

Risk communication in flood-prone communities: memories, informal practices and public action in Brazil

Comunicação de riscos em comunidades propensas a inundações: memórias, práticas informais e ação pública no Brasil

(resumo: p. 19)

Comunicación de riesgos en comunidades propensas a inundaciones: memorias, practicas informales y acción pública en Brasil (resumen: p. 19)

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Current studies on risk communication often rely on either top-down or bottom-up approaches, with a notable lack of integration between these processes. This article explores this disconnect, presents a public action framework specifically tailored to integrate top-down and bottom-up analysis of flood risk communication, apply it to examine flood memories and identify types of flood risk communication in vulnerable communities. These flood memories provide crucial insights into community experiences and interpretations of risk communication, enhancing strategies for future events. The study employs qualitative approaches, including interviews and content analysis. Results indicate that while formal risk communication may be limited, informal channels, word-of-mouth, and practices related to flood memory, community events and local organizations are present. The public action approach emerges as a valuable strategy for understanding local nuances in flood risk communication in vulnerable communities.

Keywords: Flood memories. Flood risk communication. Public action. Vulnerable communities.

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Introduction

Floods pose a significant threat to public health and sustainable urban development, particularly in vulnerable communities within developing countries that suffer from inadequate public services and infrastructure¹. Effective risk management in these contexts necessitates a collaborative approach that not only addresses the unique circumstances and needs of the affected communities² but also thoroughly understands the risks and vulnerabilities they face³, along with their existing coping mechanisms³ and local governments conditions to attack the issue^{4,5}.

Risk management policies have only recently begun to incorporate such considerations⁶, and their implementation has encountered numerous challenges^{4,5}. These challenges are further compounded by the responsibilities of subnational governments, which are tasked with informing the population about potential risks, emergency protocols, and appropriate actions in the event of disasters. Risk communication plays a critical role in this process, involving the dissemination of data and information across all stages of disaster risk management to ensure active participation and comprehension among all stakeholders^{7,8}.

Within this scenario, risk communication is pivotal for raising public awareness, enhancing preparedness, and fostering resilience against disasters. However, it frequently oscillates between top-down approaches - directed by experts and risk communication authorities with very limited participation from community members - and bottom-up approaches - grounded in community strategies but with minimal governmental or expert reach⁹. Considering this problem, this article main goals are (1) to explore this disconnect, (2) to present a public action framework specifically tailored to integrate top-down and bottom-up analysis of flood risk communication and (3) apply it to examine flood memories in order to identify types of flood risk communication in vulnerable communities in Brazil.

The paper is based on experiences within an international project which investigates the governance of water-related risks with a focus on social and cultural aspects of data practices in the UK, Germany, and Brazil, specifically in the cities of Rio Branco (AC) and São Paulo (SP)¹⁰. By rethinking how flood-related information is produced and how it flows, the project has shown it is possible to build sustainable and flood-resilient communities¹¹. Experiences within the project investigations led to the conclusion that informal practices may complement and even redesign formal risk communication and decision-making settings, enhancing performances in highly complex places¹².

Considering such findings and the Brazilian research context, this paper stands that flood risk communication in flood-prone communities can be better understood as public action¹³, working both as spontaneous practice to solve public issues, important source of information for residents and public agencies and also support for community members during and after floods.

Risk communication as public action

The disconnect between bottom-up community-based strategies and those largely top-down approaches favored by risk authorities has historical background in scientific literature on risk communication. Baruch Fischhoff's¹⁴ seminal approach highlights the evolution of risk communication from its early stages, which lacked public interaction, to more comprehensive and transparent practices that actively involve the public. To better understand the evolution of public involvement in risk communication and the roles assigned to different stakeholders, Frame 1 presents a breakdown based on Fischhoff's framework, outlining the responsibilities of government authorities/experts and communities at risk/local organizations.

Frame 1. Assignments to stakeholders according to Fischhoff approach.

Historical approach to risk communication (Fischhoff ¹⁴)	Assignments	
	Government authorities and experts	Communities at risk and local organizations
1. All we need to do is get the numbers right	Gather data	Nothing
2. All we need to do is tell them the numbers	Gather and share data with society	Access and receive data
3. All we need to do is explain what we mean by the numbers	Gather, share, and explain data to society	Access, receive and understand data in scientific discourse
4. All we have to do is show them that they have taken similar risks in the past	Gather, share, and explain data and compare to previous risk experiences	Access, receive and understand data in scientific discourse and accept the comparison as enough to accept risks
5. All we have to do is show them that it is a good deal for them	Gather, share, and explain data and compare to previous risk experiences, and persuade society to accept risks	Access, receive and understand data in scientific discourse and accept the experiences comparison as adequate argument to accept risks
6. All we have to do treat them kindly	Gather, share, and explain data and compare to previous risk experiences, and persuade society to accept risks by treating them kindly during the whole process	Access, receive and understand data, accept the comparison of experiences as valid to accept risks and understand public authorities and scientific kindness positively
7. All we have to do is make them partners	Include society members in gathering, sharing, and explaining data, and in comparing previous risks and negotiating with them	Participating in gathering, sharing, and explaining data to peers, and in comparing previous risks and negotiating with them

Source: Adapted from Baruch Fischhoff¹⁴.

Despite the value of Fischhoff's approach, the analysis of Frame 1 reveals three primary limitations: (1) it is predominantly focused on the perspective of government authorities and experts regarding effective risk communication; (2) it relies heavily on persuasiveness as the main strategy to encourage community participation; and (3) it emphasizes individual decision-making and risk perception, often neglecting the broader social, political, and institutional factors that influence these processes.

This emphasis on the expertise model or reliance on risk authorities is echoed in Brazil, particularly in the domain of disaster risk communication research. In this country, studies on disaster risk communication have mainly focused on how public agencies such as Civil Defense and other expertise agencies communicate risk to the public. These studies aim at identifying best practices for disseminating weather data

and warnings, but they tend to focus more on how these agencies operate rather than (if, and) how communities themselves receive such data, perceive and communicate risks¹⁵⁻¹⁹.

Risk communication requires more than just conveying information to the public, it needs to be a two-way process that considers and incorporates the perspectives and values of stakeholders, particularly communities, rather than solely relying on expert knowledge: experts can make mistakes when ignoring local risk knowledge and practices²⁰. Fostering participation based on persuasion and not direct understanding of local practices, on the other hand is based on two complicated assumptions: homogenizing communities²¹ and stigmatizing them as being incapable of engaging in complex discussions²². Finally, focusing on individual decision-making and risk perception overlooks power dynamics, cultural values, and structural inequalities that influence the distribution of risks and the ability of different groups to participate in risk communication, which should be viewed as a democratic process that engages all affected parties²³.

That is the reason why experts in academia, government, and risk management have increasingly recognized the potential of community-based initiatives to cope with flood hazards at a local level²⁴. Experiences in flood management in different countries have shown that residents of flood prone areas are frequently doing communication and coordination between themselves and with other communities to prepare and respond to flood hazards²⁵. Consequently, participatory approaches to community-based flood risk communication may be useful to strengthen flood mitigation at a local level, especially at informal settlements, and its implementation has even proven to enhance awareness of both self- and mutual-help efforts²⁶. These approaches foster collaboration and empowerment among stakeholders, addressing the specific needs and vulnerabilities of communities²⁷, and contribute to dismantling the oppressive structures of traditional media by expanding the diversity of voices and perspectives in communication^{28,29}. Various frameworks have been developed in scientific literature regarding community-based strategies, such as the Integrated Flood Risk Management framework³⁰, the Social Amplification of Risk Framework³¹, and the Community-Based Adaptation framework³², but they often neglect formal communication practices or overlook details of informal practices in flood risk communication.

Current disaster risk communication efforts are thus often polarized between two contrasting and potentially conflicting approaches: top-down, expert-driven strategies and bottom-up, community-centered strategies. This polarization highlights the difficulty in achieving the 2015–2030 UN Sendai Framework's goal of integrating traditional top-down risk reduction methods with emerging bottom-up approaches. The emphasis on solely adhering to one approach—whether top-down or bottom-up—can undermine the effectiveness of risk communication, as it fails to address the complexities and needs of both expert and community perspectives. Integrating these approaches is crucial for a comprehensive and effective risk management strategy⁹. Accordingly, this article aims to advance this field of study, recognizing that achieving this goal requires moving beyond formal, institutionalized practices and informal, community-based strategies.

Our main contribution regards going beyond public participation, towards a public action framework. Particularly in communities in a situation of socio-environmental vulnerability in developing countries. This public action approach must go beyond the public policy and recognize the broader range of activities undertaken by various stakeholders, including community members, to formulate, explain, pressure, and provide services to communities¹³.

Figure 1 explores a flood risk communication framework from the public action perspective that includes community flood risk communication and expert-authority. It focuses on four risk communication types: lack of risk communication, internal risk communication, unilateral risk communication and dialogic risk communication. This public action approach was used to analyze narratives of community members of flood-prone areas about their experiences with floods in Brazil. Insights on informal practices of flood risk communication in flood-prone communities have been found.

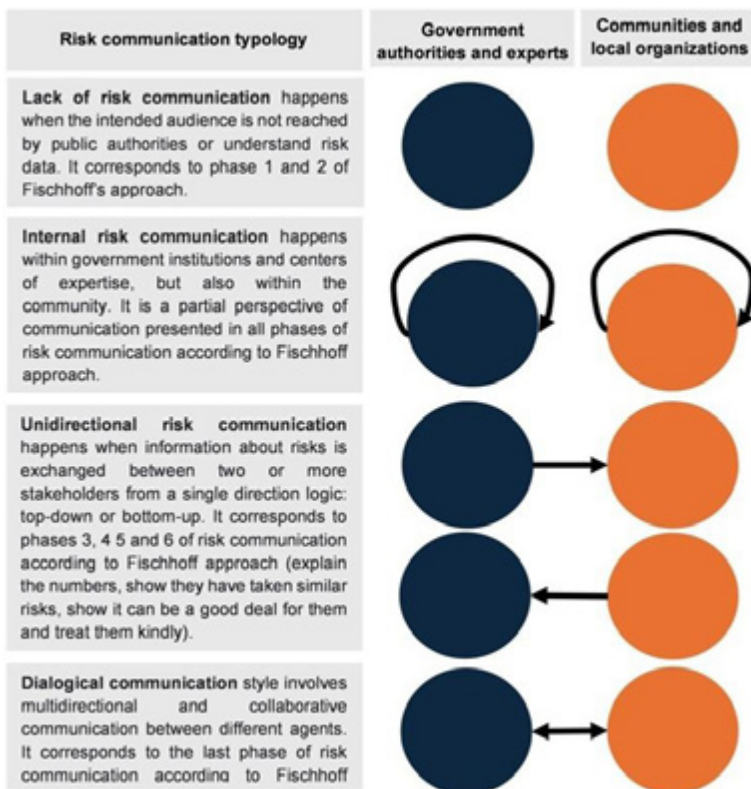


Figure 1. Flood risk communication as public action framework.

Source: Inspired by Baruch Fischhoff¹⁴ and Victor Marckezini et al.¹⁵.

Methodological considerations

This paper analyzes data collected from 2019-2022 with residents from flood-prone communities in two Brazilian municipalities: São Paulo and Rio Branco. Citizens in these cities have varied flood experiences: in the former they usually face flash flooding, and, in the latter, seasonal flooding connected to river levels. However, they share similar histories that amalgamate an informal (and incomplete) urban development of the areas they live in; high levels of socio-environmental vulnerability, numerous flood

experiences and fragile governmental support to prevent and respond to floods, which justifies the decision for analyzing both jointly.

The analyzed data was collected through the contextualized application of a transnational methodology for eliciting flood memories from local communities located in flood-prone areas³³. Such method, called sustainable flood memory, derives from previous works developed in the UK and Brazil and from the understanding that the lack of flood memories affects a community's capacity to participate, engage and tell their story³⁴. Its goal is to promote the registration and dissemination of citizens' flood memories to leverage "flood materialization" in communities at risk of forgetting and improve flood resilience and future preparedness.

The methodology flood-memory circles were adapted and developed in the selected communities in 2019 and 2020. In these events, participants were encouraged to think of two memories of floods - one that had a personal relevance and another that was memorable for their community - and share them with the group. The voices were recorded with the participants' consent and the material has been transcribed. Project approved by the Ethics Committee of Fundação Getulio Vargas under the process number 29/2019.

The researchers have used a qualitative content approach to analyze the data collected. During the pre-analysis phase, the material has been selected, read and organized, according to specific goals in specific *index*: the main spaces, institutions and themes related to flood governance in the memories narrated. Next, the exploration of the material takes place, involving the coding, categorization, and classification of data, allowing for the identification of relevant meaning units. The authors have produced the following codes and sub-codes: buildings/homes, agencies/organizations, infrastructures/services, mediation/culture, climate and environment, emotion/affect and local history and knowledge. Since this specific paper focuses on communication, the code "mediation/culture" was selected, and careful examination of its subcodes and the excerpts has been made. Finally, the treatment of results, inference, and interpretation is conducted, where the data are synthesized and interpreted in light of the adopted theoretical framework. After exploring each subcode, the authors have applied the public action framework previously presented and identified cases for each type, enabling a deep and critical understanding of the implicit and explicit content present in the material analyzed³⁵.

Finally, the authors have focused on unilateral, internal and dialogic risk communication cases and inductively identified two common groups of practices of informal flood risk communication in flood-prone areas in this material. These practices, their relation to the framework and other findings were interpreted based on the research goal and existing literature.

Results and discussions

While analyzing the interviews, all statements regarding communicative practices have been categorized into thirteen (13) non-excluding subcodes in the Mediation/Culture codification, resulting in initial thirty-five (35) analytical samples. The authors have primarily focused on these samples before excluding repetitions because the same statement may refer to different topics, a useful differentiation for analytic purposes.



The statements have been expressed by fourteen (14) out of twenty (20) participants, as expressed in Frame 2.

Frame 2. Media/Culture codification.

Topics	Interviews																			
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Boooks/Pamphlets																				
Campaigns																				
Communication (direct)																				
Sense of community																				
Festivals																				
Flood science awareness																				
Flood stories																				
Flood anecdotes																				
Media coverage																				
Mobile phone videos																				
Photographs																				
Sharing Images/stories																				
Recording/documenting/archive																				
Social media																				
Sound/smells																				
Social history																				
Telephone																				
Data/Information																				

Source: produced by the authors themselves

Then, by applying the Flood Risk Communication as Public Action framework in each excerpt, the authors have been able to distinguish between each type, as presented in Frame 3.

Frame 3. Flood risk communication as public action framework applied to Meditation/ Culture code.

Legend																					
Lack of risk communication		Internal risk communication				Unilateral risk communication				Dialogic risk communication											
Topics		Interviews																			
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Boooks/Pamphlets																					
Campaigns																					
Communication (direct)																					
Sense of community																					
Festivals																					
Flood science awareness																					
Flood stories																					
Flood anecdotes																					
Media coverage																					
Mobile phone videos																					
Photographs																					
Sharing Images/stories																					
Recording/documenting/archive																					
Social media																					
Sound/smells																					
Social history																					
Telephone																					
Data/Information																					

Source: produced by the authors themselves.



Each type in the framework makes reference to a series of practices as it has been shown in an inductive analysis made by the authors: the lack of risk communication is often related to post-flood communication, unilateral and internal flood risk communication is practiced through word-of-mouth communication and flood memory materialization, while more dialogic experiences are practiced in meetings, gatherings and grassroots organizations. A synthesis of this analysis is presented in Frame 4.

Frame 4. Flood communication practices.

Post flood communication		Legend																				Meeting, gatherings, and grassroots organization	
		Word-of-mouth communication and flood memory materialization																					
Topics	Interviews																						
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20			
Boooks/Pamphlets																							
Campaigns																							
Communication (direct)																							
Sense of community																							
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Recording/documenting/archive																							
Social media																							
Sound/smells																							
Social history																							
Telephone																							
Data/Information																							

Source: produced by the authors themselves

After excluding the repeated statements, the authors have found two (2) dialogic communication cases, four (4) unilateral communication cases, five (5) internal communication cases and ten (10) situations where there has been no risk communication (just post-flood communication). The following section will explore the contents of these typologies and their connection to their respective practices.

The lack of risk communication and the value of post-flood information

The lack of informal risk communication does not mean lack of informal communication at all: communication exists, but it happens after the event, making reference to new risks, damages, impacts and reconstruction after the floods. There is a notable gap in studies focusing on its role in post-disaster recovery and reconstruction. For instance, effective cross-scale risk communication significantly influences individual decision-making regarding reconstruction and resettlement and has important implications for long-term planning and development^{35,36}. The important

thing here is to learn from these informal experiences and think on practices to anticipate such processes, considering they already exist and can easily be incorporated in flood risk communication.

An interesting example comes from Mrs. M. story. Mrs. M is an old woman who used to live in a flood-prone area. One day, the bridge connecting her neighborhood to the main street collapsed after an intense flash flood. They decided to talk directly to a local politician to obtain pieces of wood to rebuild the broken bridge.

There we went, with two more friends. We slept at José Maria Marin's house. Not at the house, at the gate. Because at that time, José Maria Marin, he was [a politician] [...]. Then we waited at his door, we were asleep, not sleeping, we were there sitting and waiting until 8 am when he left the house. Then he said: "Come to my house, to Mr. Maria's house, we'll talk, have a coffee". And then what happened? We said what we wanted, we wanted to build a bridge, we wanted wood to build another bridge that day or the following day. And he said that the City Hall didn't have any wood, he told me that he didn't know why the City Hall didn't have any wood and whatever and I said upset: "Well, good". (Mrs. M, São Paulo)

The lack of risk communication and even response from public authorities doesn't mean there is a lack of communication and organization at the community level. After the collapse of the bridge connecting her neighborhood to the main street, Mrs. M. and her friends took direct action to address the issue by seeking help from a local politician. By personally approaching the politician and making their request for wood to rebuild the bridge, they were engaging in an informal communication practice and organization.

Post-flood experiences can also offer insights on how communities cope with floods based on specific information, whether for preparing reconstruction or to build social support, as in Mrs. C. 's experience. "My mother called me early in the morning, the next day, and I said that the night before, rainwater had got in here. She arrived just over an hour later like this...desperate (Mrs. C.)". Social support from family and close friends can help individuals cope with the emotional stress and trauma of a flood event, providing a listening ear or a comforting hug but it can also reduce negative emotional impacts and promote recovery³⁷. By contacting family members by telephone, this word-of-mouth communication of the event mobilizes people emotionally and physically towards the local resolution of the problem.

On the other hand, internal, unilateral, and dialogic risk communication types have referred to practices before or during the flood, most anticipating the practices that already exist in post-flood communication at these communities.

Internal and unilateral: word-of-mouth communication and flood materialization

The following excerpt is an example of how internal flood risk communication operates. Mr. J. tells the interviewer the exact process by which the risk of flood is communicated between neighbors for them to take action.

When it rained at night, one neighbor had to ring the other's doorbell: "take out the car because the water will rise". So, the entire neighborhood would run out at dawn to get the car out of the garage because the water was rising all over the block and entering the houses. It was a time of great fear because we would wake up and have to run to take things out, to lift things up because the sewage flooded and entered our houses. (Mr. J., São Paulo)

In this excerpt, Mr. J. describes the communication strategy used by the residents in the flood-prone area he lives in. In this case, the communication happens strictly within the community and is based on local and lay knowledge and practices. The neighbor who rings the doorbell to warn others of the rising water is sharing information about the flood risk in the area. This action has been shown to be important because it allowed people to take necessary actions to prepare for the flooding, such as moving their cars to higher ground or lifting their belongings to prevent damage from the water.

This type of communication is based on trust, which is the fundamental basis of this strategy. People believe in each other, rely on each other, and act based on the information they receive from each other. This demonstrates that trust plays a crucial role in facilitating risk communication and ensuring effective risk management in flood-prone areas. When people trust each other, they are more likely to heed warnings and take appropriate actions to protect themselves and their properties^{14,30}.

However, trust must be achieved and sometimes not even authority figures, like risk experts, can completely convince their own family members. That was the case for Mr. A, a flood risk expert working at a local environmental agency and also a resident at a flood prone area. He tries to show his father that the flood prediction for the year of 2015 was higher than their previous experiences and they should be prepared. However his father was suspicious, and only started to believe in him after the event.

Until there was a day when I said: "Oh, this one will exceed the flood of 2012", then it was at that moment that he didn't believe my story. That's when I took one of these acrylic rulers, put it on the wall and measured it out to the base of the window, measuring about 1 meter: "The water will reach here", and I said that inside the house the water would reach our waist. He looked and said: "Will the water get there? It never got there, there's no way it will get there". And then the river continued to rise, reached the second floor of the house and suddenly we were already walking with the water on our waists. Then, from that moment on, he started believing more the information I gave him and telling the story of the ruler in the window. (Mr. A, Rio Branco)

This case highlights the challenge of unidirectional communication in flood risk management. In this case, Mr. A was providing information to his father in a top-down manner, but his father was not receptive until the flood actually happened. This type of unidirectional communication can be problematic because it does not allow for the exchange of information or feedback, and may result in the public not taking action to prepare for a potential flood event. However, this example also shows that unidirectional communication can be effective in certain circumstances. While Mr. A's father did not believe the information at first, the visual aid provided helped him to better understand the potential height of the floodwaters: Mr. A. provided tangible evidence in the form of measuring the water level with a ruler and showing some time later he was right in his assumptions. This suggests that even in unidirectional communication, the use of visual aids or other tools can help to improve the effectiveness of the message being communicated. After experiencing the flood, the father became more receptive to Mr. A.'s information and even shared his story with others.

Both internal and unidirectional cases presented have made use of word-of-mouth communication practices to make risk information flow. Word-of-mouth communication is the passing of information from person to person through oral communication. In the context of risk communication, word-of-mouth refers to informal conversations and discussions that take place between individuals or groups in a community about risk and hazards and is an important aspect of informal risk communication because it often takes place outside of official channels and allows for the exchange of local lay knowledge, experiences and memories³⁸.

Speaking of sharing flood memories, emotions can play an important role in such a process, engaging the interlocutor through narratives of materialized memories as it becomes evident in the following excerpt:

Those stains there are still from the flooding, from when the canoes came and the water splashed and it got wet there and the stains fixed, you know. Even today, I think it will never end. And I have never painted it either, which is to keep a memory of the flooding. (Ms. Z, Rio Branco)

In this excerpt, the speaker mentions the presence of stains caused by flooding within a flood-prone community. These stains are described as materializations of flood memory, serving as reminders of past flood events. This deliberate choice to preserve the stains can be understood as a way to retain a memory of the flooding but also plays a significant role in informal flood risk communication. By acting as visual triggers for memories and emotions, it symbolizes the community's vulnerability, preserve collective memory, and facilitate the transmission of knowledge and information about floods.

A similar practice has also been identified in São Paulo, when a local cafeteria owner filmed when the flood water violently entered her establishment.

“For about 3 years... 2 years of the cafeteria operation, 3 years of its construction, we always go through this, that’s why we filmed it to see if it was shown to someone, right? We don’t have much to do, it’s practically a cry for help, it’s a cry for help because it’s something that we can’t solve. If we could put a drain pipe there and it... but there’s no way. That’s what made us outraged with the situation, for not being able to do anything at the time, except to run and record! You know, I’ve lived on this street for a long time, this downpour, we can’t go outside the house on a day of flooding, people being carried away by the flood, I’ve seen this since I was a child, okay? And that day we were really angry, day after day. We were outraged, so I can tell you that on that day, that’s what led us to record. (Ms. E., São Paulo)

Whether remembered in stains at the walls or videos that can circulate on the internet, the materialization of flood memories plays an important role in informal flood risk communication, since it can bring awareness about flood risks within the context of this specific community and beyond. And it is made in a way that is not necessarily rational: stains and videos are made to provoke something on the interlocutor, to make them feel³³.

A more dialogical approach: meetings, gatherings and grassroots organizations

In São Paulo, Mr J. narrates a dialogical experience of trying to solve the problem of flooding that started when a private bus company garage was built next to his neighborhood. The neighbors who had never experienced any kind of flooding, passed to cope with flooding at every single rainfall. So people at the community organized themselves in order to fight for their rights, against the company.

So, we thought of mobilizing the community with a petition and a visit to the Public Defender’s Office, and the public defender started to attend the community. I went to a meeting one day, twice, with six residents here in the neighborhood, we took a petition with many signatures, we took photos and listened to him and there began a process. I believe he called the garage owner. (Mr. J., São Paulo)

Mr. J. ‘s account highlights the importance of meetings and gatherings as informal flood risk communication practice. Community meetings and gatherings are events where members of a community come together to discuss common issues, share information and ideas, and make decisions about how to address problems that affect them. Those moments can engender the development of grassroots organizations, groups that emerge from the community and are run by the community for the benefit of the community. They are often organized around specific issues, such as environmental concerns, civil rights, or disaster response and recovery and can range from informal groups of concerned citizens to more formalized organizations with established leadership and funding³⁹.

These organizations have the potential to play an important role in community flood risk communication because they are often made up of individuals who live in flood-prone areas and have a vested interest in protecting their community. They may have first-hand experience with flooding and understand the risks and challenges associated with it. As a result, grassroots organizations can be effective in communicating flood and other climate change related risks to their community and mobilizing residents to take action to mitigate those risks⁴⁰.

In the case described, Mr. J. and other residents held meetings to discuss the flooding caused by the garage bus company and to mobilize the community to address the flooding with a petition and a visit to the Public Defender's Office, demonstrating the potential of grassroots organizations in community-based flood risk communication. This type of community organization can be an effective way to amplify the voices of community members and to hold those in power accountable for taking action to address flood risks.

This community flood risk communication experience falls under three types in the framework considering three different moments of the process: at the beginning it is an internal process, with people getting together to discuss flood issues in the neighborhood; then a unidirectional experience happens in the moment neighbors address public entities to fight for their rights; finally, the beginning of a dialogical communication takes place when there is a response from public authorities and a negotiation process starts. The residents took a collaborative approach to address the issue by involving multiple stakeholders. Residents worked together to gather signatures and share information about the flooding issue. By working together and sharing information, they were able to build a common understanding of the problem and come up with a solution that worked for them, reaching out to the Public Defender's Office for assistance.

In the context of flood risk communication, community meetings and gatherings can provide a forum for involving not only local residents, but also officials and experts, to exchange information about flood risks, assess the community's vulnerability, and develop a plan of action to reduce the risks and improve preparedness. The involvement of the community in this process can help build trust, engage stakeholders, and foster a sense of ownership and responsibility for flood risk management. Overall, community meetings and gatherings can help facilitate a public action approach, where community members take an active role in identifying and addressing flood risks in their area.

Another experience in this regard occurred in the 2015 flood in Rio Branco, when public authorities and members of a community affected by the flood got together to discuss further actions and prepare for future situations.

After those flooding days, about a year later, I participated in some events. The city hall had consulted people who lived in a flood area if they wanted to stay or leave. They decided to stay. Then the city hall painted rulers on the streets, informing where the river water reaches. (Mr. A., Rio Branco)

This excerpt shows that effective dialogue between local governments and community members can lead to successful outcomes. This was demonstrated when public authorities adapted their approach to meet the needs and desires of the community. Instead of removing residents from the area, public authorities consulted them to determine whether they wanted to stay or leave. As a compromise, visual tools were installed in the community to allow residents to monitor water levels during floods. This negotiation process between public authorities and community members represents a two-way dialogue that incorporates the perspectives and values of both stakeholders. Effective risk communication involves active listening and incorporating the views of stakeholders, which can lead to creative and mutually beneficial solutions^{8,9}.

Conclusion

A public action approach to flood risk communication can be a useful tool in integrating community risk communication as a source of information for risk management without neglecting risk authorities perspectives. By going beyond formal and institutionalized communication produced by government authorities and experts and considering citizens communication strategies, the focus may be shifted towards developing communication practices that are tailored to local contexts and that take into account the specific needs, knowledge and concerns of community members.

In this paper, the lack of flood risk communication doesn't mean the lack of communication at all. Post-flood communication continues to be important in flood management because it shows local communicative networks already operate in disaster response and recovery: what is necessary is to anticipate such experience. It is also worth noticing post-flood can also indicate new risks related to recovery and reconstruction, since risk communication is part of the whole process of disaster management. The proof is that most informal practices that happen in post-flood communication also happen before and during the event, which means people know how to make use of them in each phase of disaster management, including prevention, mitigation and preparation.

Word-of-mouth communication and flood memory materialization have emerged as interesting practices within flood-prone communities, especially those making use of internal or unilateral informal flood risk communication. Efforts to build on these practices can be used to increase awareness and communication of flood risks and to provide information on preparedness and response strategies. Also, grassroots organizations, meetings and gatherings, on the other hand, have been associated with more dialogic informal risk communication and played a vital role in creating local communicative and organizational practices.

In summary, the understanding of informal community flood risk communication practices is essential to any effective flood risk communication strategy. A public action approach, involving community members, can help to create communication practices that are tailored to local contexts and address the specific needs and concerns of the public. Through a combination of formal and informal communication practices, it is possible to work towards reducing the impact of floods on vulnerable communities.

Authors' contribution

All authors actively participated in all stages of preparing the manuscript.

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Conflict of interest

The authors have no conflict of interest to declare.

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References

1. Gupta K. Challenges in developing urban flood resilience in India. *Philos Trans A Math Phys Eng Sci.* 2020; 378(2168):20190211. doi: 10.1098/rsta.2019.0211.
2. Lima-Silva F, Martins MHM, Cunha MA, Porto de Albuquerque J, Trajber R, Pessoa JH. Diálogos em contexto de vulnerabilidade: limites e aprendizagens na pesquisa dados à prova d'água. In: Spink PK, Burgos F, Alves MA, editores. *Vulnerabilidade(s) e ação pública: concepções, casos e desafios.* São Paulo: Programa Gestão Pública e Cidadania; 2022. p. 251-63.
3. Salami RO, Giggins H, Von Meding JK. Urban settlements' vulnerability to flood risks in African cities: a conceptual framework. *Jamba.* 2017; 9(1):370. doi: 10.4102/jamba.v9i1.370.
4. Londe LR, Soriano E, Coutinho MP. Capacidades das instituições municipais de Proteção e Defesa Civil no Brasil: desafios e perspectivas. *Rev Dep Geogr.* 2015; 30:77-95. doi: 10.11606/rdg.v30i0.98715.
5. Nogueira FR, Oliveira VE, Canil K. Políticas públicas regionais para gestão de riscos: o processo de implementação no ABC, SP. *Ambiente Soc.* 2014; 17(4):177-94.
6. Almeida PEG. A Política Nacional de Proteção e Defesa Civil: os desastres como problema político. In: *Anais do 1o Seminário Internacional de Ciência Política; 2015; Porto Alegre: Universidade Federal do Rio Grande do Sul; 2015.*
7. United Nations Office for Disaster Risk Reduction. *Words into action guidelines: national disaster risk assessment, public communication for disaster risk reduction.* Genebra: UNDRR; 2017.
8. Fakhruddin B, Clark H, Robinson L, Hieber-Girardet L. Should I stay or should I go now? Why risk communication is the critical component in disaster risk reduction. *Progr Disaster Sci.* 2020; 8:100139.
9. Stewart IS. Advancing disaster risk communications. *Earth Sci Rev.* 2024; 249:104677. doi: 10.1016/j.earscirev.2024.104677.
10. Albuquerque JP, Anderson L, Calvillo N, Cattino M, Clark A, Cunha MAVC, et al. Dialogic data innovations for sustainability transformations and flood resilience: the case for waterproofing data. *Glob Environ Change.* 2023; 82:1-15.
11. Marchezini V, Albuquerque JP, Pitidis V, Rudorff C, Lima-Silva F, Klonner C, et al. Flood risk governance in Brazil and the UK: facilitating knowledge exchange through research gaps and the potential of citizen-generated data. *Disaster Prev Manag.* 2022; 31(6):30-44.
12. Tkacz N, Martins MHM, Albuquerque JP, Horita F, Dolif Neto G. Data diaries: a situated approach to the study of data. *Big Data Soc.* 2021; 8(1):1-16.
13. Spink PK. Assuntos públicos e a abordagem das linguagens de ação pública. *Cad Gestao Pub Cidad.* 2016; 21(70):160-75. doi: 10.12660/cgpc.v21n70.64366.
14. Fischhoff B. Risk perception and communication unplugged: twenty years of process. *Risk Anal.* 1995; 15(2):137-45. doi: 10.1111/j.1539-6924.1995.tb00308.x.
15. Marchezini V, Londe LR, Bernardes T, Conceição RS, Santos EV, Saito SM, et al. Sistema de alerta de risco de desastres no Brasil: desafios à redução da vulnerabilidade institucional. In: Marchezini V, Wisner B, Londe LR, Saito SM, organizadores. *Redução de vulnerabilidade a desastres: do conhecimento à ação.* São Carlos: Rima; 2017. p. 287-310.

16. Marchezini V, Londe LR. Sistemas de alerta centrados nas pessoas: desafios para os cidadãos, cientistas e gestores públicos. *Rev Gestao Sustent Amb.* 2018; 7(Spec No):525-57.
17. Horita FEA, Albuquerque JP, Marchezini V. Understanding the decision-making process in disaster risk monitoring and early-warning: a case study within a control room in Brazil. *Int J Disaster Risk Reduction.* 2018; 28:22-31. doi: 10.1016/j.ijdr.2018.01.034.
18. Saito S, Lima GRT, Dias MA. Evaluation of the end-users of disaster risk warnings in Brazil. *Sust Deb.* 2019;10(2):38-53. doi: 10.18472/SustDeb.v10n2.2019.24908.
19. Loose EB, Londe LR, Marchezini V. Communication of civil defense agencies in Brazil: highlighting risks or disasters? *REDER.* 2023; 7(1):165-73. doi: 10.55467/reder.v7i1.114.
20. Wynne B. May the sheep safely graze? A reflexive view of the expert-lay knowledge divide. In: Lash S, Szerszynski B, Wynne B, editors. *Risk, environment and modernity: towards a new ecology.* London: Sage; 2004. p. 44-83.
21. Wiesenfeld E. The concept of “we”: a community social psychology myth? *J Commun Psychol.* 1996; 24(4):337-46. doi: 10.1002/(SICI)1520-6629(199610)24:4<337::AID-JCOP4>3.0.CO;2-R.
22. Rosemberg F. Crianças pobres e famílias em risco: as armadilhas de um discurso. *J Human Growth Dev.* 1994; 4(1):28-33.
23. Janes MW, Marques MCC. A contribuição da comunicação para a saúde: estudo de comunicação de risco via rádio na grande São Paulo. *Saude Soc.* 2013; 22(4):1205-15. doi: 10.1590/S0104-12902013000400021.
24. Gero A, Méheux K, Dominey-Howes D. Integrating community based disaster risk reduction and climate change adaptation: examples from the Pacific. *Natural Hazards Earth Sys Sci.* 2011; 11:101-13. doi: 10.5194/nhess-11-101-2011.
25. Sharma R. Community based flood risk management: local knowledge and actor’s involvement approach from lower Karnali River Basin of Nepal. *J Geosci Environ Protection.* 2021; 9(6):35-65. doi: 10.4236/gep.2021.96003.
26. Yamada F, Kakimoto R, Yamamoto M, Fujimi T, Tanaka N. Implementation of community flood risk communication in Kumamoto, Japan. *J Adv Transp.* 2011; 45(2):117-28. doi: 10.1002/atr.119.
27. Ardaya AB, Evers M, Ribbe L. Participatory approaches for disaster risk governance? Exploring participatory mechanisms and mapping to close the communication gap between population living in flood risk areas and authorities in Nova Friburgo Municipality, RJ, Brazil. *Land Use Policy.* 2019; 88:104103.
28. Victor C, Edoa L. Media interventions como insurgências midiáticas nos territórios de vulnerabilidade social. *Rev Latino Am Cienc Comunic.* 2023; 22(42):115-27. doi: 10.55738/alaic.v22i42.993.
29. Victor C, Chiachiri R. Media Interventions dans la favela de Heliópolis. *Hermès La Revue.* 2023; 92:149-52.
30. Buchecker M, Ogasa DM, Maidl E. How well do the wider public accept integrated flood risk management? An empirical study in two Swiss Alpine valleys. *Environ Sci Policy.* 2016; 55 Part 2:309-17. doi: 10.1016/j.envsci.2015.07.021.
31. Kasperson RE, Webler T, Ram B, Sutton J. The social amplification of risk framework: new perspectives. *Risk Analysis.* 2022; 42(7):1367-80. doi: 10.1111/risa.13926.

32. Khan AS. COREDAR for cities: developing a capacity building tool for sea-level rise risk communication and urban community-based adaptation. In: Leal Filho W, Keenan J, editors. *Climate change adaptation in North America. Climate change management*. Berlin: Springer; 2017. p. 137-57. doi: 10.1007/978-3-319-53742-9_9.
33. Garde-Hansen J, McEwen L, Holmes A, Jones O. Sustainable flood memory: remembering as resilience. *Memory Stud.* 2017; 10(4):384-405.
34. Calvillo N, Garde-Hansen J, Lima-Silva F, Trajber R, Albuquerque JP. From extreme weather events to 'cascading vulnerabilities': participatory flood research methodologies in Brazil during Covid 19. *J Extreme Events.* 2022; 9:2241002. doi: 10.1142/S2345737622410020.
35. Bardin L. *Análise de conteúdo*. São Paulo: Edições 70; 2016.
36. Lin KHE, Khan S, Acosta LA, Alaniz R, Olanya DR. The dynamism of post-disaster risk communication: a cross-country synthesis. *Int J Disaster Risk Reduct.* 2020; 48:101556. doi: 10.1016/j.ijdrr.2020.101556.
37. Abdullah S, Sipon S, Nazli NNN, Puwasa NH. The relationship between stress and social support among flood victims. *Soc Behav Sci.* 2015; 192:59-64. doi: 10.1016/j.sbspro.2015.06.009.
38. Bradford LEA, Idowu B, Zagozewski R, Bharadwaj LA. There is no publicity like word of mouth... Lessons for communicating drinking water risks in the urban setting. *Sustain Cities Soc.* 2017; 29:23-40. doi: 10.1016/j.scs.2016.11.008.
39. Rowel R, Sheikhattari P, Barber TM, Evans-Holland M. Introduction of a guide to enhance risk communication among low-income and minority populations: a grassroots community engagement approach. *Health Promot Pract.* 2012; 13(1):124-32. doi: 10.1177/1524839910390312.
40. Dias IM, Soares PPMAS, Brondizio ES, Cruz SHR. Grassroots mobilization in Brazil's urban Amazon: global investments, persistent floods, and local resistance across political and legal arenas. *World Dev.* 2021; 146:105572. doi: 10.1016/j.worlddev.2021.105572.

Estudos recentes frequentemente adotam abordagens top-down ou bottom-up para analisar a comunicação de riscos local, sem integrar ambas. Este artigo explora essa desconexão, apresenta um framework de ação pública para integrar análise dessas abordagens e examina memórias de inundações para identificar tipos de comunicação de risco de inundações em comunidades vulneráveis. Essas memórias de inundações oferecem insights cruciais sobre as experiências e interpretações comunitárias da comunicação de riscos, aprimorando estratégias para futuros eventos. O estudo utiliza abordagens qualitativas, incluindo entrevistas e análise de conteúdo. Os resultados mostram que, apesar das limitações na comunicação formal, canais informais, boca-a-boca, práticas relacionadas às memórias de inundações, eventos comunitários e organizações locais estão presentes. A abordagem de ação pública surge como uma estratégia valiosa para compreender nuances locais na comunicação de riscos em comunidades vulneráveis.

Palavras-chave: Memórias de inundação. Comunicação de risco de inundação. Ação pública. Comunidades vulneráveis.

Los estudios recientes de comunicación de riesgos a menudo adoptan enfoques top-down o bottom-up, sin integrar ambos. Este artículo explora esta desconexión, presenta un marco de acción pública para integrar el análisis de estos enfoques y examina las memorias de inundaciones para identificar tipos de comunicación de riesgo en comunidades vulnerables. Las memorias de inundaciones ofrecen conocimientos cruciales sobre las experiencias y las interpretaciones comunitarias de la comunicación de riesgos, mejorando las estrategias para futuros eventos. El estudio utiliza enfoques cualitativos, incluyendo entrevistas y análisis de contenido. Los resultados indican que, aunque la comunicación formal puede ser limitada, están presentes canales informales, boca a boca, prácticas relacionadas con las memorias de inundaciones, eventos comunitarios y organizaciones locales. El enfoque de acción pública surge como una estrategia valiosa para entender las particularidades locales en la comunicación de riesgos en comunidades vulnerables.

Palabras clave: Memorias de inundaciones. Comunicación de riesgo de inundaciones. Acción pública. Comunidades vulnerables.