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Caregiving as a determinant of disaster exposure: A gender-sensitive reinterpretation of the 2011 Genoa flood☆

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ABSTRACT

Disaster impacts are shaped by social inequalities that influence exposure, vulnerability and recovery. While flood mortality in Italy generally affects men more frequently than women, exceptional events may reveal different mechanisms through which disaster risk is produced. This study reinterprets the 4 November 2011 Genoa flood, in which all six fatalities were women or girls, through a gender-sensitive qualitative case study. The analysis combines institutional reports, scientific literature, archived newspaper accounts and a reflexive positionality statement from one author who experienced the event. Findings indicate that the victims' exposure was closely associated with gendered caregiving responsibilities, including accompanying children and protecting relatives during the emergency. Rather than contradicting previous national evidence, the Genoa case highlights caregiving as a socially produced mechanism of vulnerability during fast-onset disasters. We argue that disaster risk reduction should explicitly consider care responsibilities when designing warning systems, emergency communication and preparedness strategies.

1. Introduction

Disasters are not socially neutral events. Although natural hazards may affect entire populations, exposure, vulnerability, and recovery are shaped by social inequalities that influence who is at risk, why, and under which circumstances. Over the past three decades, disaster research has increasingly adopted gender-sensitive and intersectional perspectives, demonstrating that disaster impacts are not determined solely by hazard intensity but also by socially constructed roles, unequal access to resources and everyday responsibilities. From pioneering works of ([1,2], recent feminist scholarship further argues that vulnerability should be understood as a socially produced condition, emerging from the interaction between gender norms, power relations and the unequal distribution of responsibilities rather than as an intrinsic characteristic of individuals (*[3–5]). Alburo-Cañete highlights the importance of: "(a) placing gender and lived experiences at the center of analysis; (b) recognising how power operates in these contexts; (c) exploring alternative means to represent lived realities through different methods; (d) embodying reflexivity in the research process, as experienced by one of this paper's authors; and (e) pursuing social, political, and institutional change."

Among these socially constructed dimensions, caregiving has received comparatively limited attention within flood risk research, despite representing a key component of everyday social organization. Across many societies, women continue to undertake a disproportionate share of care work, including childcare, assistance to older relatives and responsibility for family wellbeing, in most of the cases this is unpaid work. During rapidly evolving emergencies, these responsibilities may shape mobility, decision-making and evacuation behavior, influencing exposure to hazardous environments. Disaster impacts therefore reflect not only the physical characteristics of the hazard but also the social organization of care, which may generate unequal patterns of risk [6–8].

Moreover, various studies underline how gender should not be polarized between men and women but also consider gender minorities [9,10] and raise the problem that violence and gender-based violence tend to increase during crisis [7,11]. Rather than assuming that women are universally more vulnerable than men, this perspective recognizes that gendered caregiving responsibilities may become socially produced

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determinants of disaster vulnerability under specific emergency conditions.

Recent advances in disaster risk research increasingly emphasize that hazard assessment alone is insufficient to explain disaster impacts and that social vulnerability must be explicitly integrated into risk analyses (* [12]). Similarly, evidence-based reviews of disaster management highlight the need to incorporate gender perspectives throughout preparedness, response, and recovery processes. Acanga* et al. [13] identify five key strategies for gender-inclusive perspectives, which include conducting context-based studies on vulnerability and response; reflexive social learning; incorporating collective agency in policy and institutional frameworks; research shifting and focus on the global South communities; and transparent and feasible knowledge dissemination mechanisms with standardized gender and sex- disaggregated data, and new modern platforms.

Together, these studies support a shift from interpreting vulnerability as an individual attribute towards understanding it as the outcome of interactions between environmental hazards and socially organized responsibilities. Within this broader framework, the gendered risks associated with climate change are effectively synthesized, for example, by Dunne [14] (Fig. 1).

Disaster vulnerability is shaped not only by hazard characteristics but also by the interaction of gender, social roles, and local socio-economic conditions. Preparedness and risk perception are likewise influenced by gender and socio-economic differences that vary across geographical contexts [15]. These findings reinforce the need to examine flood vulnerability through a gender-sensitive perspective that considers everyday social practices, including unpaid caregiving responsibilities.

Floods are among the most frequent and deadly climate-related hazards worldwide, and their impacts are expected to intensify as climate change increases the frequency and intensity of extreme precipitation events [16,17]. At the same time, growing urbanisation and social inequalities continue to increase the number of people exposed to flood hazards worldwide [18].

Maps of global exposure to flooding show that flood risk is high in many high-income countries [12] including Northern Italy. In Italy, floods represent one of the deadliest natural hazards, particularly in densely urbanized areas exposed to flash floods. Long-term analyses of Italian flood fatalities show that mortality generally affects men more frequently than women, largely because men are more likely to engage in behaviours that increase exposure, such as driving through flooded roads or attempting to protect vehicles and property ([19]; [20]). While these findings provide an essential national perspective, they may also conceal exceptional events in which different mechanisms of exposure operate.

The flash flood that struck Genoa on 4 November [21] represents one such case. The event caused six fatalities, all women or girls, during a rapidly evolving urban flood.

This paper presents a gender-sensitive qualitative reinterpretation of the [21] Genoa flood. Through documentary analysis it examines whether caregiving responsibilities contributed to the victims' exposure and discusses how recognising care as a socially produced determinant of disaster vulnerability can strengthen disaster risk reduction, emergency communication and preparedness strategies.

2. Methodology

On 4 November [21], an intense convective storm associated with a Mediterranean cyclone triggered a flood in Genoa, causing six fatalities and extensive damage. Exceptional rainfall, locally exceeding 180 mm h^{-1} and 400 mm in 12 h, overwhelmed the highly urbanized Fereggiano catchment, where channelized waterways and dense urban development amplified flood impacts [22]. The event has been also widely discussed as a paradigmatic example of the interaction between extreme rainfall, urban vulnerability and institutional failures ([23]; [24,25]). Starting from this literature, this study adopts a qualitative approach to examine whether gendered caregiving responsibilities contributed to disaster exposure during the Genoa flood. The analysis is based on multiple documentary sources, including scientific literature, institutional reports and articles on local, national, and international newspapers published immediately after the event ([26]; Cittaclima 2017; GenovaToday [21] a; GenovaToday [21] b; GenovaToday [21] c; [27] [21]; BBC [21]; NBC NEWS [21]; Aljazeera [21]).

In this way scientific data were systematically triangulated to reconstruct the circumstances surrounding the six fatalities and identify recurring patterns linking caregiving responsibilities and disaster exposure.

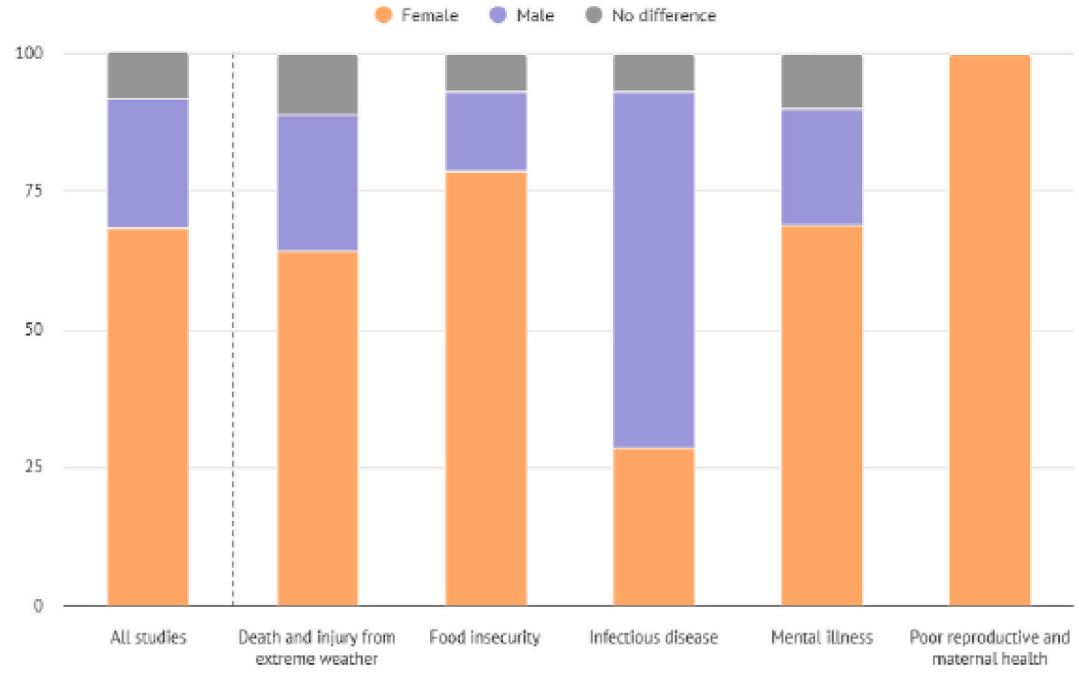


Fig. 1. Mapped: How climate change disproportionately affects women's health. Source: [14] carbonbrief.org).

The approach focused on the activities undertaken by the victims immediately before their deaths and the social circumstances influencing their movements during the emergency. The aim was not to reconstruct individual biographies but to identify common mechanisms through which caregiving responsibilities may have shaped exposure to flood risk.

Following recent feminist approaches to disaster research [28,29] this study explicitly acknowledges the researcher's positionality as an integral part of the research process, rather than considering it a source of bias (*[3]). The research question was formulated based on the personal experience of one of the authors, who experienced the [21] Genoa flood. Due to a combination of personal circumstances, including caring full-time for a four-month-old daughter who did not attend nursery school and remaining at home because she was unemployed at the time, the author was not directly exposed to the flood. In line with discussions on reflexivity and positionality in qualitative research and environmental research (*[30]; [31,32]), this lived experience informed the formulation of the research question while not constituting evidence for the analysis itself. All findings and interpretations are based exclusively on triangulated documentary sources. The positionality of one of the authors is therefore explicitly acknowledged as a means of enhancing transparency in the research process, rather than being concealed as a potential source of bias.

3. Results: the 2011 Genoa flood and caregiving-related exposure

Documentary evidence suggests that the circumstances surrounding the fatalities also reveal a social dimension of vulnerability. It is possible to identify recurring patterns in the activities undertaken by the six victims immediately before their deaths summarized in Table 1. In three cases, women were travelling to collect children from school to ensure their safety as weather conditions rapidly deteriorated. In another case, a woman had temporarily replaced an ill family member at work and was returning home when she was caught by the flood. Five victims sought refuge inside the same residential building, where rapidly rising floodwaters entered the basement before they could reach the upper floors. These individual circumstances differ in their immediate details but consistently reveal how ordinary caregiving responsibilities shaped movements through the city during the most hazardous phase of the event.

Data reported in Table 1 reveal a consistent pattern across all six fatalities: the responsibilities towards children and family members. The documentary evidence consistently shows that movements through the affected area were largely motivated by caregiving obligations rather than voluntary risk-taking or attempts to protect property. These details underline how social roles and moral obligations, to protect, to care, to "be there", still present in our society [33] can translate into deadly risk in situations of sudden hazard.

Table 1
Recurring patterns identified through documentary analysis.

Documentary evidence	Relevance for vulnerability	Suggested mechanism
Three victims were attempting to collect or protect children.	Increased exposure	Caregiving responsibility
One victim was assisting a family member by replacing him at work before attempting to return home.	Hazard-related mobility	Family obligation
Five victims died after seeking refuge inside the same building as floodwaters rapidly entered the basement.	Reduced adaptive capacity	Limited response time
All fatalities occurred during the afternoon, coinciding with school dismissal.	Concentration of exposure	Institutional context

This interpretation differs from the dominant pattern described for Italy. National analyses over last decades have shown that flood mortality more frequently involves men, often because of behaviours such as driving through flooded roads or attempting to recover vehicles or valuables from garages and basements (Salvati et al., 2018; [20]). In the Genoa case, by contrast, exposure was associated with caregiving responsibilities performed during a rapidly evolving emergency.

The documentary evidence also highlights the importance of institutional context. Despite worsening meteorological conditions, schools remained open throughout the day and no indication was given for children to remain safely inside the buildings after dismissal. Consequently, many parents and caregivers travelled across the city during the most hazardous phase of the event.

Taken together, these findings suggest that the [21] Genoa flood represents an exceptional case in which disaster exposure was strongly associated with gendered caregiving responsibilities embedded in everyday social practices.

4. Discussion

Present global warming increases the frequency and intensity of extreme events, such as flooding that remains one of the most deadly and costly natural hazards associated with climate change on a global scale [18]. Extreme weather events impact society differently and disaster science must embrace gendered and intersectional approaches in disaster risk reduction on society [17].

This study does not suggest that women are inherently more vulnerable to floods. Rather, the Genoa case illustrates how disaster exposure may be socially produced through gendered caregiving responsibilities that shape everyday mobility during rapidly evolving emergencies. By analyzing documentary evidence through a gender-sensitive qualitative perspective, the study identifies a recurring mechanism linking unpaid care work with disaster exposure. This interpretation is consistent with feminist disaster scholarship, which conceptualizes vulnerability as the outcome of socially constructed roles, power relations and everyday practices rather than as an individual characteristic (*[3]; [5,11]).

The Genoa flood is analytically significant because it represents an exceptional case within the Italian context. Previous national studies have shown that flood mortality predominantly affects men and is frequently associated with voluntary risk-taking behaviours, such as driving through flooded roads or attempting to protect vehicles and property ([19,20]). The present findings do not contradict this evidence but rather complement it by identifying a different pathway to disaster exposure. In the Genoa case, movements through the affected area were primarily motivated by caregiving responsibilities towards children and family members rather than by attempts to protect material assets. This suggests that multiple socially mediated mechanisms may contribute to flood mortality, depending on the interaction between gender roles, everyday responsibilities, and the characteristics of the hazardous event.

Building on these observations, we propose the concept of caregiving-related mobility to describe movements undertaken to provide care or protect dependents during emergency situations. Although the present study cannot establish causal relationships beyond the case examined, it suggests that caregiving responsibilities may influence exposure during fast-onset disasters by requiring individuals to travel or remain in hazardous areas at critical moments. As illustrated in Fig. 2, this mechanism emerges from the interaction between gender norms, the unequal distribution of unpaid care work, institutional decision-making, and hazard dynamics.

The findings also highlight the importance of institutional context. In Genoa, schools remained open despite worsening weather conditions, concentrating routine caregiving movements during the most hazardous phase of the flood. Rather than attributing vulnerability solely to caregiving responsibilities, the analysis suggests that exposure resulted from the interaction between everyday care practices and emergency

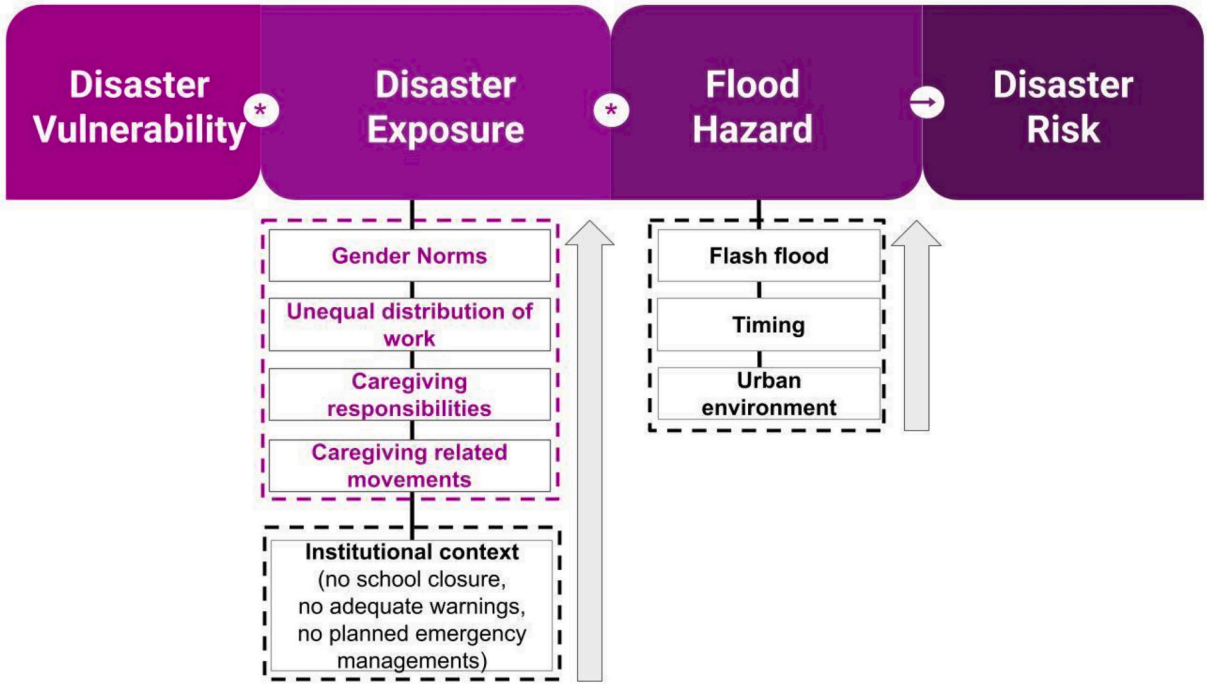


Fig. 2. Conceptual framework emerging from the Genoa case study.

management decisions, especially in a changing world where flood probability of occurrence will increase due to anthropogenic climate change.

These outcomes have practical implications for disaster risk reduction. Emergency planning and warning systems often assume that individuals can respond independently to hazard information. However, caregiving responsibilities may constrain decision-making and require movements that increase exposure, particularly during school dismissal or when dependent family members require assistance. Integrating unpaid care responsibilities into preparedness planning, emergency communication and evacuation strategies could therefore contribute to more inclusive disaster risk reduction, consistent with recent evidence-based recommendations on gender-responsive disaster management ([13]; UNDRR, 2022).

This study has several limitations. It is based on a single qualitative case study and relies on documentary evidence rather than interviews with survivors or witnesses. Consequently, the findings should not be generalised to all flood events. Instead, they provide a conceptual interpretation that may guide future comparative research examining whether similar caregiving-related mechanisms emerge across different hazards, institutional settings, and socio-cultural contexts.

5. Conclusions

This study reinterprets the [21] Genoa flood through a gender-sensitive qualitative perspective, suggesting that caregiving responsibilities may constitute a socially produced determinant of disaster exposure during flash floods.

Although based on a single case study, the analysis contributes to the growing literature on gender and disasters by proposing caregiving-related mobility as a mechanism through which unpaid care work can shape disaster exposure. Future comparative research should examine whether similar patterns emerge across different hazards and socio-cultural contexts.

Recognising unpaid care work within disaster risk reduction may support more inclusive preparedness, emergency communication and evacuation planning, ensuring that disaster policies better reflect the social realities through which disaster exposure is produced.

CRediT authorship contribution statement

Anita Grezio: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Methodology, Investigation, Conceptualization. **Sabrina Presto:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Methodology, Conceptualization. **Giuliana Rubbia:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Methodology, Conceptualization.

Declaration of competing 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. Institutional funds supported the present studies.

Data availability

Data will be made available on request.

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