk perception level of societies, it should not be forgotten that this perception can be improved with effective risk communication. Risk communication can be defined as an information sharing and interaction process that aims to enable individuals and society to understand the risks arising from disasters, take appropriate precautions and become prepared for such events (Bradley et al. 2014). The main purpose of risk communication is to raise awareness in society about disaster risks, to direct individuals to be prepared for such situations, to prevent the spread of misinformation, and to strengthen community resilience through these joint efforts (Shah et al. 2023). At the same time, effective risk communication can prevent panic and chaos by conveying accurate information quickly and clearly in the event of a disaster (Nazlı 2024). The findings of our study reveal that the people of the region have risk awareness regarding flood disasters. However, despite this awareness, the

participants encountered physical destruction during the flood. This situation shows that despite the knowledge of risks, risky behaviors are not avoided.

In the context of disasters, effective dissemination of early warnings and understanding individual responses to these warnings are crucial. Our research has shown that different actors are involved in the delivery of early warnings and that warnings are usually delivered via voice messages or SMS. However, it has been determined that SMS warnings create problems in reaching individuals who do not have access to a telephone or who cannot use a telephone. Oktari et al.'s study in Indonesia showed that the Aceh Central Government has the capacity to implement early warning systems appropriately. The study also highlighted the importance of involving all stakeholders in early warning systems (Oktari et al. 2014). In a study conducted in a region of Namibia where floods are frequently experienced, it was determined that local governments are responsible for early warning systems but have serious deficiencies, especially in terms of financial and human resources (Moises et al. 2024). In a study conducted in Vietnam, the effect of flood early warning systems on strengthening societal capacity was examined, and it was concluded that these systems are extremely effective in reducing disaster risks (Pham et al. 2024). A study conducted in the Khayelitsha settlement in the Republic of South Africa revealed that early warning systems were communicated by local governments through churches, schools, and social media platforms, such as WhatsApp, Facebook, and Instagram. The study also highlighted the need for local governments to increase their capacity by strengthening their human resources (Muhame et al. 2024). In the study conducted by Alias et al., it was determined that 56% of the participants received early warning before the flood, and the majority of these warnings were received through television and information disseminated among the public (Alias et al. 2020). A study conducted in two different flood-prone areas in Bangladesh found that 71% of participants knew the causes of floods. However, the same study also noted that participants had significant difficulties accessing flood warnings (Rahman et al. 2013). A study conducted after the flood disaster in Germany in 2021 stated that the flood warning messages sent before the incident were inadequate and far from understandable (Lindenlaub et al. 2024). A study covering 350 municipalities in Japan determined that there were various difficulties in delivering early warning systems to vulnerable groups (Cao et al. 2024). Our research findings reveal that flood early warning information is communicated by a variety of actors and that citizens contribute to this process by warning each other. However, despite early warnings, it was observed that some participants chose to go out. Reasons behind these behaviors include the desire to move their vehicles to higher places, health needs such as going to the hospital, and grocery shopping. Early warnings failed to direct some participants towards correct behavior and evacuation processes, causing them to experience vulnerabilities. Additionally, it has been found that there are difficulties in delivering early warnings in rural areas. The main reasons for this situation include lack of internet access and limited telephone use. However, it was determined that citizens in rural areas supported the process by warning each other. In this context, social solidarity and social network relations play an important role in the transmission of early warnings.

The extent of destruction and losses in the event of a flood may vary depending on different factors. Samansiri et al. in their study stated that the effectiveness of early warning systems is negatively impacted by deficiencies in policies and governance, societies' reactions to early warnings, as well as weaknesses in the tools and technologies used to convey and respond to warnings (Samansiri et al. 2023). A study examining vulnerabilities

in flood disasters revealed that women, the elderly, and children are at higher risk physically and psychologically during floods. It was also found that males aged 10–29 have higher mortality rates. Other risk factors include previous flood experience, flood-related trauma, existing health problems, difficulties in accessing medicines and low socio-economic status (Lowe et al. 2013). In our research, we determined that aid was delayed due to the destruction of transportation routes caused by the flood, and interventions could only be carried out in line with the existing capacity. Another study conducted in Bangladesh stated that communities living in wetlands are extremely vulnerable to sudden flood risks (Choudhury and Haque 2016). In a different study conducted in Bangladesh, it was particularly noted that NGOs played a critical role in delivering various aid such as food, water, clothing, and medicine to those in need during the response to the flood disaster (Hossain 2020).

The research revealed that various actors play a role in the delivery of early warnings and that citizen-based warnings have emerged within communities. Participants stated that they gave more importance to early warnings after the flood disaster they experienced, and developed effective evacuation methods, and regularly followed these warnings. This shows that important lessons have been learned from flood disaster experiences.

5 Conclusion

The preparedness of individuals, communities and states against flood disasters and their ability to act appropriately at the right time plays a critical role in reducing physical, social and economic losses. Flood early warning systems have the potential to minimize vulnerability by informing individuals and communities in a timely and accurate manner. Reliable and timely warnings allow individuals to act safely without experiencing fear and panic. The ability of society to transform early warnings into correct behaviors can be improved by organizing educational activities and awareness meetings. The accessibility and reliability of early warning systems are of vital importance for societal capacity. Short messages, radio/television broadcasts, and technological devices such as sirens or loudspeakers at the local level are important methods for effectively communicating warnings. These systems need to be inclusive at the local and national levels and managed through reliable sources. In addition, it is of great importance for local governments and the central administration to develop policies and establish reliable mechanisms early warning systems.

6 Limitations

This study has some limitations. The participants of the study are individuals who experienced the flood disaster in Kastamonu Bozkurt and Sinop Ayancık districts, in 2021. The findings of this study are limited to the statements of volunteer participants who experienced the flood disaster. Its strength could be that evaluates the early warning communication and behaviors of individuals affected by the flood disaster in Sinop Ayancık and Kastamonu Bozkurt districts within the framework of societal capacity.

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Data availability The authors do not have permission to share data.

Declarations

Conflict of interest The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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