

Gender Dimensions of Disaster Risk and Resilience

Existing Evidence

Authors

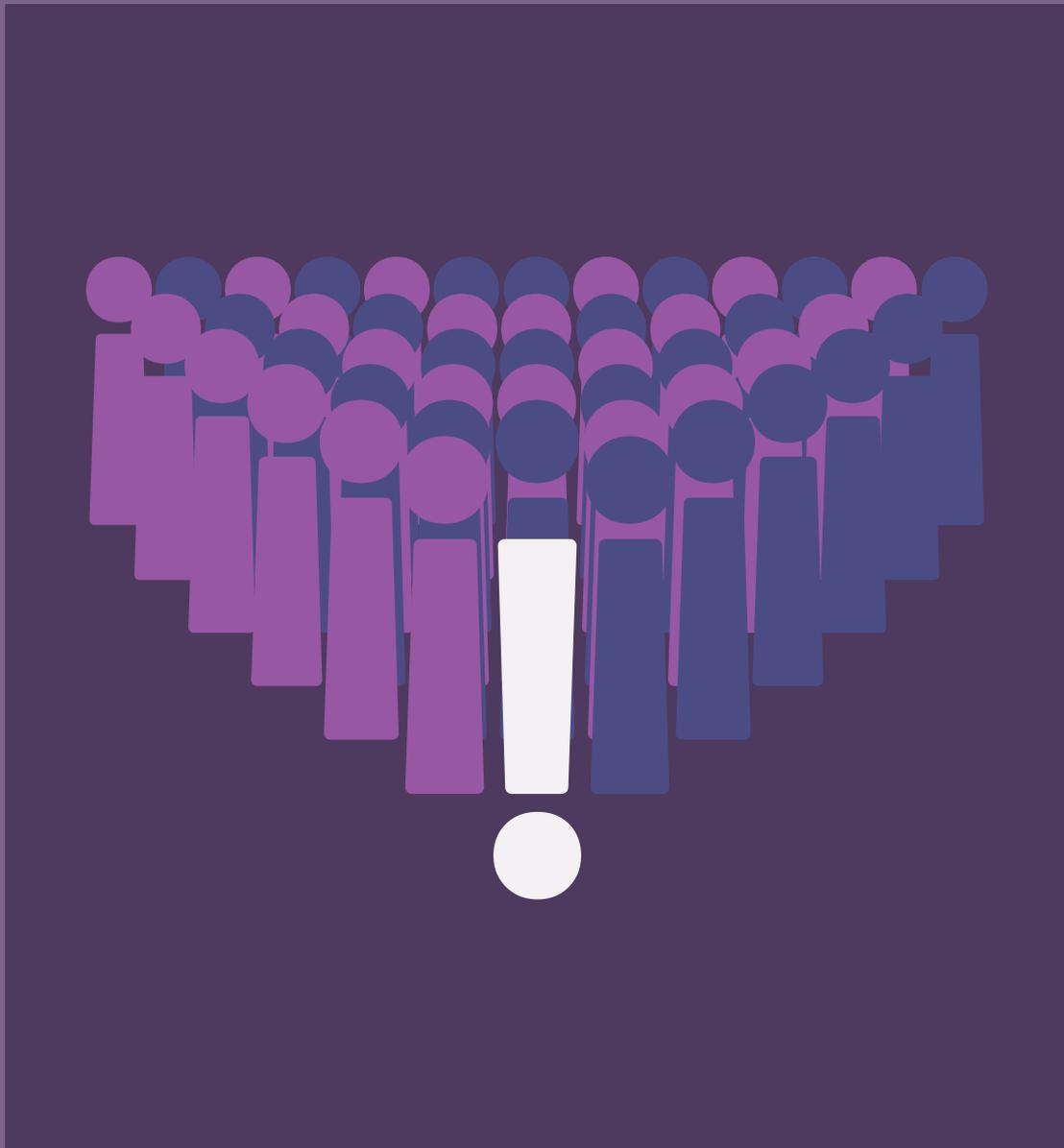
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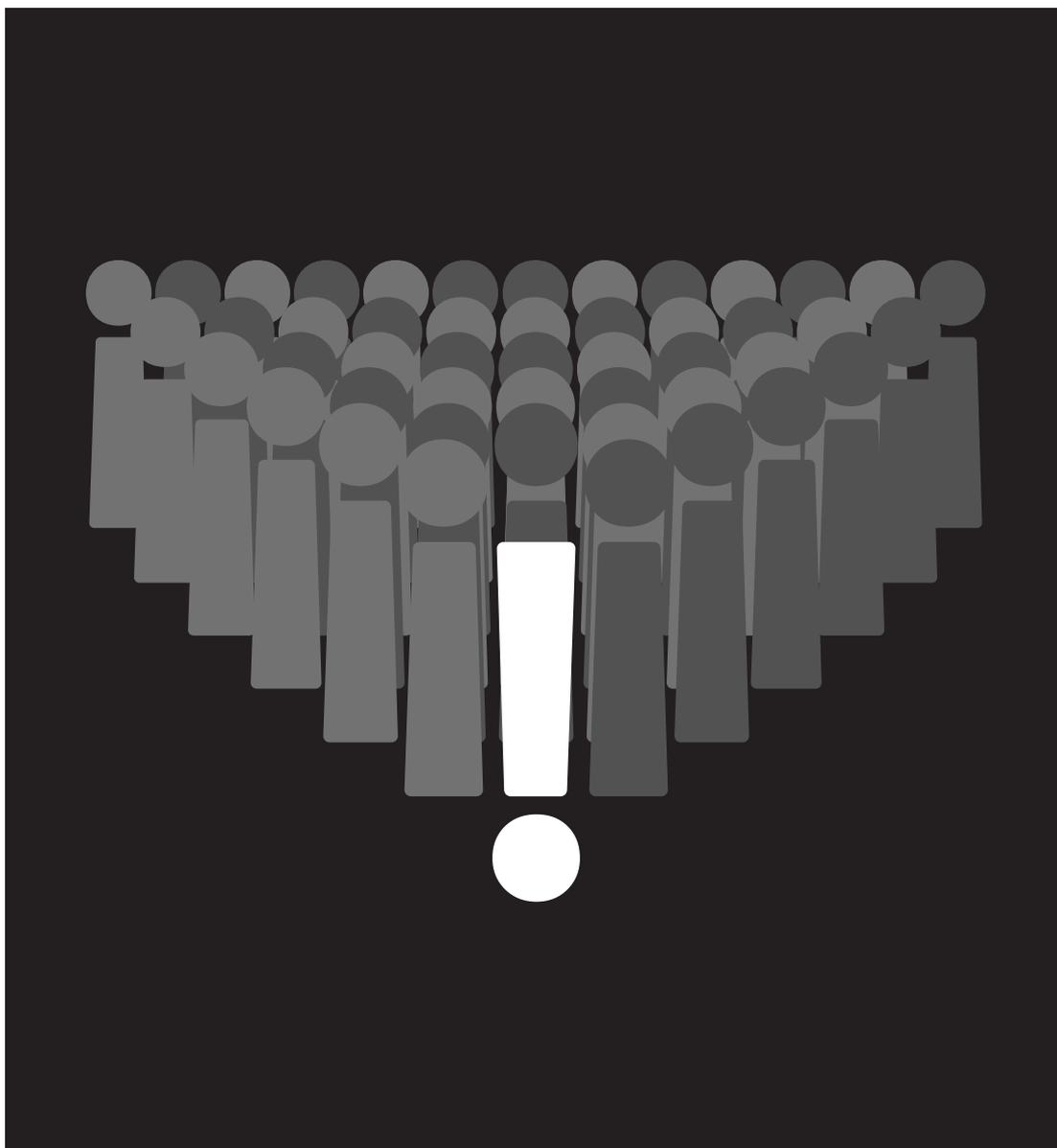
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Acronyms

ASP	adaptive social protection
FAO	Food and Agriculture Organization
GFDRR	Global Facility for Disaster Reduction and Recovery
ILO	International Labour Organization
PDNA	postdisaster needs assessment
PSNP	Productive Safety Net Program
PTSD	post-traumatic stress disorder
SADD	sex and age-disaggregated data
UN	United Nations
UNDP	United Nations Development Program
UNDRR	United Nations Office for Disaster Risk Reduction (formerly UNISDR)
UNISDR	United Nations for Disaster Risk Reduction (now UNDRR)
WHO	World Health Organization

Acknowledgements

The report was written by Alvina Erman, Sophie Anne De Vries Robbé, Stephan Fabian Thies, Kayenat Kabir, and Mirai Maruo.

The report has benefitted from valuable input from Stephane Hallegatte, Kathleen Beegle, Maitreyi Das, Christian Bodewig, Victoria Stanley, and Anne T. Kuriakose. Editorial services were provided by Lucy Southwood and graphic design support was provided by Brad Amburn. Erika Vargas, Yoko Kobayashi, Aarthi Sivaraman, Simona Palummo and Sandra Karolina Jensson provided valuable communications and knowledge management support.

The team acknowledges the valuable guidance received during the conceptualization of this research from Cristina Otano, Cindy Patricia Quijada Robles, Brian Walsh, Margaret Arnold, Michael B. O'Sullivan, Jennifer Solotaroff, Elizaveta Perova, Emcet Oktay Tas, Javier Baez, Emmanuel Skoufias. The team would also like to thank Jessica Gardner from Stats2Info and Mendy Marsh from VOICE.

This report could not have been developed without the financial support of the GFDRR Single-Donor Trust Fund for Mainstreaming Disaster Risk Management in Developing Countries, which is financed by USAID, as well as GFDRR Multi-Donor Trust Fund.

Finally, a special thanks goes to Julie Dana, GFDRR Practice Manager at the initiation of this work, for her vision and leadership, and Maitreyi Bordia Das and Niels Holm-Nielsen, who, under difficult circumstances, supported this work as interim Practice Managers of GFDRR.

Summary

Men and women, boys and girls have different experiences of disasters. Gender dynamics impact both the way they are affected by disasters and their capacity to withstand and recover from them. Gender inequalities can result in gender-differentiated disaster impact, and differentiated impacts can influence gender dynamics, which in turn affect future resilience to shocks.

Disaster risk management policies are designed to maximize results, taking local conditions—including gender dynamics—as fixed. When women and men are affected differently by disasters, practitioners and policy makers have a responsibility to use the tools available for mitigating disaster impacts to close gender gaps in outcome. An improved understanding of the gender dynamics of disaster risk and resilience also allows for better policy and program design, which benefits all stakeholders.

Debunking myths and stereotypes, and uncovering the underlying drivers of gendered outcomes, are important components of that effort. Recognizing that there are multiple vectors of vulnerability and exclusion, calling for more contextualized and nuanced analysis is also vital. This is what this report, *Gender Dimensions of Disaster Risk and Resilience—Existing Evidence*, seeks to achieve.

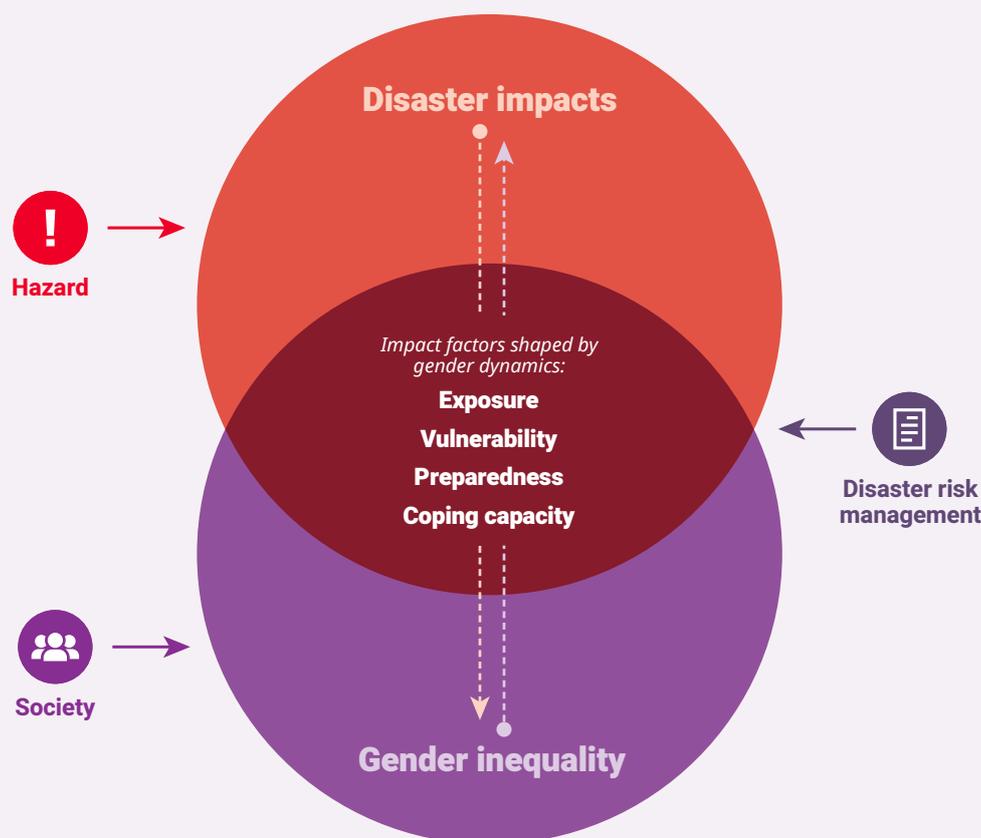
This report reviews existing evidence and data on how men and women, boys and girls are impacted by, prepare for and cope with disasters. It is not about depicting women and girls as perpetually worse-off victims of disasters; rather, it is about recognizing that men and women, boys and girls are affected in different ways. The report objectives are to:

- » Identify gender gaps in disaster outcomes and resilience—and the underlying drivers of those gaps—to create better policies and programs
- » Identify the most important knowledge and data gaps, which will guide the next steps for analytics in this space
- » Offer an operationally useful framework that can be used for local assessments of gender dynamics in disaster risk and resilience.

Conceptual framework

We present a non-linear framework (*figure S.1*) for considering the role of gender in disaster risk and resilience. The framework is a simple representation of a complex reality. **Disaster impacts** (orange circle) depend on hazard type and intensity, who and what is exposed, levels of vulnerability and preparedness, and coping capacity. Floods, droughts, earthquakes and other natural hazards are gender neutral. **Gender inequality** (purple circle) arises from the expected roles of men and women in a society, which influence socioeconomic status, level of agency, and the way men and women prepare for, react to, are impacted by, and recover from, disasters. In the overlay (maroon area) between gender inequality and disaster impacts are the factors that drive disaster impacts and are influenced by gender dynamics.

Figure S.1 • A conceptual framework for considering gender dynamics and disaster impacts



Sources: Adapted from World Bank 2012 and Hallegatte et al. 2017.

It is in the overlay maroon area where **gender-differentiated** impacts of disaster are generated. These, in turn, can exacerbate gender inequality by influencing the prevailing socioeconomic conditions that determine gender equality. For example, when, due to a lack of access to bank accounts, women hold a larger share of their assets in tangible form than men, they are at greater risk of losing their assets to disasters, which would worsen gender inequality. Gender-differentiated impacts also influence resilience to future disasters.

Disaster risk management policies and interventions should operate in the overlay maroon area. This means good disaster risk management should consider ways in which gender dynamics influence disaster impacts in any given area before making decisions on policy or project design, to be able to mitigate gendered differences in disaster outcomes and maximize benefits for all.

The findings of this review are organized around this framework (*figure S.1*). **Section 1** focuses on the gender-differentiated impacts on health, education and child labor, economic outcomes, voice, and agency that result from gender dynamics in disaster **exposure and vulnerability**. **Section 2** focuses on gender dynamics in the drivers of **preparedness and coping capacity** that comprise our definition of **resilience**. **Section 3** reviews postdisaster data collection and analysis and identifies data gaps. **Section 4** uses the framework to identify policy recommendations that can prevent gender-differentiated disaster impacts and support a more inclusive disaster risk management agenda, and **Section 5** presents next steps.

The report is grounded in evidence from the literature. The conclusions are based on consolidated results from case studies in different contexts and, in the best cases, global reviews and data sources. The more case studies and data available to assess a particular question, the more confident the response. But even for the questions where several case studies are available, the assessment will not be confidently representative beyond the context of those specific case studies, and conclusions drawn do not replace the need for local assessments.

Three obvious facts underscore the guiding principles of this report:

- 1. Disasters encompass a wide range of hazards.**
- 2. Women are highly diverse group.**
- 3. Gender is not just about women: it is about the relations between males and females.**

S.1 • Disaster impacts: exposure and vulnerability

Natural hazards are gender neutral; but the impacts are not. Men and women, boys and girls face different levels of exposure and vulnerability to natural hazards, driven by gender relations and discrimination in society. This results in differentiated impacts on endowments (health, education, assets); economic outcomes (employment, assets, wages, consumption); and voice and agency (child marriage, gender-based violence, women as agents of change). Women are disproportionately affected by disasters in several outcomes, including life expectancy, unemployment, labor force re-entry, and relative asset losses. Gender-based violence—a manifestation of systematic inequality between men and women—is exacerbated at times of emergency.

While women and girls are in a disadvantaged position in society at large, this does not by default translate into worse disaster outcomes. A common belief is that women are more likely to die during a disaster. Yet, men account for 70 percent of flood-related deaths in Europe and the United States. This is driven by several reasons, including an overrepresentation of men in rescue professions. In less developed countries, more women tend to die from disasters. Although men are also overrepresented in risky and rescue professions in these countries, gender gaps in access to information on disaster preparedness, access to public shelters and limits to mobility seem to contribute more to gendered mortality outcomes, putting women at a disadvantage.

Boys and girls are affected differently by disasters. For health outcomes, boys are disadvantaged when affected *in utero* or early life due to biological factors. However, the preferred treatment of boys means that girls are worse off when their families face scarcity due to disaster and families are more likely to take their daughters out of school if they cannot pay tuition or the domestic burden increases after a disaster. On the other hand, if labor needs increase—for example, in agriculture—boys are more likely to be taken out of school. Disaster impacts on education are also reflected in child marriage and labor rates.

Economically, disasters have different effects for men and women, with women largely disadvantaged. In developing countries, agriculture is the most important economic sector for female employment; and women farmers tend to be more vulnerable to disasters than male farmers. The domestic burden also tends to increase after a disaster, and women usually bear the brunt of this, at the cost of missing out on other income-generating activities. Their lack of access to bank accounts also means that women's assets are less protected than men's.

Gender-based violence is exacerbated in postdisaster situations. Domestic violence rates also tend to increase in slow-onset disasters, such as droughts.

Finally, women are important agents of change and their involvement and leadership in decision making when it comes to disaster planning, response and reconstruction is crucial for making sure that disasters do not disadvantage women or girls.

S.2 • Resilience: preparedness and coping capacity

Gender dynamics play a role in a wide range of factors associated with resilience, from preparedness levels to access to coping mechanisms that can support recovery.

Women tend to perceive risks more saliently than men, but there is no clear evidence that this translates into greater preparedness action. When it comes to evacuation behavior, access to early warning and safe shelter options are important determinants. In developing countries, women have lower access to information and communication technologies, which could influence their access to relevant information in postdisaster situations. In many cases, lack of access to safe shelter is also an issue, often deterring women from evacuating.

Individual and household disaster recovery is driven by access to coping mechanisms—including finance and savings, assets, government support, livelihoods, and the ability to switch income sources in the aftermath of a disaster—or adaptation through migration.

Lower access to bank accounts, formal sources of finance, and stable income impacts women's ability to cope and recover in the aftermath of a disaster. While microlending and informal finance can promote recovery, overreliance on these options can make women particularly vulnerable to disasters. Further, in places where women keep their assets in high-value, tradable goods, their assets are more likely to be sold in times of hardship, potentially helping the family recover, but also reducing their wealth.

The postdisaster coping mechanism adopted also affects gender equality. For example, male out-migration can have positive implications for women's voice and agency by transforming household power dynamics.

S.3 • Data gaps in disaster risk management

To understand the underlying gender dynamics of disaster risk and design appropriate policies, the first step is ensuring data collection is disaggregated by sex and age. Disaster risk management lags behind other sectors in collecting and reporting of sex- and age disaggregated data (SADD). Three priorities are:

- » Making sure SADD is available for casualties and affected populations.
- » Collecting more information on damages and losses at the individual, rather than household, level.
- » Improving access to information on people with disabilities or from racial, ethnic, or religious minorities.

S.4 • Key messages for policy making

Policies that take gender dynamics into account will mitigate disaster impacts more efficiently without exacerbating existing gender gaps. The full report recommends a set of policy actions in exposure, vulnerability, preparedness, and coping capacity for use before, during and after a disaster to mitigate differentiated impacts for men and women, boys and girls. These policies are indicative, and do not replace the need for a local gender gap assessment before deciding on policy action. Their key messages are:

- » Identifying a gender gap in disaster outcomes—for example, in mortality—but not what drives them is a lost opportunity for creating effective policies and interventions.
- » Community involvement is key to channeling preparedness and early warning information, and women’s participation in this process is crucial.
- » Increasing female representation in disaster risk management and civil protection agencies helps legitimize and support women’s contributions to disaster risk reduction and resilience.
- » Social protection is an increasingly important policy for addressing disaster vulnerability and can be carefully used to mitigate gender-differentiated disaster impacts.
- » Disaster reconstruction is an opportunity to build back in a way that breaks down the constraints faced by women.
- » Undertaking a local assessment helps identify gaps and barriers that make natural disasters particularly harmful for certain populations before policy agendas are set.

S.5 • Next steps

Next steps for this work can be organized around both analytical and operational priorities.

Analytical priorities include closing important knowledge and data gaps. Specifically, this involves:

- » Moving beyond anecdotal evidence when relevant and possible by leveraging existing global and regional data to scale up case studies.
- » Understanding what does and does not work for different population groups by investing more in rigorous impact evaluations of disaster risk management and resilience building projects and interventions.
- » Leveraging new data and technologies—such as mobility data—to explore topics, previously understudied, including gendered evacuation patterns and behaviors.

From an **operational** perspective, resources and guidance on how to conduct gender gap assessments in disaster risk management will be needed at the country and project level. While this report can inform the design of gender gap assessments by providing a useful conceptual framework, relevant literature and data sources, it cannot replace the need for local assessments. Agreeing on a common framework for local assessment will help achieve consistency in disaster risk management gender gap assessments.

Introduction

I.1 • Background

Gender dynamics impact the way men and women, boys and girls are affected by disasters and their capacity to recover from disasters. As well as defining expected roles in a society and determining how men and women prepare for, react to, and recover from disasters, gender dynamics influence the extent to which women are part of disaster planning and recovery.

Gendered differences in disaster outcomes influence the prevailing socioeconomic conditions, which determine gender equality and the capacity to recover from future shocks. For example, when a lack of access to bank accounts means that women hold a larger share of their assets in tangible form, they are at greater risk of losing their assets than men, which would worsen gender inequality.

Gendered differences in disaster impacts can also influence resilience to future disasters, creating a negative feedback loop. For example, in the context of frequent flood exposure, prevailing social norms may drive women to stay close to their homes so they can salvage belongings when the flood comes, while men pick up employment outside the community. The nearby labor opportunities therefore available to women may not offer the income and stability they need to respond efficiently to flood exposure, which in turn affect their capacity to cope with future shocks.

Women usually play an important role in disaster preparedness, response, and recovery efforts. Their involvement often results in better performance and has a transformative effect on the communities they serve.

BOX I.1

Definition of terms

- » **Gender** refers to the social, behavioral, and cultural attributes, expectations, and norms associated with being male or female.
- » **Gender inequality** refers to how these factors determine the way in which men and women relate to each other and the resulting differences in power between them.
- » **Agency** is the capacity to make decisions about one's own life and act on them to achieve a desired outcome, free of violence, retribution, or fear.
- » **Gender-based violence** is an act—or threat of an act—perpetrated against a person's will, that inflicts physical, mental, and sexual harm or suffering, and is based on socially ascribed (gender) differences between males and females. These acts can occur in public or in private.

Sources: World Bank 2012, Klugman et al. 2014, IASC 2015.

An improved understanding of the gender dynamics of disaster risk and resilience allows for better policy and program design, which benefits all. Debunking myths and stereotypes, uncovering the underlying drivers of gendered outcomes, recognizing that there are multiple vectors of vulnerability and exclusion, calling for a more contextualized, and nuanced analysis are all important components of that effort. For example, the experience of girls and boys is different from that of women and men. Narratives that depict women as perpetually vulnerable and men as inevitably antagonistic ignore ways in which women are agents of change and neglects both the constraints men face and the opportunities for mobilizing them as allies for gender and social equality (Doss et al. 2018).

This report is a review of evidence and data on how men and women, boys and girls are impacted by, prepare for and cope with disasters. The objective is to map out, understand and identify the most important knowledge gaps in the channels through which gender dynamics affect outcomes in disaster impacts and resilience.

The review contributes to existing knowledge by providing an up-to-date, in-depth, and comprehensive analysis of gender dynamics in disasters, their impacts, and consequences. It has a broad scope, covering almost all types of natural disaster, focusing on direct and indirect impacts as well as resilience—including both preparedness and coping capacity—and reviewing literature from developed and developing countries.

Recent literature reviews have mostly focused on gender and climate change. Many explicitly cover links between natural disasters and gender (Goh 2012; Sellers 2016); others implicitly identify causes of women’s vulnerability to climate change, including the increasing prevalence of natural disasters (Schwerhoff and Konte 2020). Although a significant number of reviews are on climate change and gender, in-depth reviews of the literature on gender in the context of natural disasters are limited. This review updates and adds to previous work on gender and natural disasters—notably foundational work by Enarson, Fothergill, and Peek (2007, 2018) and Enarson (2000)—and thematic literature reviews, including impacts on: gender-based violence (Phillips and Jenkins 2016); children and adolescent girls (Bradshaw and Fordham 2015; Gil-Rivas 2014); and health and well-being (Harville, Xiong, and Buekens 2010).

This report is part of the Global Facility for Disaster Reduction and Recovery’s (GFDRR’s) commitment to the World Bank Group’s Gender Strategy 2016–2023, which has raised the bar on deepening gender equality in World Bank operations and policy dialogue (World Bank 2015). It adds to similar gender-focused work in thematic areas, including Das (2017), which focuses on the relation between gender and water, and Orlando et al. (2018) on gender inequality in energy. This work will inform future operational activities and operational guidance notes.¹ The framing of this paper is aligned to Sustainable Development Goal (SDG) 5 on gender equality; it is also in keeping with SDG 11 on sustainable development, which includes disaster risk reduction.

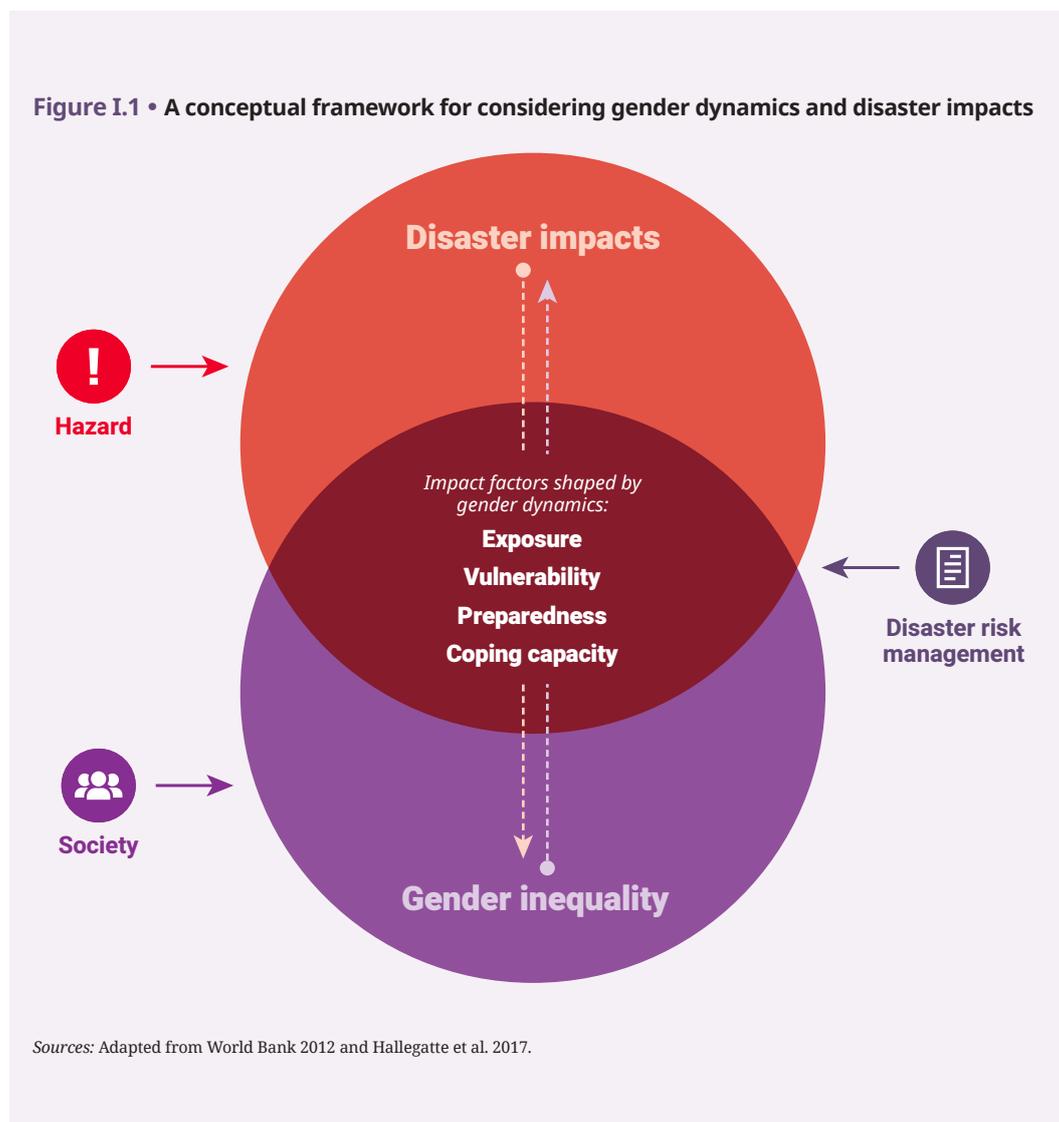
Section 1 focuses on differentiated impacts resulting from gender gaps in exposure and vulnerability, while **Section 2** explores the outcome variables that drive resilience, such as knowledge, behaviors and risk perception, which improve preparedness and access to coping mechanisms, influencing capacity to recover from a shock. **Section 3** provides an overview of access to and the use of sex-disaggregated data in disaster risk management. **Sections 4 and 5** offer concluding remarks, policy recommendations and next steps.

I.2 • A conceptual framework

This report outlines a non-linear framework for considering the role of gender in disaster risk and resilience. It combines two existing World Bank frameworks, for:

- » Analyzing gender (World Bank 2012)
- » Assessing socioeconomic resilience to natural hazards (Hallegatte et al. 2017).

The framework in *figure I.1* is a simplified representation of a complex reality. Natural hazards such as floods, earthquakes and tsunamis, are gender neutral. The **intensity** of a cyclone, an earthquake or a tsunami is the same for men and women. However, the **impact** of a disaster (orange circle), depends on the intensity and type of hazard, who and what is exposed, and levels of vulnerability, preparedness, and capacity to cope with and recover from the shock. Gender inequality (purple circle) arises from the expected roles of men and women in a society, which influence their socioeconomic status, level of agency, and, as a result, the way they prepare for, react to, are impacted by, and recover from, disasters. The overlay (maroon area) between gender inequality and disaster impacts includes factors that drive disaster impacts and are also influenced by gender dynamics.



In the context of disasters, gender dynamics influence:

- » **Exposure and vulnerability**, by affecting the types of asset men and women own, how they gain income, their level of engagement in disaster risk management, and so on.
- » **Preparedness**, by affecting conditions that determine risk perception levels, access to early warnings and evacuation behavior.
- » **Coping and recovery**, by affecting access to formal and informal finance and stable and high-paying labor, which can support recovery.

When gender dynamics influence disaster impacts, as indicated in the overlay maroon area, it leads to differentiated impacts for men and women, boys and girls. Gender-differentiated impacts can exacerbate gender inequality by influencing the prevailing socioeconomic conditions. This, in turn, can influence the factors determining the disaster impacts of future hazards. We call this the negative feedback loop, and it is illustrated in *figure I.1* with the dotted arrows.

Disaster risk management should operate in the maroon overlay area (*figure I.1*). This means good disaster risk management should consider ways in which gender dynamics influence disaster impacts in any given area before making decisions on policies and interventions. When disasters affect women and men differently, policy makers have a responsibility to use the tools available for mitigating disaster impacts and strengthening resilience to close that gap.

BOX I.2

Definition of terms

- » **Exposure** constitutes the assets that are of interest and at risk—including population, environment, economy, buildings—in a disaster-affected area.
- » **Vulnerability** is those assets' susceptibility to damage or impact from a hazard.
- » **Risk** is often represented as the probability or likelihood of hazardous events or trends occurring, multiplied by the impacts if they do occur. Hazard, exposure, and vulnerability constitute risk, and are the three usual drivers of disaster risk.
- » **Resilience** is a system and its component parts' ability to prepare (anticipate, absorb, accommodate), or cope (recover) from the effects of a hazardous event in a timely and efficient manner, including by ensuring the preservation, restoration, or improvement of its essential basic structures and functions.

Sources: Hallegatte et al. 2017, World Bank 2013, UNDRR 2020.

I.3 • Challenges and limitations

Data limitations are a significant challenge in understanding how gender dynamics influence disaster vulnerability, preparedness, and recovery. When assessing the impact of disasters on women and men and how they recover from them, some of the variables of interest—such as monetary poverty and disaster losses—are measured at household level. But treating households

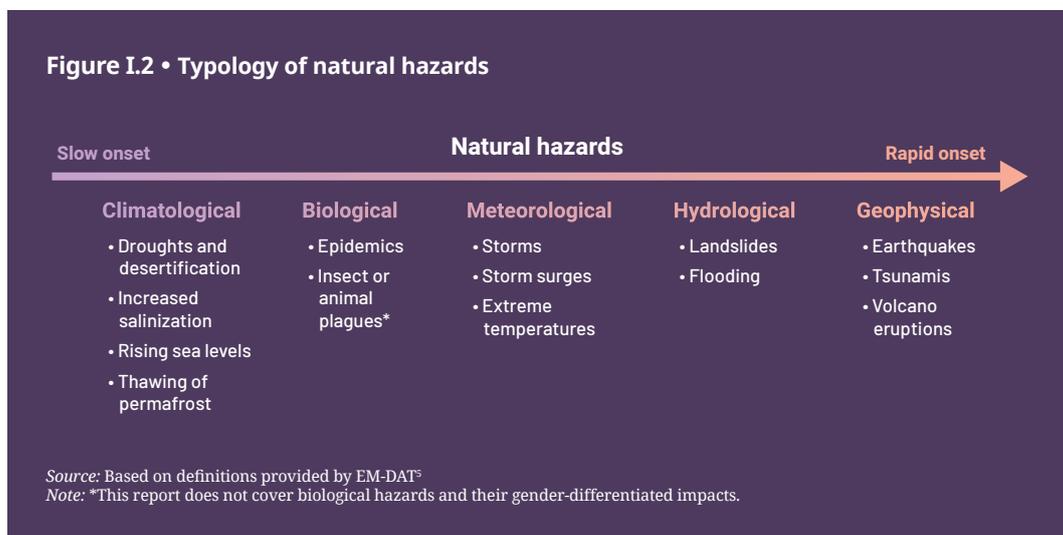
as a single unit assumes that disaster losses, and resources used to cope with disasters, are shared equally inside the households. Given the observed gaps in access to and control over assets between men and women, this is an unrealistic assumption.

Focusing on female and male household headship to identify gender gaps or gender-differentiated impacts is not a substitute or solution to this problem. Male-headed households tend to be two-parent households, while female-headed ones are often (but not always) single-parent households. As a result, the latter face specific challenges that could be unrelated to gender dynamics. Using this variable also wrongly assumes that women in male-headed households have equivalent outcomes to women in female-headed ones. Data gaps remain, and assessing intrahousehold gender dynamics continues to be a challenge. So, this report prioritizes evidence using individual-level analysis and presents results-based household-level analysis conservatively.

Gender dynamics are context-specific and global assessments do not replace the need for local analysis. The conclusions in this report are based on consolidated results from case studies from different contexts and, in the best of cases, global reviews and data sources. The more case studies and data that are available to assess a particular question, the more confident the response. But even for the questions where several case studies are available, the assessment is not confidently representative beyond the context of those specific case studies. As such, the conclusions drawn do not replace the need to do local assessments. Rather, this report provides a framework for identifying gender gaps in the context of disaster risk and resilience, guiding local assessments to the most important issues, and exploring what could be done to address them.

I.4 • Defining hazards and disasters

According to the Centre for Research on the Epidemiology of Disasters,² a **disaster** is a situation or event that overwhelms local capacity, requiring an external response, or is recognized as such by national and/or international actors. **Natural disasters** are severe alterations in the normal functioning of a community or society due to natural hazard events (IPCC 2014). **Natural hazards** are naturally occurring physical phenomena caused by either rapid or slow-onset events; they can have geophysical, hydrological, meteorological, climatological or biological origins.³



Although their name suggests they are strictly nature-induced, natural disasters can have human origins, too—for example, when they are caused by climatological change. **Figure I.2** shows a simplified classification of natural hazard types. This report does not include biological disasters, as these are broadly covered in the health literature. Throughout the report, we use ‘natural hazard’ to refer to the event or physical phenomenon itself.⁴ We use ‘**natural disaster**’, ‘**disaster**’, and ‘**shock**’ interchangeably to describe disasters caused by natural hazards.

I.5 • The impact of COVID-19

The report is written at a time of unprecedented crisis caused by the surge of COVID-19, which has affected gender dynamics, including the ones discussed in this report. While epidemics and pandemics are outside the scope of this report (**figure I.2**), it would be negligent not to consider the deep impact that the COVID-19 crisis has had on society and the new challenges that have arisen in relation to gender dynamics in disaster risk management and resilience.

Early assessments on the impacts of the pandemic have found that, although men seem to be more susceptible to the virus, women are disproportionately affected by its social and economic impacts (de Paz et al. 2020). Women are overrepresented in some of the occupations that are being hardest hit—such as retail, travel, leisure, and hospitality. When schools close or children are taken out of school, the increased childcare and other domestic responsibilities often fall on women, which has further implications for female labor participation and financial autonomy. There are also reports of a surge in gender-based violence during quarantine, when access to supportive services is disrupted (Haneef and Kalyanpur 2020). Finally, their lack of control over housing, land and property may leave women particularly vulnerable to health crises. If they lose their partner, women can also lose their housing and livelihoods, as was reported during the HIV and Ebola epidemics (Stanley and Prettitore 2020).

These effects lead to differences in men’s and women’s capacity to prepare for and recover from natural disasters. Little is known about the gender dynamics of the COVID-19 crisis and even less is known about how they will manifest when risks are compounded by natural disaster. However, governments and researchers would be advised to keep this new reality in mind as they consider the next steps for this agenda, both in policy and research.

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Endnotes

- Operational guidance notes include those in the Disaster Recovery Guidance Series, such as GFDRR. 2018. *Gender Equality and Women's Empowerment in Disaster Recovery*. World Bank: Washington, DC. <https://www.gfdr.org/en/publication/gender-equality-and-womens-empowerment-disaster-recovery>.
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Disaster impacts: exposure and vulnerability

Men and women face different risks of exposure and vulnerability to natural hazards, which leads to differentiated impacts of disasters. It is important to study the channels through which natural hazards affect men and women differently and systematically assess those differences to ensure assessments and project designs maximize outcomes for all.

This section focuses on the gender gaps in exposure and vulnerability to natural hazards that result in differentiated impacts of disasters for women and men, boys and girls. It is based on the factors driving gender inequality according to the World Bank Gender Strategy 2016–2023 (World Bank 2015b), which include:

- » **Endowments:** health, education, and child labor
- » **Economic outcomes:** livelihoods, assets, and consumption
- » **Voice and agency:** child marriage, gender-based violence, women as agents of change.

1.1 • Health

This subsection focuses on how the gender dynamics of exposure and vulnerability lead to differentiated impacts in life expectancy and mortality, mental health, and early childhood development. It also covers women's health needs in the context of disasters.

1.1.1 • Life expectancy and mortality

Globally, natural disasters have the following impacts on mortality and life expectancy:

- » **Direct impacts:** for example, death from injury or drowning
- » **Increased morbidity:** for example, repeated floods can lead to chronic respiratory disease, which can reduce life expectancy
- » **Economic impacts on life expectancy:** for example, a lower income reduces access to healthcare and quality food.

Natural disasters have a disproportionately negative effect on women's life expectancy. Globally, women live about 4.7 years longer on average than men, including in most low and middle-income countries. In a study covering 141 countries from 1981–2002, Neumayer and Plümper (2007) find that natural disasters—including droughts, earthquakes, extreme temperatures, famines, fires, floods, landslides, volcano eruptions, waves/surges, and windstorms—lower women's life expectancy more than men's, either directly, by killing more women than men or indirectly, by killing women at an earlier age due to higher morbidity and more severe economic impacts. Other studies, covering different types of natural disaster, also find that women die at a higher rate than men, particularly in developing countries (Doocy et al. 2013; Krishnaraj 1997; Pradhan et al. 2007; Sugimoto et al. 2011).

Lower socioeconomic status and limited access to information and agency seem to drive women's disaster vulnerability and contribute to their higher disaster-related mortality rates. Neumayer and Plümper (2007) find that the disproportional impact of natural disasters on women's mortality is weaker in countries where women have a better socioeconomic status.¹ Access to warning information and safe shelters matters. Depending on their age, women were three to five times more likely than men to die in Bangladesh's 1991 cyclone (Ikeda 1995). The author suggests that this discrepancy was primarily due to women's limited access to risk information and their lack of agency for making decisions about a hazard event. Men quickly and actively gathered warning information about the cyclone, while women mainly relied on word of mouth for their information and some were not aware of the cyclone. Women also had limited knowledge about the location of shelters. The final decision to evacuate seemed to fall on male family members, even when women wanted to evacuate.

Although primarily driven by socioeconomic and cultural context, biological and physiological differences can also contribute to the gender gap in postdisaster mortality and life expectancy (see discussion in Sellers 2016; Neumayer and Plümper 2007). For example, Frankenberg et al. (2011) find that adult women were twice as likely to die in Indonesia's 2004 tsunami, and that in Aceh and North Sumatra, physiological differences between adult men and women were a contributing factor in mortality. But while the authors account for socioeconomic status, physical differences (height), and household composition to assess the gender gap in adult mortality, there are other possible contributing factors that should be controlled for, including:

- » The ability to self-evacuate through learned skills such as climbing and swimming (Oxfam International 2005; Cannon 2002; Hunter et al. 2011)²
- » Women's clothing restricting their movements (Alam and Collins 2010)
- » The higher likelihood of women evacuating with children and elderly (Schwoebel and Menon 2004), and
- » Differences in knowledge and shelter safety conditions, affecting women's ability to safely access these shelters (Paul and Dutt 2010; Haynes et al. 2016).

Findings and discussions on the role of these factors, however, are primarily anecdotal, inconclusive, and in many cases, speculative (Sellers 2016).

In high-income contexts, men's disaster-related mortality rate is higher than women's, seemingly driven by exposure. Using the World Health Organization's (WHO's) mortality database from 1995–2011 covering 63 countries, Zagheni, Muttarak, and Striessnig (2015) find that men are more likely to have died from floods and storms. However, the database does not cover most of Africa and Asia, and, when compared to EM-DAT data,³ seems to underestimate number of deaths from hydrometeorological events. Higher disaster mortality among men has been observed in both developed (Ashley and Ashley 2008; Badoux et al. 2016; Doocy et al. 2013) and developing countries (Delaney and Shrader 2000). A review of flood events in Europe and the United States finds that males account for 70% of flood-related deaths (Doocy et al. 2013). Men are often overrepresented in risky rescue work and other outdoor activities, such as forestry and construction, increasing their direct exposure to natural hazards and often resulting in more casualties (Badoux et al. 2016; Delaney and Shrader 2000).

There is a lack of conclusive evidence on the gendered impacts on life expectancy by disaster type. Neumayer and Plümper (2007) find that the gender gap in terms of impact grows with the severity of the disaster, to women's disadvantage. However, their study uses an annualized

average of all disasters for a country to measure disaster severity, so it is not possible to differentiate effects by single disaster or disaster type. Understanding the relationship between types of disaster and men's and women's mortality would shed further light on how natural disasters impact them differently.

1.1.2 • Mental health

Natural disasters take a toll on mental health and well-being. Women consistently show higher propensity towards depression, anxiety, and stress-related disorders, while suicide is more common among men (Hammen 2005; Hawton and van Heeringen 2009; Olf et al. 2007). Studies in different regions and for different disasters document that women have higher odds of experiencing post-traumatic stress disorder (PTSD) and anxiety after a disaster. The ratio of women experiencing mental health challenges to women not experiencing such challenges is higher than the ratio for men. Two notable studies with large sample size are on the 2004 Indian Ocean tsunami in Indonesia (Frankenberg et al. 2008) and the 1998 floods in Hunan, China (Liu et al. 2006). Smaller studies providing consistent evidence include the 1999 Marmara earthquake in Turkey (Başoğlu, Şalcıoğlu, and Livanou 2002), Cyclone Nargis in Myanmar (Kim et al. 2010), floods in the United Kingdom (Mason, Andrews and Upton 2010; Paranjothy et al. 2011), Hurricane Katrina in the United States (Mills, Edmondson and Park 2007), and bushfires in Australia (Bryant et al. 2014).

Although differentiated impacts on men's and women's mental health are well documented, the reasons for this differentiation are much less understood. Olf et al. (2007) find that many factors might contribute to the higher rates of PTSD among women, including: the type of trauma women experience (more violence, sexual, interpersonal, and gender-based violence); their stronger perception of threat and loss of control; and insufficient social support resources for managing trauma-related symptoms. Studies from rural Australia hypothesize that higher suicide rates among men are the result of traditional masculinity preventing men from seeking help (Alston 2012; Alston and Kent 2008; Bryant and Garnham 2015; Hanigan et al. 2012; Judd et al. 2006). Other studies associate livelihood choices and suicide, finding that drought-related crop failures leave farmers, particularly male farmers, at higher risk of suicide (Hagen et al. 2019; Hanigan et al. 2012; Kennedy and King 2014). One could hypothesize that the effect of prolonged crop failure from consecutive droughts or other disasters would be different from one-time disasters.

1.1.3 • Early childhood development

Disasters can have long-lasting effects on early childhood development, driven by biology (where boys are disadvantaged) and preferred treatment (where girls are disadvantaged) (Dinkelman 2015; Gunnsteinsson et al. 2019; World Bank 2020). These findings are consistent with the strand in health literature that finds that boys are more vulnerable to nutritional and physical stress *in utero* and early life than girls (Kraemer 2000). For example, a study in Bangladesh finds that tornado exposure has more impact on infant boys than girls, and that the positive health effects of vitamin A supplements to dampen the effects of *in utero* tornado exposure were substantially larger for boys, while girls were largely unaffected (Gunnsteinsson et al. 2019). In Japan, *in utero* cold wave exposure was found to have a stunting effect only on boys, who experienced an average height reduction of 0.1–0.8cm in Japan's coldest regions (Ogasawara and Yumitori 2019). Kumar, Molitor, and Vollmer (2014) find that children—especially boys—in rural India exposed to droughts *in utero* and during their first year are more likely to have a lower weight for age and be underweight or severely underweight.

Although boys are likely to be more innately vulnerable to natural disasters *in utero*, girls face social vulnerability due to preferred treatment of boys when families face scarcity due to disasters. Disasters crowd out critical early childhood health investments—for example,

in nutrition and immunization. Gender discrimination in investment and resources is well documented (see, for example, Miller 1997) and boys may be prioritized over girls when resources are scarce. Analyzing health outcomes of 110,000 children under five in India, Datar et al. (2013) find that exposure to natural hazards increases susceptibility to illnesses such as diarrhea, fever, and acute respiratory illness. While girls and boys are equally susceptible to illnesses, the adverse effect of nutritional outcomes is smaller among boys; implying that disaster effects on children’s growth are often a result of households prioritizing boys in postdisaster times. In Japan, although the stunting effects of prenatal cold wave exposure was only found in boys, postnatal cold wave exposure seems to only affect girls (Ogasawara and Yumitori 2019). Although the authors do not have access to individual birth data, a possible explanation is that parents’ inability to distinguish the sex of the fetus during pregnancy makes them take the same precautions against cold regardless of sex, while postnatally, precautionary behavior is biased against girls.

1.1.4 • Women’s health

Women’s reproductive and maternal health needs create unique postdisaster health impacts. When natural disasters negatively affect access to reproductive healthcare and modern contraception, many health outcomes for women are compromised (Nour 2011). Damaged health facilities, disrupted infrastructure and diminished economic resources can reduce access to these services, interrupting women’s access to modern contraception (Behrman and Weitzman 2016; Hapsari et al. 2009; Leyser-Whalen, Rahman, and Berenson 2011), family planning, feminine hygiene products and maternal care (Kissinger et al. 2007; Nour 2011; Stockemer 2006). Hapsari et al. (2009) find that the prevalence of unplanned pregnancy in Yogyakarta after the Indian Ocean tsunami was higher among women who had difficulties obtaining contraceptives. Behrman and Weitzman (2016) show that heightened earthquake intensity reduced the use of contraceptives in Haiti, resulting in increased pregnancy, including unwanted pregnancy. The authors suggest that the impact of the disaster may have changed intrahousehold power dynamics, as women in most affected areas were less successful at negotiating condom use in their partnerships. Disasters can also exacerbate pre-existing race and class barriers for women to healthcare, as seen after Hurricane Ike in the US Gulf coast, where black women were more likely to have difficulty accessing contraception than Hispanic or white women (Leyser-Whalen, Rahman, and Berenson 2011).

Table 1.2 • Summary of literature on the gender gap in health outcomes in the context of natural disasters

Country	Disaster/Year	Findings	Reference
MORTALITY AND LIFE EXPECTANCY			
Global: 141 countries	Disasters, 1981–2002	Disasters and their subsequent impact kill more women on average than men or kill women at an earlier age than men. <i>(Source: EM-DAT)</i>	Neumayer and Plümpner 2007
Global: 4,093 events, no mention of country coverage	Flood events, 1980–2009; excludes flooding caused by hurricane, storm surges, and tsunamis	Men are more likely to die from flooding in developed countries, whereas in developing countries, mortality among women is higher. The primary cause of flood-related mortality is drowning. <i>(Sources: EM-DAT, the Dartmouth Flood Observatory Global Archive of Large Flood Events Database, and a review of historical flood events)</i>	Doocy et al. 2013
Global: 63 countries	Hydrometeorological disasters, 1995–2011	Across all age groups, mortality rates from hydrometeorological disasters are higher for men than for women; this difference is higher among adults compared to children or the elderly (WHO). EM-DAT underestimates the numbers, especially for high-impact events. <i>(Sources: WHO mortality database and EM-DAT)</i>	Zagheni, Muttarak, and Striessnig 2015
Bangladesh	Cyclone, 1991	Women aged over 19 were three to five times more likely to die.	Ikeda 1995

Bangladesh	Tornado, 2005	Women were 1.24 times more likely to die.	Sugimoto et al. 2011
Nepal, Sarlahi district	Flood, 1993	Fatality rates: 13.3 per 1,000 for girls and 9.4 per 1,000 for boys, 6.1 per 1,000 for women and 4.1 per 1,000 for men.	Pradhan et al. 2007
Indonesia, Sumatra	Tsunami, 2004	Women aged 15–44 died twice as often as men of the same age.	Frankenberg et al. 2011
Indonesia, Sumatra	Tsunami, 2004	Men living in highly affected areas who survived the tsunami had lower mortality risks over the next five years than men from less affected areas. The same is not found for women.	Ho et al. 2017
India	Latur earthquake, 1993	Although only 48 percent of the population, 55 percent of those who died were women.	Krishnaraj 1997
Honduras and Nicaragua	Hurricane Mitch, 1998	More men than women died from the hurricane in both countries.	Delaney and Shrader 2000
United States	Floods, 1995–2005	Depending on the age group, men are 1.5–2 times more likely to die in floods than women.	Ashley and Ashley 2008
Switzerland	Disasters, 1944–2015	75% of all people who died were male.	Badoux et al. 2016
MENTAL HEALTH			
Indonesia	Tsunami, 2004	Among 20,000 tsunami survivors, post-traumatic stress reactivity was higher among women than men.	Frankenberg et al. 2008
Turkey	Earthquake, 1999	Among 1,000 interviewed survivors, PTSD scores and depression rates were higher among women than men (53% vs 33% and 38% vs 24% respectively).	Başoğlu, Şalçoğlu, and Livanou 2002
Japan	Earthquake, 2011	A notably larger share of women (40%) and men (24%) reported deteriorating mental health in affected areas than in non-affected areas (24% of women and 13% of men. However, men received care less often than women.	Yoshida 2014
EARLY CHILDHOOD DEVELOPMENT			
India	All disasters in EM-DAT during 1991–93, 1997–99, 2004–06	Girls and boys are equally susceptible to acute illness as a result of disasters, but girls are more likely to suffer negative long-term nutritional outcomes of disasters.	Datar et al. 2013
South Africa	Drought, 1996	Drought exposure in infancy raises later-life disability rates by 3.5–5.2%, with effects concentrated in physical and mental disabilities. While both boys and girls are impacted by drought, the negative disability and cohort size for boys/men is 40–100% larger than girls/women.	Dinkelman 2015
Nicaragua	Hurricane Mitch, 1998	Negative impacts on weight-for-height z-scores are similar for boys and girls; boys seem to be relatively worse off in terms of the impact of the shock.	Baez et al. 2007
Bangladesh	Tornado, 2005	Tornado exposure has few significant impacts on female infants. Vitamin A supplements dampen the health impacts of <i>in utero</i> exposure to tornados among boys; girls are largely unaffected by the tornado in control and treatment localities.	Gunnsteinsson et al. 2019
Japan	Cold wave	Stunting effects of prenatal cold wave exposure only found in boys, but postnatally, cold wave exposure seems to only affect girls.	Ogasawara and Yumitori 2019
India	Droughts	<i>In-utero</i> exposure to droughts negatively influences health and child development; effects appear stronger for boys, low-caste children, and those exposed in the first trimester of pregnancy.	Kumar, Molitor, and Vollmer 2014
WOMEN'S HEALTH			
Indonesia, Yogyakarta	Tsunami, 2006	One year on from the tsunami, participants of a study of 450 married women had changed their contraceptive, with injections and implants decreasing and pills increasing. Among those having difficulty accessing contraceptives, there was higher prevalence of unplanned pregnancy.	Hapsari et al. 2009
Haiti	Earthquake, 2010	Using geographic variation in earthquake destructiveness, difference-in-difference analysis shows that heightened earthquake intensity reduced the use of injections (the most widely used contraceptive in Haiti) and increased pregnancy and unwanted pregnancy rates.	Behrman and Weitzman 2016
United States, Texas	Hurricane Ike, 2008	The hurricane hampered access to contraception. Overall, 13% of women reported difficulties accessing contraception. The effect was larger among black women.	Leyser-Whalen, Rahman, and Berenson 2011

1.2 • Education and child labor

The impacts of natural disasters on school enrollment affect boys and girls differently. Natural disasters can force parents to withdraw their children from school because they cannot pay tuition or need additional support at home or extra labor income (Björkman-Nyqvist 2013; Cas et al. 2014; Takasaki 2017). School enrollment can also increase after a natural disaster, as the opportunity costs of education change (de Janvry et al. 2006; Gitter and Barham 2009). Whether girls or boys are withdrawn school and/or engage in child labor depends on parents' needs and the value they place on their children's education.

When families need additional income and labor, boys tend to be affected more than girls. For example, Takasaki (2017) finds that boys (but not girls) in Fijian families affected by Cyclone Amy in 2003 were more likely to participate in farm work and had lower school enrollment rates than those in families that were not affected. The author noted that boys with no older brothers and a more educated father were particularly vulnerable. This is likely because, with his higher level of education and presumably better paid employment, the father's opportunity cost of missing work to farm is high. Similarly, Cas et al. (2014) find that boys who lost both parents in the 2004 tsunami in Sumatra at the age of 15–17 completed on average 1.7 fewer years of schooling and were 34 percent more likely to be working work five years after the event, compared to their peers who did not lose a parent. Girls were also less likely to be in school, but in contrast their male peers, there is no evidence that those who lost one or both parents dropped out sooner than those whose parents survived. Also in contrast to boys, girls who lost both parents were 26 percent less likely to participate in the workforce five years on than their peers whose parents survived. This is most likely due to marriage, as girls were 62 percent more likely to be married five years after the disaster (see [Section 1.4.1](#)).

When there is less value in work—due to, say, a drought—the opposite effect can be observed. For example, a drought in Nicaragua in 2001–02 led to a 23 percent increase in school enrollment among boys from families with less than one hectare, as it lowered the value of farm labor and hence the opportunity cost of education (Gitter and Barham 2009). Drought also had a negative effect on child labor in Mexico for both girls and boys, although school enrollment did not rise (de Janvry et al. 2006).

When parents cannot afford tuition or need additional support at home, girls tend to be more affected. Björkman-Nyqvist (2013) finds that a 15 percent decrease in rainfall in Uganda resulted in a 5 percent decrease in girls' enrollment in the highest grade of elementary school. No effect was found for boys or younger girls. The author suggests that, since the absence of a pension system means that older family members often rely on their children's income, and girls are expected to marry and leave the household, it is reasonable to assume that parents will value boys' education more since they will make a bigger contribution to their household as adults. Girls also often help around the house—preparing food, fetching water, and washing clothes—and this work becomes more burdensome in times of drought. When primary tuition fees were abolished in Uganda, enrollment increased, and the effect was stronger for girls than boys. But even when school was free, a decrease in rainfall was associated with lower test scores for girls (and a drop in enrollment among the poorest girls). Boys, on the other hand, were unaffected, indicating that parents continue to prioritize their education. In Mexico, de Janvry et al. (2006) find that girls' school enrollment decreased by 5 percent after their locality was affected by earthquake, hurricane, flood, or plague (not drought). They find no effect for boys. The likelihood of engaging in child labor also increased for both girls and boys after a natural disaster.

Table 1.3 • Summary of literature on the gender gap in educational outcomes in the context of natural disasters

Country	Disaster/Year	Findings	Reference
Indonesia, Sumatra	Tsunami, 2004	For older adolescent boys and girls (aged 15–17 years), losing both parents in the tsunami decreased school enrollment by 40 and 55% respectively in the long term (five years after the event). It also increased the probability of boys being in the workforce by 34%, but decreased the probability for girls by 26%.	Cas et al. 2014
Fiji	Cyclone Amy, 2003	Among cyclone victims with housing damage, boys (not girls) contribute to farming activities, leading to significantly lower school enrollment among boys. Housing aid mitigates school dropouts among boys but does not influence their labor use. Boys with no elder brothers and a more educated father are particularly vulnerable in their progression to higher school levels.	Takasaki 2017
Nicaragua	Droughts, 2001–02	Droughts increase school enrollment among boys by 23% in households with less than one hectare of land, because the opportunity costs of school decrease.	Gitter and Barham 2009
Uganda	Droughts, 1979–2003	A 15% decrease in rainfall results in a 5% decrease in the highest grade of female elementary school enrollment. No effect is found on the enrollment of boys and younger girls. When schooling is free of charge, a negative income shock has an adverse effect on girls' test scores, while boys are unaffected.	Björkman-Nyqvist 2013
Mexico	Various natural disasters, 1997–2000	In places affected by natural disaster in the previous six months, the likelihood of girls being in school decreases by 5%. No such effect is found for boys. Most natural disasters increase child labor for boys (6.7%) and girls (4%). Drought decreases child labor for both boys and girls.	de Janvry et al. 2006

1.3 • Economic outcomes

Natural disasters can impact an individual's economic conditions directly—for example, by wiping out a harvest or damaging or destroying assets used to generate income—and indirectly, by causing price changes, disrupting infrastructure, affecting suppliers, and so on. Disasters have different effects on different sectors, depending on their exposure (outside/inside activities, proximity to high-risk areas) and vulnerability (dependency on infrastructure, importance of weather, sensibility to external shocks) to impacts of natural hazards.

These factors are important in understanding disaster impact at the individual, household, and societal level. Gender discrimination and social norms, in society and the household, continue to influence labor market participation, asset accumulation, ownership and consumption outcomes, and consequently, how disasters impact the economy. This subsection focuses on how gender-based differences in the exposure and vulnerability of livelihoods and assets to natural hazards and intrahousehold dynamics result in different postdisaster consumption outcomes for men and women.

1.3.1 • Livelihoods

Heavily reliant on weather, climate, and water to prosper, agriculture is one of the most vulnerable sectors to natural disasters. Twenty-three percent of all damages and losses caused by natural disasters between 2006 and 2016 were in agriculture (crops, livestock, aquaculture and fisheries and forestry sectors) (FAO 2017). Globally, a larger share of employed men (30 percent) work in agriculture than women (25 percent) (ILO 2016). But in low- to middle-income countries and most regions,⁴ agriculture is the most important economic sector for female employment and employs a larger share of employed women than men (ILO 2016).

Women farmers tend to be smaller-scale and use fewer inputs and technologies than men, making them more vulnerable to the impacts of drought (Croppenstedt, Goldstein, and Rosas

2013; FAO, IFAD and ILO 2010). Their lower productivity results, on average, in a 20–30 percent yield gap between men and women (FAO 2011). Female farmers dedicate more hours to unpaid family work, have lower access to off-farm labor and, when they do get laboring work, are paid less than men (FAO 2011; ILO 2016). For example, the average daily wage for female farm workers in India is 74 percent the male wage (National Sample Survey 2007, calculated in Mahajan 2017). Mahajan (2017) also finds that in rice-growing areas, low rainfall shocks are associated with a decrease in female farm workers' wages, but do not affect men's wages, indicating that demand for female farm labor is more sensitive to rainfall variability. With lower productivity, smaller margins, and fewer options to shift income, female farmers face a higher risk of falling into poverty and/or become more dependent on their husband at times of natural disaster. This, in turn, lowers female bargaining power within the household (Doss 2013).

Women are more likely to face unemployment, re-enter the labor market or shift to self-employment after a disaster. Acevedo (2014) analyzes the extent to which labor supply changes in response to extreme weather events. Using individual labor supply data in the Colombian Caribbean, the study finds that the probability of unemployment increases by 7 percent among women living in a municipality that has experienced at least one flood. This was 3 percent higher than men. Similarly, after Hurricane Katrina, women were substantially less likely than men to keep their pre-hurricane employment or a job of similar status (Zottarelli 2008). Several other studies, although based on anecdotal evidence and indirect inferences, state that women had greater employment losses after Hurricane Mitch, which hit several Central American countries (Bradshaw 2004; Enarson 2000); they were also slower to re-enter the waged labor market (Delaney and Shrader 2000).

These difficulties could be a result of an increase in domestic duties after a disaster, which tends to affect women more than men. For example, after a 2018 flood in Dar es Salaam, it was observed that 60 percent of those who reported missing work due to the flood were women; and on average, women stayed home 17 days, while men stayed home 15.5 (Erman et al. 2019). Women tend to take on more responsibility for managing postdisaster needs than men—for example, cleaning up after a flood and taking care of children who cannot go to school. A similar result is found in El Salvador, where Halliday (2012) finds that women's domestic labor increased after the 2001 earthquake, while their income-generating work in livestock and out-migration decreased. This effect was not found for men. For more on the role of labor in the capacity to cope with a disaster, see [Section 2.2](#).

Postdisaster occupation segregation also plays a role in labor market outcomes, as it is easier for men to find work in postdisaster construction and rehabilitation. Delaney and Shrader (2000) note that women in Honduras' agro-processing industry had yet to return to their jobs in the aftermath of Hurricane Mitch, whereas men quickly found work in construction and rehabilitation activities. Similar effects were observed in the United States, where women's earnings in New Orleans were 7 percent lower in the year following Hurricane Katrina, while men's earnings were up 23 percent, primarily from working in postdisaster construction and sales (Peek and Fothergill 2008).

1.3.2 • Assets

Women often own a smaller share of total household assets and, as a result, lose less due to disasters than men in absolute terms. However, when women lose the few assets they own, the welfare consequences are often more severe than they are for men or when assets are jointly held. Literature and data on land ownership in developing countries indicate that women are less likely to own land than men; and when they do, they own less land (Deere and Doss 2006).⁵

However, due to a lack of sex-disaggregated data on physical asset ownership, there is much less evidence when it comes to who owns what. This data gap is also reflected in the lack of information on gendered patterns in disaster damage and loss data (see [Section 3](#)).

Individual studies shed some light on women's share of ownership of household wealth. Married women in Ecuador own 44 percent of household assets (including land); in Ghana, they own 19 percent, and in Karnataka, India, 9 percent (Deere et al. 2013). When considering movable assets only, married women in Uganda own 10 percent, and in Bangladesh, around 8 percent (Quisumbing, Kumar, and Behrman 2018).

The most common form of informal savings for poor women are small, high-value items that they can sell for cash in an emergency (Vonderlack and Schreiner 2002). For example, Antonopoulos and Floro (2005) find that women typically hold tangible rather than financial assets, while men tend to hold financial and transport assets. Others note that gold and jewelry are common forms of saving among women in India, Pakistan, and Indonesia (Frankenberg, Thomas, and Smith 2003; Goedecke et al. 2018; Zulfiqar 2017). In Bangladesh and Uganda, women hold a larger share of their assets in jewelry and livestock, whereas men own more land and property (Quisumbing, Kumar, and Behrman 2018). In Ghana, printed fabrics are high-value traded items, which women can sell in case of emergency (Doss et al. 2018).

Holding a large share of total assets in tangible form makes women more exposed and more vulnerable to natural hazards. A detailed household survey in Dar es Salaam found that asset losses—including household appliances, other electronics, clothes, and furniture—made up 77 percent of total flood damage, surpassing the value of housing repairs (Erman et al. 2019). However, holding their wealth in this form also has advantages. Women can use small, tradable assets to smooth consumption when affected by a disaster (Frankenberg, Thomas, and Smith 2003). In the absence of access to financial accounts, they also give women more control over their assets, and are an alternative to holding cash at home. When women do save cash, they tend to hide it to retain control over it. Famously, when the Indian government demonetized bank notes of certain values in 2016, many women were compelled to bring out their hidden cash to exchange in the banks, forcing them to disclose their savings to their husbands and other family members (Syngle 2017; Nikore 2016; Doshi 2016). Protecting women's assets from the impacts of disasters would require closing the gender gap in access to financial services and improving access to other safe storage methods to help them maintain control over their assets (Johnson 2004; Vonderlack and Schreiner 2002).

Female-headed households are often overrepresented among populations that are highly exposed to natural hazards and/or in fragile structure, making them more vulnerable to disaster impacts. Among those made homeless by Hurricane Mitch in Nicaragua and Honduras, 40 and 50 percent respectively were female-headed households. This is significantly higher than the national average of female-headed households, which is 24 and 20 percent respectively (Bernard 2010). Erman et al. (2019) also find that female-headed households are more likely to be exposed to flooding in Dar es Salaam, even when controlling for poverty. Wiest (1998) documents that there are nearly three times as many female-headed households in the *chars* (riverine islands) and embankment zones of Bangladesh's regular flooded zones of Kaziput, Chilmari and Bhola than in non-eroded zones. Of these women, 63 percent have husbands who work mostly elsewhere, while the rest are widowed or single. Since female-headed households often face constraints such as having a single income or a larger number of dependents, it is likely that their overrepresentation in high-risk areas is driven primarily by financial constraints. More insecure tenure arrangements among women can also play a role (Erman et al. 2019). Areas exposed to flood risk in cities are often the last pieces of land to be exploited,

and housing there tends to be more informal. They are often cheaper while still being close to job opportunities in the city. Households unable to settle in other areas move here to access housing and jobs at the expense of frequent flood exposure (Erman et al. 2020; Hallegatte et al. 2017). Once settled there, insecure tenure can make it more difficult to leave (see [Section 2.2](#)).

1.3.3 • Consumption

Disasters change household consumption patterns, and women and girls are first to report skipping meals or going hungry when there is a food shortage as often happens in the aftermath of a natural disaster (Alston 2015; David and Enarson 2012; Keshavarz, Karami and Vanclay 2013; Segnestam 2009; Shoji 2010). Using individual data, Shoji (2010) finds that females in Bangladesh are 1.6 times more likely to sacrifice meals after a disaster. This trend results in higher infant mortality and higher postdisaster underweight and stunting rates among girls than boys (Datar et al. 2013), as already discussed in [Section 1.1.3](#). Households with an educated head and more physical assets are less likely to reduce meal frequency due to disasters and the marginal effect is larger for female household members than males (Shoji 2010).

There is nascent evidence that postdisaster expenditure on women’s goods is significantly reduced. After Cyclone Phailin in Orisha, India in 2013, there were sizeable decreases in total postcyclone expenditure in affected households, primarily drawn by lower per capita food expenditure and no significant changes in health or education expenditures. One of the largest decreases in household expenditure categories was in women’s goods, which includes clothing, shoes, hygiene products, and toiletries (Christian et al. 2019). The study suggests that, since the worst-hit households spend less on women’s goods but more on social expenditures such as community festivals (without any significant decrease in health or education expenditures), women buffer their households from negative consumption shocks. The effect could also be driven by limited decision-making power over the use of household resources.

Table 1.4 • Summary of literature on the gender gap in economic outcomes in the context of natural disasters

Country	Disaster/Year	Findings	Reference
LIVELIHOODS			
India	Rainfall shocks, 1993–2007	A district-level panel dataset covering 14 major states including data on individual wages and rainfall shocks shows that a single-unit increase in a rainfall shock in rainfed rice-growing areas corresponds to a 10% increase of female-to-male wage ratio. This is driven by a greater increase in demand for female labor.	Mahajan 2017
Colombia, Caribbean coast	Rainfall shocks, 2001–2010	Individual labor supply data of 800,000 adults and children shows that women in a municipality that experienced at least one flood are 3 percentage points more likely to be unemployed than men. Participation of children aged 12–17 in the labor force increased 1.4 percentage points for boys and 4.7 percentage points for girls in response to floods.	Acevedo 2014
United States	Hurricane Katrina, 2005	A two-round survey with 1,369 respondents (in 2005 and 2006) found that, among those affected by the hurricane, women were substantially less likely than men to maintain their pre-hurricane employment.	Zottarelli 2008
Tanzania, Dar es Salaam	Flood, 2018	Data from a representative sample shows that women were more likely than men to miss work after the floods: 60% of those who reported missing work were women. They also tended to stay home for slightly longer than men (17 days compared to 15.5).	Erman et al. 2019
El Salvador	Earthquake, 2001	Three waves of panel data between 1988 and 2002 show that women spent more time on domestic duties after the earthquake. A 1% increase in earthquake damage is associated with 1.54 hours’ increase in domestic labor, decreasing the time women spent on income-generating work in livestock or out-migration. For men, adverse agricultural outcomes increased migration and hours spent in the field.	Halliday 2012

ASSETS			
Uganda and Bangladesh	Different shocks, including floods and droughts, 2007–2010	Panel datasets show that, in Bangladesh, floods and droughts have negligible impact on land and asset holdings. In Uganda, floods have a positive effect on married men's land holdings, and droughts have significant negative impact on married women's non-land assets, while their husbands' assets are unaffected.	Quisumbing, Kumar, and Behrman 2018
CONSUMPTION			
Bangladesh	Floods, 2004	Data from 326 households show that, without rescheduling payments to cope with negative income shocks of floods, households are, on average, 5.1% more likely to skip meals. Women and girls are 1.6 times more likely to do so than men and boys.	Shoji 2010
India	Cyclone, 2013	Two independent but overlapping sources of variation—exposure to a cyclone and the rollout of a rural livelihoods intervention—show that the storm led to a reduction in overall household expenditure, with the largest reduction in women's goods.	Christian et al. 2019

1.4 • Voice and agency

Women's lack of voice and agency in decision making can drive gender gaps in outcomes. Specific expressions of women's agency include freedom from gender-based violence, the ability to decide when to marry and the ability to have a voice in society (World Bank 2015b). This section explores how women's voice and agency manifest themselves in postdisaster situations, focusing on child marriage and gender-based violence. **Box 1.1** looks at women's voice in society, focusing on women as agents of change in the context of disaster risk management.

1.4.1 • Child marriage

Losing a parent in a disaster increases the prevalence of child marriage for girls and decreases it for boys. Cas et al. (2014) show that, among children who lost both parents after the 2004 tsunami in Sumatra, boys were 7 percent less likely to be married than boys whose parents survived. Girls, on the other hand, were 62 percent more likely to be married. The death of both parents leaves children with fewer psychosocial and economic resources, which pushes girls into early marriage. For boys, it tends to delay marriage as they work to support the rest of the family.

The economic role of marriage and traditional cultural norms determines the effect of shocks on the prevalence of child marriage among girls. In sub-Saharan Africa and India, where marriage is accompanied by substantial monetary or in-kind transfers, local economic shocks have opposite effects on the marriage behavior of a sample of 400,000 women. Droughts, which reduce annual crop yields by 10 to 15 percent, increase female child marriage by 3 percent in sub-Saharan Africa where bride price is paid by the groom's family, and reduce female child marriage by 4 percent in India, where dowry is paid by the bride's family (Corno, Hildebrandt, and Voena 2017).

Research on disasters and marriage behavior find that age of marriage decreases due to disasters. Khanna and Kochhar (2020) show that a flooding event in 2008 in Bihar, India, decreased the age of marriage and that the effect was more pronounced among boys (10 months) than girls (4.5 months). The authors suggest that the flood made families decide to marry boys earlier to smooth consumption with the dowry, which also affected the age of marriage for girls. The study also shows that marrying younger affects the status of girls and women, as married women are less likely to work, have their own money to spend or own a cellphone. They also find that these effects are more pronounced among Hindus—for whom dowry in marriage is the norm—and the landless, who are more credit-constrained. Similarly, Das and Dasgupta (2020) find that the female age of marriage decreased as a result of the 2001 Gujarat earthquake and identify the dowry as the driving mechanism.

BOX 1.1

Women as agents of change

Addressing gender inequalities by enhancing women's participation in decision making is crucial for building communities' resilience to natural disasters. Although it often goes unnoticed, evidence demonstrates that women have an active role in disaster preparedness, response, and recovery efforts (UNISDR 2015). Acknowledging women's contributing role, the government of Vietnam has issued a decree that gives the Women's Union an official space in disaster-related decision-making bodies (UN Women 2017). A local government in the Philippines has set aside budget for women to conduct community consultations and feed into community-level development plans (Tanner, Markek, and Komuhangi 2018). And in Bangladesh, the Comprehensive Disaster Management Plan thoroughly addresses gender concerns, stipulating that women's representatives are to be included in the people's councils involved in preparing disaster action plans, discussion with women's groups when preparing these plans is obligatory, and council members must be provided with gender sensitivity trainings (Ikeda 2009).

Because women have a better understanding of what women need, their involvement and leadership in disaster decision making is crucial (Tanner, Markek, and Komuhangi 2018). In Bangladesh, engaging women in community mobilization efforts to address cultural reasons for women's reluctance to access shelters has proven efficient. This may be because they find it easier to identify women's needs, or because women are more likely to trust other women in some contexts (World Bank 2011). Not involving women in such processes can have negative consequences, as seen in the aftermath of the Great East Japan Earthquake, where the lack of female involvement

in designing and operating evaluation sites led to a disregard of their needs and concerns or discouragement from speaking about them. The government has since amended its Basic Disaster Management Plan to ensure women participate in designing and operating evacuation sites and temporary housing, to ensure these meet the needs of women and families with children (Government of Japan 2014).

Female participation in postdisaster and recovery phases can have transformative effects on gender dynamics. In a longitudinal study of a small tsunami-affected coastal community in Chile, Moreno and Shaw (2018) demonstrate how women's participation in postdisaster work, such as community kitchens, helped strengthen female leadership and made them active agents of change in their communities. By diffusing public and private spaces, the disaster created an opportunity for women to move from low to high community involvement, a situation that still prevailed seven years after the disaster. In a qualitative study, Ikeda (2009) shows that women's involvement in community-based disaster risk management in Bangladesh is transforming cultural behaviors, leading to wider support among both men and women for addressing specific women's needs in disaster risk management.

The Sendai Framework, adopted in the Third United Nations World Conference on Disaster Risk Reduction in 2015, recognizes the significant role women play in disaster preparedness, response, and recovery (UN 2015). The framework emphasizes the need for enhancing women's leadership in promoting universally accessible response, recovery, rehabilitation, and reconstruction approaches.

1.4.2 • Gender-based violence

Gender-based violence, a manifestation of systematic inequality between men and women, is exacerbated during a time of emergency (Abiona and Foureaux Koppensteiner 2018; Bradshaw and Fordham 2013; Fisher 2010; Weitzman and Behrman 2016). Violence tends to increase in the immediate aftermath of a disaster, and women and children are at greater risk of physical and sexual violence in emergency settings (Gennari et al. 2015). Owing to a lack of adequate data on the incidence of pre-disaster event violence, it is difficult to measure the scale-up of violence (Bradshaw and Fordham 2013). However, qualitative evidence reveals an increase in the risk of both stranger-perpetrated sexual violence and intimate partner violence⁶ after natural disasters in developed and developing country settings.

In refugee and displacement camps, where protection and privacy are often inadequately addressed, risks for women and girls are higher. Horton (2012) explores the vulnerability of women and girls in internally displaced persons camps in Haiti after the 2010 earthquake. Although there are no reliable data on prevalence, crowded conditions and a lack of security contributed to an increase in multiple forms of gender-based violence.

Examining overall levels of violence and the types of violence after the 2004 Indian Ocean tsunami in Sri Lanka, Fisher (2010) finds that girls and women were subjected to sexual violence and other forms of physical abuse by strangers from the onset of the emergency. However, there is also growing recognition that intimate partner violence is a crucial concern in emergency settings (IASC 2015) and it is often considered the most prevalent form of postdisaster violence against women. Understanding and recognizing reasons behind this postdisaster increase in intimate partner violence is important for program design, particularly to ensure that resources targeted for women do not lead to more violence.

In their study of 2010 Haiti earthquake, Weitzman and Behrman (2016) find that women living in the most devastated areas were more likely to experience physical and sexual intimate partner violence for up to two years after the disaster. According to the study, the consequences of the impact of the earthquake affected men's controlling behavior, which is linked to the risk of intimate partner violence. In Tanzania, droughts lead to a considerable increase in intimate partner violence (one standard deviation corresponds to 13.1 percent increase), an effect that is more pronounced among poorer households, those with divorced partners, those who rely solely on agriculture, or where females are less empowered⁷ (Abiona and Foureaux Koppensteiner 2018). In the United States, several studies have consistently found increases in prevalence of intimate partner violence after Hurricane Katrina (Anastario, Lawry, and Shehab 2009; Harville et al. 2011; Schumacher et al. 2010). This includes psychological victimization (35 percent increase for women, 17 percent for men) and physical victimization (98 percent increase for women) (Schumacher et al. 2010).

Sexual exploitation of women and girls also increases after a disaster, with women often forced to provide sexual favors in return for food and benefits. Delaney and Shrader (2000) observed reports of an increased level of sexual violence and coerced prostitution after Hurricane Mitch, particularly among adolescent girls in temporary shelters in rural areas. Some shelters even hired security guards to reduce this type of violence. This is in line with observations from a Haitian women's organization that, after the 2010 earthquake, women and girls exchanged sexual acts for food and benefits, including coupons, access to direct aid distributions, cash-for-work programs, money, or even a single meal (MADRE 2012).

In the context of silencing and stigmatization, many survivors of gender-based violence cannot seek support or access adequate services. Often, they do not speak out over fear of being

blamed; particularly in societies that highly value the “purity” of women (Felten-Biermann 2006). In Japan, social pressures—including the praise of stoicism—encouraged survivors and women’s support groups to remain silent on cases of sexual violence in the aftermath of the 1997 Hanshin Awaji earthquake (Saito 2012). Similarly, following the 2009 Black Saturday Bushfire in Australia, which caused the subsequent relocation of 7,000 people, women at increased risk of intimate partner violence faced pressure to deny or forgive violence from family members and peers, and many who spoke of seeking help were ignored, blamed, and silenced (Parkinson and Zara 2013). Fisher (2010) and Bradshaw and Fordham (2013) point out that postdisaster gender-based violence is not the product of an extraordinary reaction to a disaster situation, and should be viewed and understood in context, alongside pre-existing violence.

Table 1.5 • Summary of literature on voice and agency outcomes in the context of natural disasters

Country	Disaster/Year	Findings	Reference
CHILD MARRIAGE			
Indonesia, Sumatra	Tsunami, 2004	Five years after the disaster, young women who had lost their parents as adolescents in the tsunami were 62% more likely to be married than their peers who did not lose a parent. Young men of the same age who had lost their parents in the tsunami were 7% less likely to be married than their peers who did not lose a parent.	Cas et al. 2014
Sub-Saharan Africa and India	Rainfall shocks (droughts), 1950–2010	A sample of 400,000 women is used to study marriage behaviors in sub-Saharan Africa and India. In sub-Saharan Africa, where the groom’s family pays a bride price, droughts increase child marriage by 3%; in India, where the bride’s family pays a dowry, droughts reduce it by 4 %.	Corno, Hildebrandt, and Voena 2017
India, Bihar	Riverine flooding, 2008	The 2008 floods of the Kosi River reduced the age at marriage for men by 10 months, and for women, by 4.5 months. After the flood, married women were 8.6% less likely to work, 8.9% less likely to have their own money, and 8.6% less likely to own a cellphone, so marrying at a younger age reduced their status in the household.	Khanna and Kochhar 2020
India, Gujarat	Earthquake, 2001	Using a sample of 2,189 women and a difference-in-differences strategy, the authors find that the earthquake resulted in women marrying at a younger age, and that they were less likely to marry within their own village. They also find that women were less likely to marry a man with a higher level of education than their own and more likely to marry into a poorer household.	Das and Dasgupta 2020
GENDER-BASED VIOLENCE			
Tanzania	Rainfall shocks (droughts), July 2007–June 2008	Droughts led to a considerable increase of domestic violence Tanzanian households—for example, a single standard deviation decrease in rainfall from the long-term mean increased the incidence of domestic violence by about 13% from the baseline. Violence was targeted towards wives, only present when both spouses worked in the agricultural sector, and absent in female-headed households.	Abiona and Foureaux Koppensteiner 2018
Haiti	Earthquake, 2010	Exposure to earthquake devastation increased the probability of both physical and sexual intimate partner violence one to two years after the disaster.	Weitzman and Behrman 2016
United States	Hurricane Katrina, 2005	Among women, the crude rate of daily new cases of gender-based violence increased from 4.6 per 100,000 before the disaster to 16.3 per 100,000 in 2006, remaining elevated at 10.1 per 100,000 in 2007.	Anastario, Lawry, and Shehab 2009
United States	Hurricane Katrina, 2005	Reports of physical victimization of women increased from 4 to 8% after Hurricane Katrina but were unchanged for men.	Schumacher et al. 2010
Central America	Hurricane Mitch, 1998	Women exhibited common signs of depression, such as sleep disorders and headaches, but were able to maintain their usual responsibilities. Information about men, on the other hand, indicates a manic or violent reaction to psychological distress, manifested through dysfunctional coping mechanisms such as alcoholism, gambling, and violent behavior.	Delaney and Shrader 2000
Indonesia and Sri Lanka	Tsunami, 2004	Instances were reported of men offering tsunami-affected women money or goods for sex or engaging in relationships under a false pretense that marriage would follow.	Fisher 2010

References for Section 1

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Endnotes

1. They measure socioeconomic status as a combination of economic and social rights using Cingranelli and Richard's (2010) Human Rights Database. Economic rights include equality in pay, hiring and promotion; free choice of profession without having to obtain permission; job security; and the right to work in dangerous occupations such as the military or police. Social rights include equal inheritance; the right to own, manage, and retain property; participation in social, cultural, and community activities; and the right to education.
2. Although studies have identified gender gaps in swimming ability in some countries, the link between ability to swim and mortality during disasters is not clear cut (Sellars 2016). Presumably, for certain types of high-intensity disaster, such as tsunamis, the ability to swim or climb tree would not make a difference.
3. EM-DAT, *The International Disaster Database*. <https://www.emdat.be/database>.
4. Africa, North Africa, Arab States, Southeastern Asia and the Pacific, Southern Asia, Eastern Europe, and Central Asia.
5. Also, FAO, *Gender and Land Rights Database*. <http://www.fao.org/gender-landrights-database/en/>.
6. Intimate partner violence refers to behavior within an intimate relationship that causes physical, sexual, or psychological harm, including acts of physical aggression, sexual coercion, psychological abuse and controlling behaviors (WHO definition, in Krug et al. 2002).
7. Proxying female empowerment by inheritance policy at husband's death, the study finds that domestic violence incidence decreases when the prevailing inheritance policy allocates rights to the spouse and children at the time of the husband's death.

Resilience: preparedness and coping capacity

Resilience—the capacity to withstand and recover from a shock—requires disaster preparedness, response, and recovery. The level of disaster preparedness is impacted by risk perception, knowledge about how to prepare, actual preparedness action, and access to early warnings. Disaster recovery can be driven by several factors, including access to coping mechanisms, such as savings and other assets, credit, remittances, and social protection, which can help households recover. Sources of livelihood, availability of alternative labor or income options, and the ability to migrate can also affect households' recovery and adaptation. And in many of these factors that affect resilience, gender plays an important role (Ahmad 2012).

Their role as caregivers, the lack of available resources, discrimination in the labor market, and specific cultural restrictions mean that women face particular challenges when recovering from disasters (UNISDR, UNDP, and IUCN 2009). Intrahousehold financial power dynamics and barriers to accessing government support and other formal entities, such as banks, may prevent women from accessing and controlling household resources. Section 1 explored how the gender dynamics of exposure and vulnerability to natural hazards tend to result in women being hit harder when a disaster happens. The focus of this section is how gender affects resilience, from preparedness levels to the ability to recover.

2.1 • Disaster preparedness: risk perception, preparedness actions and early warnings

Gender can contribute to the factors that determine disaster preparedness. These include socioeconomic status, risk perception, education, access to information and media, and previous disaster experience (Wachinger et al. 2013).

Studies on flood risk in several developed countries find that, when they face similar exposure levels, women's perception of the risks of floods tend to be higher than men's (Finucane et al. 2000; Kellens et al. 2011; Miceli, Sotgiu and Settanni 2008). In Taiwan and Romania, for example, women tend to fear and worry more about the risk of earthquakes than men (Kung and Chen 2012; Armaş and Avram 2008). In contrast, Bradford et al. (2012) finds no clear relationship along gender lines in levels of concern over flood risk in six European countries.

Hanaoka et al. (2018) suggest that risk perception could be shaped by people's emotional response to a previous experience with a disaster, and that this could differ between women and men. They find that men who experienced the Great East Japan Earthquake in 2011 became more tolerant of risk, while women's perceptions of risk remained unaffected. If this is true, it could help explain the trends identified in differences in risk perception between men and women.

It is not clear how gendered differences in perceived risk of natural disasters translates into preparedness action; but responsibilities in household and social family roles seem to matter.

Evidence from Europe suggests that men are more prone to adopt protective behaviors than women (Miceli, Sotgiu and Settanni 2008), or to consider themselves better prepared for flooding (Bradford et al. 2012). This is the case even where women perceive a higher risk of flooding or where no difference in risk perception was identified. The results are slightly surprising, since it is generally believed that perceptions of risk strongly influence the way people adapt and prepare for shocks (Bryan et al. 2013; Erman et al. 2020). Studies suggest this could be because men's social role in the family context leads to them adopting more protective behaviors than women, or because the findings, largely based on self-reported data, reflect men's higher confidence level in their ability to take preventative actions (Miceli, Sotgiu and Settanni 2008; Bradford et al. 2012).

It can also depend on the types of action and responsibility that men and women adopt to prepare for a disaster. Evidence suggests that men tend to take responsibility for protecting property and other technical aspects, while women usually focus on stocking supplies and preparing family members (Szalay et al. 1986; Morrow and Enarson 1996). In Romania, women were more likely than men to accumulate reserves in response to higher concerns of earthquake risk (Armaş and Avram 2008). An analysis of credit card usage in the days leading up to landfall of Hurricane Odile in the Mexican state of Baja California Sur in September 2014 supports this hypothesis. It suggests that women used their credit and debit cards more extensively than men to buy food and fuel in the days before landfall (Martinez et al. 2016).

Their place of work also influences men's and women's levels of disaster preparedness. Evidence suggests that, in some contexts, male-dominated sectors provide better conditions for strengthening disaster preparedness. For example, in Chile's Atacama region, the male-dominated mining industry provides emergency risk reduction training. According to one study, this helps explain why men there tend to have higher levels of perceived preparedness to flooding than women, who primarily work in service and commerce (Bronfman et al. 2019). Working outside or near risk areas also results in better awareness of surrounding environments. For example, the tobacco fields on the slopes of Indonesia's volcanoes in Central Java are primarily managed and worked by men. As a result, these men gain more information on volcanic hazard than women in the area, who primarily stay in the villages (Lavigne et al. 2008).

Higher levels of education contribute to disaster preparedness and evidence suggests that women's education levels can have important community spillover effects. Focusing on earthquake preparedness in Thailand's Andaman Coast, Muttarak and Pothisiri (2013) show that at the individual level, a higher level of formal education is associated with improved disaster preparedness, even when controlling for household income.¹ They find important spillover effects of education on disaster preparedness at both household and village level. Living in a household with two or more persons with at least secondary education or in a village with a higher share of women who have at least secondary education both increase disaster preparedness. A 1 percent increase in the proportion of women with at least secondary education increases the odds of preparation by 11 percent,² but there is no such relation between male education level and preparedness. However, the limited size of the sample (544) and the simplistic way the authors defined preparedness make it difficult to extrapolate these results out of context. According to their analysis, education is a more important determinant than household income, previous experience with disaster and participation in evacuation drills, which have no significant impact on preparedness. The number of disaster information sources people have is also positively related to the number of preparedness actions they take, with one additional source increasing the odds of preparation by 35 percent.

BOX 2.1

Definition of terms

- » **Risk perception** influences how people respond to hazards, thereby determining whether they turn into disasters with devastating effects on communities. Understanding how people perceive risk in the context of natural hazards is central to improving risk communication activities and preparedness.
- » **Early warning systems** are the set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare to act promptly and appropriately, thus reducing the possibility of harm or loss.

Source: IPCC 2014.

2.1.1 • Evacuation behavior

Although women are more likely to intend to evacuate and to actually evacuate in an emergency event (Thompson, Garfin and Silver 2017), non-demographic factors seem to be more important in evacuation behavior. The literature shows clear links between risk perception, preparedness, evacuation intention, and behavior. In a close look at the relationship between gender and evacuation behavior in a postdisaster study in North Carolina, United States, Bateman and Edwards (2002) find that women are more likely to evacuate because they tend to be disproportionately exposed to physical risks and have a heightened perception of risk.

However, when controlling for living in mobile home or risk perception, gender is no longer significant. In their statistical meta-analysis of hurricane evacuation studies, Huang, Lindell, and Prater (2016) find that, when comparing the role of gender in evacuation behavior with other factors, official warnings, living in a mobile home, or peer evacuations are stronger predictors than gender. Mean correlations with evacuation behavior are: official warnings (.034), mobile home residency (0.28), peer evacuations (0.3), and having female gender (0.06).

Evidence from developing countries is scarce, but studies highlight additional factors that are important for evacuation behavior. For example, Das (2019) and Haque (1995), investigating evacuation in India during Cyclone Phailin in 2013 and Bangladesh during the 1991 cyclone, indicate that poor conditions for women in cyclone shelters might be an important factor driving female household members to stay home. They also find that fear of looting is an important factor keeping families from evacuating; but in this case, men tend to stay behind to protect the property. Lavigne et al. (2008) report the same for volcano disruptions in Indonesia. Alam and Collins (2010) and Alam and Rahman (2014) report that, while women in cyclone-affected communities in Bangladesh might have the intention to evacuate, they depend on male household members to do so, following the cultural the norm.

2.1.2 • Early warning

The different methods men and women use to access early warnings to natural disasters are linked to access to technology. There has been significant progress in establishing and improving early warning systems in developing countries, convincingly attributable to the implementation of the Hyogo Framework for Action.

The significant increase in cellphone use and mobile internet services, including in more remote areas, have also improved access to early warnings. However, across low- to middle-income countries, women are 8 percent less likely than men to own a cellphone, and 20 percent less likely to use mobile internet services (Rowntree and Shanahan 2020). The gap is widest in South Asia, where these figures increase to 23 and 51 percent respectively. Several studies confirm the gender gap in accessing information and communication technologies in developing countries (Rashid 2016; Suresh 2016; Wyche and Olson 2018) but have not systematically explored the gap in access to early warnings and the implications for disaster risk preparedness. There is also a knowledge gap around the way different communities and populations receive, process, digest, and respond to early warning information, and specifically how men and women respond and react to different early warning messages.

2.2 • Coping capacity: access to finance, livelihood, migration, and social protection

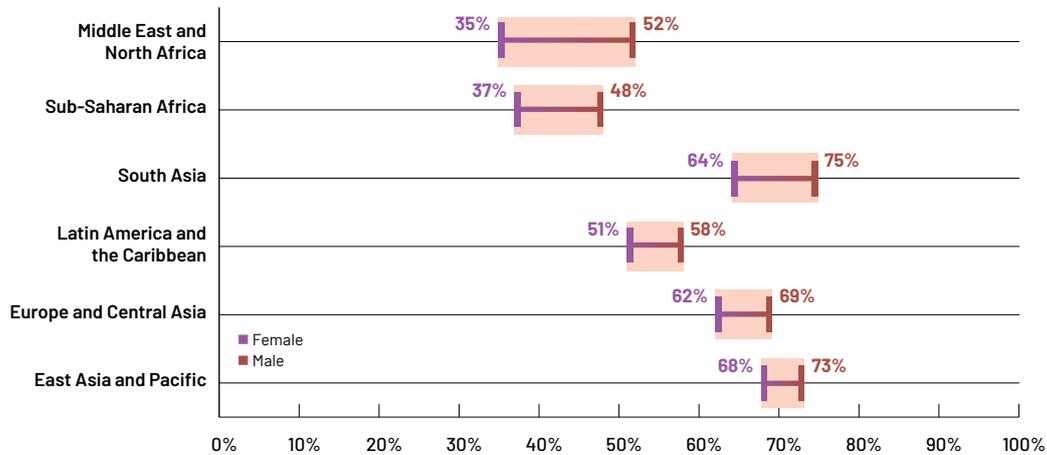
When a household is affected by a disaster, the availability of coping mechanisms that can support them to withstand income shocks, protect or diversify their livelihoods, or adapt to new conditions will determine their ability to recover. Coping mechanisms include access to finance, government support, the ability to switch income sources, and adaptation through migration. Some studies assess the effectiveness of such mechanisms at household level. Erman et al. (2019, 2020) find that access to both informal and formal finance sources seems to help households in Dar es Salaam, Tanzania and Accra, Ghana recover from flooding. Looking at the effects of drought in rural Kenya, Wineman et al. (2017) find that credit availability and access to different sources of income seem to reduce households' chances of falling into poverty after a low rainfall shock. Arouri, Nguyen, and Youssef (2015) find similar results in Vietnam, where greater credit availability enabled households to better cope with the effects of natural disasters.

But while household lending can help absorb smaller shocks, it is not enough for more severe disasters. Assessing the impact of rural floods in Malawi, McCarthy et al. (2017) find that holding a savings account and having access to non-agricultural income sources were mostly ineffective in mitigating the impacts of floods. Government aid can support recovery with adaptive social protection and other postdisaster support (see [Section 4](#)). Finally, migration can help households recover or adapt (Coniglio and Pesce 2015; Kubik and Maurel 2016; Nawrotzki and DeWaard 2016; Berlemann and Tran 2020).

2.2.1 • Access to finance, savings, and assets

The ability to save and access a bank account helps households protect their assets from disaster impacts, but the gender gap in banking is significant. The use of savings is a common coping mechanism to recovery from a disaster. In Ghana, after the devastating flood of 2015, 43 percent of affected households used savings as the primary way to cope with impacts (Erman et al. 2020). Having access to a bank account is important to protect savings from disaster impacts. In Dar es Salaam, households that reported they had not recovered from a recent flood were 27 percent less likely to hold a bank account than those that had recovered (Erman et al. 2019). The authors also find clear differences between male- and female-headed households in Dar es Salaam, with the former being 18 percent more likely to have access to a formal bank account and 25 percent more likely to practice saving. According to the *Global Findex Database*, the gender gap in bank account ownership is 9 percent in developing countries, but there is significant regional variation ([figure 2.1](#)).

Figure 2.1 • In every region, men are more likely to own a formal bank account



Source: Demirgüç-Kunt et al. 2018.

Formal sources of finance—such as bank lending and insurance—can support household recovery after a disaster. However, in many developing countries, formal sources can be difficult to access or unavailable. For example, the *Global Findex Database* finds that only 8 percent of people in sub-Saharan Africa had borrowed from a financial institution or used a credit card in the previous 12 months (Demirgüç-Kunt et al. 2018). Similarly, Erman et al. (2019) find that only 4 percent of residents in flood-prone Dar es Salaam own insurance that covers disaster damage.

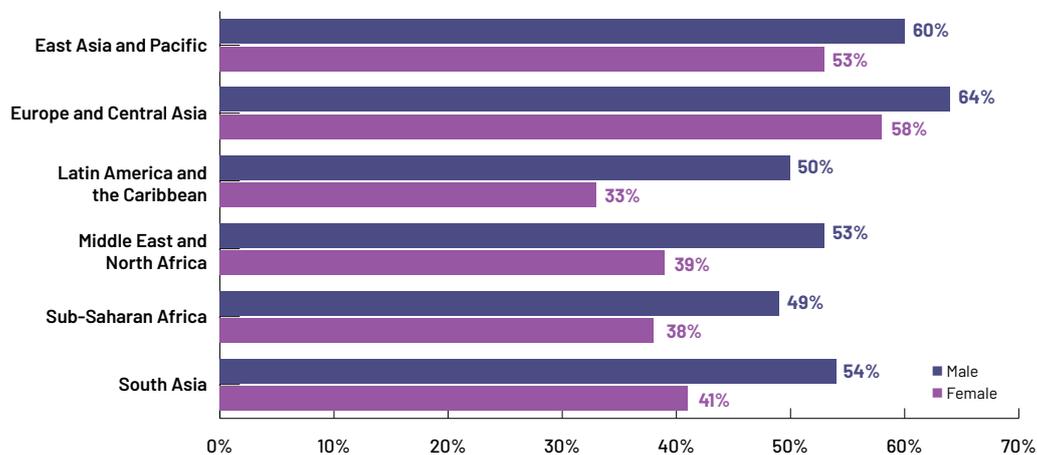
People are therefore more likely to rely on informal tools, such as loan sharks, community savings groups, remittances, and small-scale lending among friends and family. These are instrumental in recovering from income shocks, including disaster exposure. Access to informal finance was identified as an important driver of recovery from flood exposure in Dar es Salaam and Accra (Erman et al. 2019, 2020). For those affected by Cyclone Nargis in Myanmar, community-level credit access was one of the most important drivers of recovery (Kostner, Han, and Pursch 2018).

However, credit only helps people recover from less severe events. When a bigger disaster happens, community savings groups and other informal finance sources can quickly run out of money, so they tend not to cover disaster impacts (Erman et al. 2019). The risk of debt traps and predatory lenders can also cause families to lose their livelihood if they cannot pay back loans. In Myanmar, the effects of Cyclone Nargis continue to be reflected in elevated debt burdens for certain livelihood groups, such as farmers, 10 years after the shock, with some farmers forced to sell or pawn their land and fishermen to sell their boats to escape debt traps (Kostner, Han, and Pursch 2018).

Women tend to rely on informal finance more than men, which can make it more difficult for them to access funds in case of a disaster. In the developing world, men are on average 22 percent more likely to have borrowed from a financial institution or used a credit card than women in the past year; in high-income countries, they are 7 percent more likely to do so (Demirgüç-Kunt et al. 2018). Carlsson Rex and Trohanis (2012) find that poor women frequently face more barriers in accessing credit or insurance than poor men. They point to women’s lack of collateral due to gender gaps in land ownership and more unstable labor arrangements, and to their lack of access to information. Emerging as an alternative to traditional banking, the microfinance industry has helped bridge the gender gap in access to credit, by lending smaller amounts with less stringent pre-conditions.

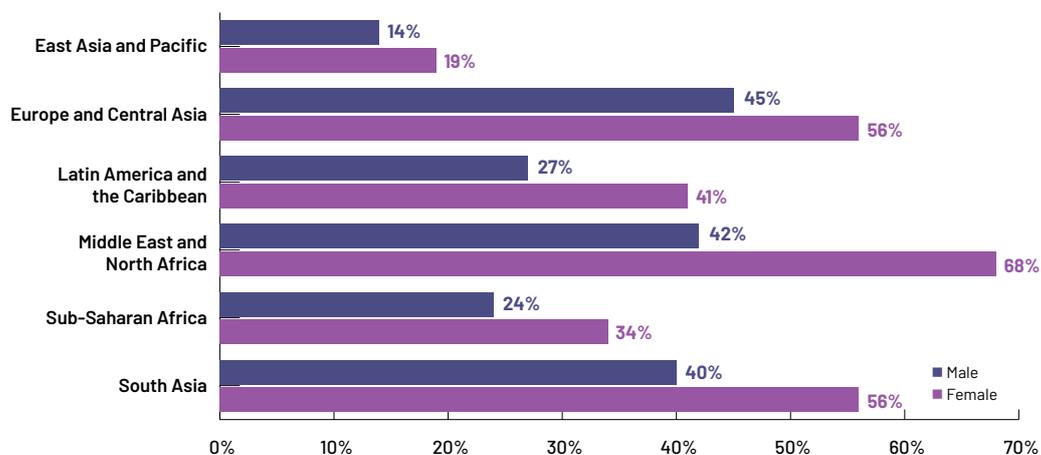
In 2013, the microfinance community reached 211 million clients, of whom 75 percent were women (Reed et al. 2015). However, even within the microcredit industry, female applicants tend to face harsher credit rationing and are granted smaller loans than men (Garikipati et al. 2017). The *Global Findex Database* assesses men’s and women’s capacity to obtain emergency funds, defined as the ability to access 1/20 of gross domestic income in local currency within a month (Demirgüç-Kunt et al. 2018). Women’s capacity to do this is generally lower than men’s, with some regional variation (*figure 2.2*). When looking at the sources of emergency funds, *figure 2.3* shows that women are much more likely to obtain funds from friends and family, while men are more likely to earn the money. Although microlending has shown to be effective in promoting recovery (Erman et al. 2019, 2020), overrelying on informal finance sources may make women particularly vulnerable to disasters. In Dar es Salaam, for example, only 15 percent of savings group members report that their group covers damages from flooding (Erman et al. 2019).

Figure 2.2 • Gender-differentiated access to emergency funds, by region (2017)



Source: Demirgüç-Kunt et al. 2018.

Figure 2.3 • Gender-differentiated access to emergency funds from friends and family, by region (2017)



Source: Demirgüç-Kunt et al. 2018.

Note: Figure only shows respondents who said they can access emergency funds.

2.2.2 • Assets

Selling off assets to cope with the impacts of disasters can help households recover, and women tend to own assets that are conducive for consumption smoothing. As discussed in *Section 1.3*, women hold a larger share of their assets in movable form, including jewelry, gold, and livestock. These are easier to sell in times of hardship than immovable assets, such as land and dwellings (Vonderlack and Schreiner 2002). For households, selling assets to cope with shocks is a last resort. Quisumbing, Kumar, and Behrman (2018). But it is common practice, especially among women (Frankenberg, Thomas, and Smith 2003). In Bangladesh, Quisumbing, Kumar, and Behrman (2018) find that, once they had experienced flooding, both wives and husbands accumulated jewelry, indicating that shocks prompt precautionary saving. Since assets conducive to trading make up a much larger share of women's wealth than men's, selling them to cope with shocks can have severe consequences for women. The authors also find that in Uganda, where women's assets make up a small share of total household wealth, wives' assets decrease when the household is affected by drought, while husbands' assets remain unchanged. In some of these cases, women are not involved in the decision to sell. Doss et al. (2018) find that, among households responding to shocks³ in Karnataka (India) by selling assets, jewelry was most frequently sold. Despite jewelry often being the most important asset for women in Karnataka, only 15 percent of these sales were made by women alone. Forty percent were made by men, and 45 percent were made jointly. In contrast, they find that in Ghana, most of the assets sold in response to a shock (mostly livestock)⁴ were individually owned and sold by the respective owner.

Women tend to face more insecure tenure arrangements and land ownership, making them less resilient to shocks. Secure tenure and land ownership makes it easier to move when a place of residence is increasingly exposed to floods, because people can use land titles as collateral to access cheaper finance in postdisaster situations. Globally, women own just 20 percent of land (UNDP 2016), which is often held in the name of the male household head. In Dar es Salaam, Tanzania, Erman et al. (2019) find that female-headed households are overrepresented among households with insecure tenure arrangements and among those directly affected by flooding.

2.2.3 • Livelihoods

Informal and insecure labor is associated with a lower capacity to recover from flood exposure (Erman et al. 2019, 2020). In Accra, households that depend on casual labor as the primary source of income tended to have lower capacity to recover from the 2015 flood. In Dar es Salaam, breadwinners of households with low recovery capacity were more likely to be self-employed. This could be because self-employment in certain contexts is more likely to take place on the street or at home, which could delay postdisaster recovery if the house or neighborhood is severely damaged. Informal employment, which is not declared in official social security records, can also affect access to legal protection (minimum wage) and governmental support (unemployment benefits, health insurance). However, informal and casual labor may also be more flexible and adaptive than formal employment. This is especially so in the event of a larger shock that disrupts formal supply chains and damages industries. For example, Akter and Mallick (2013) find that households dependent on ad hoc, informal labor recovered their income quicker than other households in postcyclone Bangladesh, especially when such work was available close to their homes.

In low- to middle-income countries, women are more likely to work in the informal economy⁵ and face more insecure working arrangements than men, putting constraints on their coping capacity (ILO 2018). Globally, women are three times more likely to be (mostly unpaid) contributing family workers. Women in the informal sector also face under-employment: 14 percent work fewer than 20 hours a week; in Africa, the Americas, and Arab states, this reaches

20 percent (ILO 2018). As a result, women in the informal sector tend to earn less than men and face more insecure labor arrangements, particularly in low-income countries. This means they have lower capacity to accumulate the savings and assets that could help them cope with disaster losses.

Differential unemployment rates between men and women in a postdisaster situation can be a consequence of the ease or difficulty of finding employment. While the evidence is anecdotal, Delaney and Shrader (2000) find that men and women in Nicaragua and Honduras suffered employment losses equally in the immediate postdisaster period, but that women's re-entry into the waged labor market was much slower. Enarson (2000) suggests that women's flexibility to re-enter the labor market is lower because they take on the "triple duty" of income generation, "disaster work"—including emergency response and political organizing—and the lion's share of childcare and caring for the elderly.

Frequent exposure to disasters can contribute to the arbitrariness of women's employment arrangements, which limits resilience. Dar es Salaam is highly exposed to seasonal flooding and residents in high-risk areas allocate significant time to repairing, protecting, and cleaning their houses during the rainy season. In focus group discussions with residents, Erman et al. (2019) found that households in high-risk areas always try to ensure at least one adult is home to protect assets, as when the water comes, it can be unexpected and quick. They note that women tend to take on this role, perhaps driven by increased domestic obligations of women in this context (Ilahi 2000). This limits women's ability to undertake more profitable and secure wage labor outside the home.

Gender inequality places women in a disadvantaged socioeconomic position, which is reinforced by exposure to natural hazards, making it even harder to sustain and respond to future shocks. The negative feedback loop between gender inequality and disaster risk is particularly pertinent to labor, since source of livelihood is a determinant of both severity of disaster impact and recovery capacity, and discrimination against women in labor markets is well documented (ILO 2020).⁶

A household's ability to increase time allocated to labor after a shock increases its capacity to recover. Larger households are associated with better capacity to recover from flooding impacts (Erman et al. 2019), since they have more people that can help in times of need. Consequently, female-headed households face a disadvantage because they are generally smaller in size than male-headed households. Women are also often constrained through their domestic duties, leaving them with less time for paid labor when needed (Koolwal 2019).

2.2.4 • Migration

Migration can be an adaptation strategy for coping with disasters (Delaney and Shrader 2000; Enarson 2000; Wiest 1998). In postdisaster situations, people migrate to find better economic opportunities and restore their livelihoods. It is often a last-resort strategy, which people use when there is no other option.

Men are more likely than women to use migration as an adaptation strategy. Gray and Mueller (2012b) show that severe droughts in Ethiopia increase male (usually long-distance) mobility from 5.7 to 9.8 percent a year. The opposite effect is found among women, whose mobility—mainly short-distance and marriage migration—is reduced from 8.3 to 5.5 percent due to drought. Sugden et al. (2014) find in Nepal and India that 87–99 percent of people using migration as a permanent or seasonal adaptation strategy are male. Gentle et al. (2014) link migration to adaptation in Nepal, finding that a rise in climate-related disasters in Lamjung

District led to higher male out-migration, increasing the share of female-headed households from 15 to about 26 percent between 2001 and 2011.

In some cases, however, women are more likely to migrate. Evidence from Bangladesh suggests that moderate (5–20 percent) flood exposure at subdistrict level leads to increased short-distance mobility within the district, primarily among women and the poor (Gray and Mueller 2012a). They find no effect among men, households with higher expenditure levels, or for long-distance mobility. They also find that crop failure in the subdistrict affecting more than 5 percent of the population—often the result of drought—is associated with an increase in both short- and long-distance mobility. This holds true for men and women of all income groups, though the increase is larger among women. However, the authors do not state whether this is long- and short-distance migration. Interestingly, they find that direct household exposure to flooding has no effect on mobility, while direct exposure to crop failure has a negative effect, indicating that when households suffer directly, it may increase labor needs locally or remove the resources needed to migrate.

While male out-migration can have negative effects on the women who stay behind by increasing their responsibilities, it can also offer opportunities. In Mali, women who are left behind by male out-migration are expected to take on more responsibilities with fewer resources (Djoudi and Brockhaus 2011). But by transforming household power dynamics, male out-migration can have positive implications for women’s voice and agency (Le Masson et al. 2016). In places as diverse as Benin and Mexico, Dah-gbeto and Villamor (2016) and Radel et al. (2012) find that male out-migration increases women’s decision making in land use and agriculture.

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Endnotes

1. The authors measure disaster preparedness in terms of taking one or more of the following measures to prepare for a possible earthquake or tsunami during a high-alert period: no preparation; keeping a close watch of the situation; preparing survival kits; planning evacuation procedure and emergency plan with household members; inspecting the house structure; and other preparations.
2. On average, 11 percent of women and 14.8 percent of men in Thailand have completed lower secondary school only; 12.4 percent of women and 15.5 percent of men have completed lower and upper secondary school (UNICEF).
3. The most-reported shock was natural disaster (67 percent); other shocks were included.
4. In Ghana, crime and accidents were the most reported shocks (38%). Natural disasters were the third most common, at 10 percent.
5. In low-income (lower-middle) countries, 92 (85) percent of employed women and 88 (83) percent of employed men are in informal employment.
6. Women do more hours of unpaid care work, are less likely to be engaged in paid work, earn less than men and are more likely to be underemployed (work fewer hours).

Data gaps in disaster risk management

To understand the underlying gender dynamics of disaster risk and therefore design appropriate policies, the first step is ensuring data collection is disaggregated by sex and age. Over the last decade, there has been significant progress in collecting better and more sex- and age-disaggregated data (SADD). However, large gaps still exist, especially when it comes to the impact of natural disasters on gender. By 2014, 190 countries were collecting statistics on women's representation in government (up from 167 in 2005), and the number collecting data on intimate partner violence rose from 44 to 89 in the same period. But the number of countries reporting sex-disaggregated data on the impact of natural disasters remains low.¹ Disaster fatalities still tend to be recorded in terms of overall numbers rather than disaggregated by sex and age (Eklund and Tellier 2012).

Even when disaggregated data are collected, a gap remains between collection and analysis, hindering critical decision making in humanitarian response (Benelli, Mazurana, and Walker 2012). Differences in methods, concepts and definitions used in statistics hinder comparability across countries and time, and as most analyses linking gender to natural disasters are based on qualitative or small-scale quantitative studies, they cannot be extrapolated to a whole society or across countries. This section provides insight into disaster data collection practices and their limitations and identifies data gaps.

3.1 • Postdisaster data collection

The first response to a major natural disaster is from the humanitarian sector, and the focus is on saving lives, limiting damages and restoring order (GFDRR 2015). During this phase, organizations and governments conduct rapid, preliminary assessments, using sector-specific methodologies and tools, to identify immediate needs.

Building on these preliminary assessments, a postdisaster damage and needs assessment (PDNA) often follows. Originally focused on quantifying losses and damages from natural disasters, PDNAs have evolved into an “integrated framework for assessing disaster effects and impacts on all sectors” that is broadly used to assess disaster impacts and determine priority recovery interests and needs (Jeggle and Boggero 2018).

PDNA data collection relies on primary and secondary data sources and uses various collection methods. Primary data are gathered in the project area through postdisaster surveys, focus group and community discussions, one-on-one in-depth interviews, and so on, as well as follow-up surveys and regular program monitoring and evaluation (Rex et al. 2012). Secondary data sources—such as government censuses, administrative records and registries and regular household surveys—provide a baseline on which to build primary data collection.

3.2 • Limitations of postdisaster data collection

One major limitation of postdisaster data collection is its overreliance on data captured at household level. Driven by time and budget constraints—and perhaps also by a lack of knowledge—most postdisaster surveys are done at household level, asking questions only to the household head. Postdisaster assessment also relies on secondary data on poverty, measured by income or consumption, which does not usually consider redistribution within the household. There may also be limitations in terms of the questions asked. Surveys tend to measure housing damage and agricultural land loss, but often do not record smaller household losses. This includes kitchen appliances and sewing machines, which are usually used by women, in timesaving and income-generating activities. It is also reasonable to assume that, if owned by women, these smaller, high-value assets make up a significant share of their total assets. Losing them may have significant consequences for their welfare; so it is important to record and better understand such losses (Bradshaw 2013; Bradshaw and Fordham 2013).

There is recognized tradeoff between the urgency to obtain information, the time burden for respondents, and the quantity and quality of data in postdisaster surveys. The urgency to rapidly assess disaster impacts and implement relief measures increases time pressure. PDNA guidelines indicate that data collection should take 6–12 weeks, but in practice it is often done in 3–4 weeks (Jeggle and Boggero 2018). Shorter exercises rely more on secondary data, fewer field visits and less accurate and comprehensive information on social parameters and household impacts. Financial constraints mean that postdisaster surveys are usually a one-off exercise. Repeated postdisaster data collections, capturing long-term impact of a disaster, are a rarity. The longitudinal 10-year postdisaster study in Myanmar after Cyclone Nargis is a clear exception (Kostner, Han, and Pursch 2018).

Practicalities, such as a lack of trained data collection personnel—including, in some contexts, female employees who are willing to travel and interview other women—hinder data collection and analysis (Benelli, Mazurana, and Walker 2012). A general misunderstanding about the scope of SADD and generational analyses might also pose a burden on SADD collection. In other cases, it is simply not possible to access areas hit, as has been the case, for example, during the COVID-19 pandemic. And when face-to-face surveys are replaced by phone surveys, they run the risk of excluding the share of population without phone access. In some contexts, there is a large gender gap in phone access and ownership. In addition, some phone survey efforts (including the latest World Bank COVID-19 high-frequency survey) are deliberately targeted at household heads, thereby generating biased data.

Past PDNAs reveal that data collected on social and human development are not disaggregated and/or consistent enough for trend analysis. In some cases, baseline data are not available in the disaster-affected area. Collecting SADD is rarely integrated within the national statistical strategy; rather, these data tend to come from ad hoc or one-off exercises. As a result, they tend to be out of date and inconsistent, making it difficult to monitor trends. For example, only 24 percent of available gender-specific data is from 2010 or later and only 17 percent is available for two or more points in time (UN Women 2018). Even when national-level SADD exists, they are usually not granular enough for analysis at a geographical level that would be meaningful in the context, such as areas affected by disaster, which could be a mid-size city, or several villages or municipalities.²

While household surveys are used extensively to develop baselines and assess postdisaster needs, they often fail to include certain populations such as homeless people, migrants or those living in areas that are hard to reach due to conflict or natural disaster. In many countries, little information is collected on people with disabilities or from racial, ethnic, or religious minorities

(UN Women 2018). Countries often do not invest enough in gender statistics, do not collect data on a frequent basis and lack the expertise or willingness to collect data on often sensitive issues, such as sexual orientation, gender identity, indigenous status, and HIV status (UN Women 2018). Such country-level data gaps hinder comparisons of pre- and postdisaster conditions of the population as a whole (Eklund and Tellier 2012; Goyder et al. 2005).

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Endnotes

1. United Nations. Moving Forward on Gender Statistics. <https://unstats.un.org/unsd/gender/dataWW2015.html>.
2. Nationally representative data tend to be on national, urban/rural, second administrative tier, and capital city levels.

Policy recommendations

Gender inequality exacerbates vulnerability to disasters, and policies that consider gender dynamics will mitigate disaster impacts more efficiently. Experts in disaster risk reduction may ask themselves what a piece of gray infrastructure—such as a drainage canal—has to do with gender inequality. The answer is that even seemingly gender-neutral public good investments will be influenced by gender dynamics, as intracommunity and intrahousehold power relations can affect who gains access to a public good. For example, people will only benefit from cyclone shelters if they know where they are and when to use them. Gender dynamics often mean that women lack access to technology and the networks where this kind of information is shared. It is also important to design the shelters so both men and women want to use them. The shelters will not be as efficient in mitigating disaster impacts if women are less likely to use them than men and end up in harm's way of the cyclone as a result.

This section focuses on a set of policy actions that mitigate gender-differentiated impacts of natural disaster, either by addressing gender gaps in exposure and vulnerability or by strengthening resilience. **Table 4.1** provides an overview of policy actions that mitigate the gendered disaster impacts discussed in this report. They are organized by main determining factor as identified in the conceptual framework (**figure I.1**), and by timing within the disaster cycle (pre, during, or postdisaster). Policies that do not depend on the disaster cycle or that can be implemented at different stages span across all or several stages of the disaster cycle. The policies recommended here are indicative, and do not replace the need for a local gender gap assessment before deciding on policy action. As shown in **table 4.1**, most policies cannot be considered until a local assessment has been done (indicated with a dot); others can be considered everywhere and anytime.

1. Accessible safety measures and training

Policies that could lower mortality in disasters depend on who tends to die. When more men die in disasters, which is the case in most high-income contexts, it tends to be because they are overrepresented in rescue work. In such contexts, increased safety measures and training of civil protection agencies are policy options to consider for lowering the death rate. In low-income countries, more women tend to die in disasters than men, and socioeconomic factors are the main contributors. To improve disaster risk management and save more people in such contexts, governments and agencies need to assess the barriers that prevent women from accessing and benefiting from preventive and emergency response resources. They must ensure women have access to training, receive early warnings and know what to do in case of an emergency, and that shelters and camps are safe and responsive to women's needs.

2. Social protection

Governments can use social protection to mitigate the human development impacts of disasters on children, considering gender dynamics to maximize benefits. Where there is a risk that parents will prioritize boys when resources are scarce, social protection can efficiently mitigate human development impacts. Countries may consider conditional cash transfers, to ensure resources are used in a way that benefits all household members. Conditional cash transfers are generally not linked to the disaster cycle, but can be used to scale up support in postdisaster situations. **Box 4.1** offers an overview of the role of social protection in building resilience and how governments can use it to mitigate differentiated impacts of disasters on women and men, girls and boys.

Table 4.1 • Policy actions to mitigate differentiated impacts of disasters for men and women, boys and girls

Before disaster	During disaster	After disaster
EXPOSURE AND VULNERABILITY		
Improve safety of civil protection agencies, with training and equipment [●]		
Ensure shelters are safe, with working lights, women-only bathrooms and spaces, enough space for all, and so on		Build back better, consider addressing pre-disaster gender gaps when rebuilding infrastructure and services [●]
Prevent the negative child development impacts of disasters, with conditional cash transfers [●]		
Meet women's health needs in first response, shelters, and camps, with menstrual hygiene kits, and pre-natal, pregnancy and lactating care		Promote joint ownership in housing reconstruction programs and land administration systems [●]
Mitigate sexual harassment in aid delivery by increasing female presence in aid, using pre-determined time slots for aid pick-up to avoid overcrowding, strengthening supervision, reporting mechanisms and accountability		Special assistance plans and programs for women, children, elderly, people with disabilities, and other marginalized groups in housing reconstruction programs [●]
Land and housing titles to promote women's ownership rights [●]		
Ensure women's representation in civil protection, humanitarian aid, community outreach, and policy making, from community to international levels by hiring more women (creating an attractive and inclusive work environment), and investing in capacity building for women already on the job [●]		
Channel disaster response resources via community and women's groups [●]		
PREPAREDNESS		
Use social protection to address specific preparedness needs [●]		Build back schools and other public buildings to function as multipurpose shelters, ensuring they are functional spaces for all populations [●]
Review legal, regulatory and disaster risk management planning framework for gender gaps		
Community early warning, disaster preparedness, and response training [●]		
Community sensitization on evacuation plans, ensuring women provide and receive community planning and outreach [●]		
Use existing social protection providers, trainings, community groups and beneficiary networks to inform preparedness action and disburse early warning information [●]		
Ensure early warning messages are adequate and reach all affected people, including women and other vulnerable marginalized populations [●]		Ensure a system is in place to capture SADD and information on gaps, opportunities and lessons learned in prevention, preparedness, and coping [●]
COPING CAPACITY		
Support financial inclusion by switching government payments from cash to digital [●]		
Social protection to support income diversification and savings with cash transfers, support for savings groups, trainings, and so on [●]		
Adaptive social protection to help mitigate adverse coping behavior, and (in some cases) domestic violence [●]		
Childcare provision at public works [●]		

Improves both

Notes: Policy actions are organized according to recommended timing of intervention (horizontal). Color coding reflects the outcome that the policy is aimed to improve, a dot [●] indicates whether a local assessment is needed prior to action.

3. Female representation and participation

Increasing female representation in disaster risk management and civil protection agencies helps legitimize and support women's contributions to disaster risk reduction and resilience. Women have long been involved in planning, preparing, and responding to disasters at community level, with little recognition. Providing women's groups with training, resources, and the authority to engage in preparedness and emergency response would strengthen their position in the community and ensure more women get disaster preparedness and response information. To be sure emergency and reconstruction resources support inclusive recovery, a proportion of funding could be channeled to community centers and similar facilities used mainly by women. Increasing the presence of women in civil protection and humanitarian and government disaster response can help decrease the prevalence of gender-based violence. Programs also tend to perform better when women are involved, because they usually better identify women's and children's needs and, in some contexts, can reach other women more easily.

4. Building back better

Disaster recoveries are opportunities to build back in a way that breaks down the constraints faced by women. For example, replacing damaged streetlights with solar powered lights, which are more reliable where outages are common, would make streets safer for women after dark. Housing reconstruction programs improve women's tenure when the housing they rebuild is jointly titled in both partners' names. They also ensure that women who lose a partner and female-headed households get legal rights to land and housing. In the aftermath of the 2004 tsunami, Indonesia's Reconstruction of Aceh Land Administration System Project introduced the option of jointly registering land, significantly increasing the proportion of titles issued jointly from 4 percent to 45 percent in four years (World Bank 2015a).

5. Community involvement

Involving communities—and particularly women—in channeling preparedness and early warning information is crucial. To avoid establishing a new network of community organizations, governments could use existing networks, such as social protection systems (*box 4.1*). After a disaster, reconstruction can strengthen preparedness, by, for example, turning schools and other public buildings into multi-purpose shelters that can be used in future disaster events. It is important to ensure the design of these structures is informed by local consultation, and that they provide a safe and comfortable environment for all.

6. Knowledge and data

To create better policies that work for all people, collecting data on gaps, opportunities and lessons learned on preventing, preparing for, responding to, and recovering from disasters is crucial. In most contexts, collecting information on ethnic minorities is also essential. For comparability and to facilitate knowledge accumulation across countries, postdisaster data collection and assessments should—where possible—be predefined and share a common framework across agencies, regions, and countries. The PDNA framework, commonly used to assess disaster impacts, is an excellent starting point for this.

7. Local gender gap assessments

As already mentioned, these recommended policies do not replace the need for local assessments to identify the gender gaps and barriers that make natural disasters particularly harmful for certain populations before policy agendas are set. Anticipating that governments will carry out local assessments, this report suggests relevant questions in the context of gender dynamics of disaster impacts. Although it is more general, parts of the World Bank's Gender Strategy (2015b) can also inform gender gap assessments.

Building resilience with social protection

An increasingly important policy for the World Bank portfolio, social protection supports preparedness and coping capacity by providing in-kind or monetary assistance to households or employment opportunities in public works programs.

It also plays an important role in helping countries and people address disaster vulnerability, build resilience, and manage shocks (Monchuk 2014). Social protection programs, typically managed by the government, can support resilience in several ways, including:

- » **Financial inclusion of the most vulnerable households** through digital transfers, access to bank accounts, or mobile transfer services
- » **Promoting income diversification and female labor participation** through work and income opportunities
- » **Smoothing consumption** and averting the adoption of negative coping mechanisms through postdisaster financing
- » **Supporting preparedness and adaptation practices** by coupling support with early warning information and disaster preparedness training

When using digital transfers, social protection programs promote the financial inclusion of unbanked populations, and in some cases, directly help households set up bank accounts, as part of enrollment. Of the 140 million account owners globally who opened their first bank account to receive government transfers, 57 percent are women and 54 percent are in the poorest 40 percent of households (Demirgüç-Kunt et al. 2018). Kenya's Hunger Safety Net Program increased coverage of households with bank accounts from almost zero to over 90 percent in four of the country's poorest counties, by providing bank accounts to the over 300,000 households that enrolled in the program (Bowen et al. 2020). The program provides regular transfers to 100,000 of the poorest enrolled households, while additional transfers are triggered in the event of a drought shock (NDMA 2015).

Regular and reliable support to poor households can help them diversify livelihoods, increase

investments in education and health and accumulate savings to manage shocks (Monchuk 2014). Social protection programs can be effective in mitigating differential impacts of disasters on men and women. For example, India's Targeted Rural Initiatives for Poverty Termination and Infrastructure Program (TRIPTI) offset the disproportionate negative impact of Cyclone Phailin on women's consumption and had a similar effect on expenditure on children's goods (Christian et al. 2019). Mexico's conditional cash transfer program PROGRESA helped offset the negative impact of natural disasters on girls' school enrollment (de Janvry et al. 2006). Even when mitigating disaster impacts is not an explicit objective, social protection, if designed appropriately, can help address the underlying drivers that result in differentiated impacts of disasters for men and women, boys and girls.

Public works programs typically build community assets—such as irrigation systems—that promote resilience. But they can also support women's labor participation (World Bank 2014), infrastructure development and land rehabilitation to mitigate the impact of drought or flooding, and support natural resource management, serving both participants and non-participants. For example, Ethiopia's Productive Safety Net Program (PSNP) creates community assets, such as water points, that help reduce women's time burden and encourage women's participation by offering more flexibility and community day care services (Jones, Tafere, and Woldehanna 2010). Other programs use quotas to promote female participation—for example, India's National Rural Employment Guarantee Scheme reserves one-third of all positions for women.¹ SADD are not available for many public works programs in Africa. In those that do provide data on female participation, the average is 46 percent.²

Adaptive social protection (ASP), which governments can scale up before or after a disaster to address additional needs, provides a cushion for affected households, and can be particularly important for women. ASP programs typically include a mix of cash transfers, in-kind support, public works, and other services (Bowen et al. 2020; table B4.1.1). They typically have two components: a constant component,

BOX 4.1

usually focused on livelihood diversification and productivity, and an adaptive component that scales up support in connection to disasters, to help recipients avoid negative coping mechanisms, such as taking children out of school or decreasing food intake.

Preliminary results from an impact evaluation of the Sahel Adaptive Social Protection Program find that 18 months into the program, beneficiaries (95 percent of whom are women) were more likely to earn money from non-agricultural businesses compared to control groups (Bossuroy et al. forthcoming). Evidence on the effects of the PSNP in Ethiopia finds that the program's cash-for-work component and direct transfers to chronically food-insecure populations help families smooth food consumption patterns, facilitate school enrolment, and provide basic necessities, which can help mitigate some of the differentiated effects of disasters on men and women (World Bank 2010). Female beneficiaries also reported receiving greater respect within the household and community.

Many public works programs consider gender in their targeting and design. For example, most World Bank-funded public works programs

include a female quota; 30 percent of World Bank cash transfer programs target women exclusively (World Bank 2014); 95 percent of the Sahel Adaptive Social Protection Program beneficiaries are women; and 60 percent of Hunger Safety Net Program beneficiaries in Northern Kenya are women. However, there is no systematic review of gender-differentiated targeting practices in ASP programs and little evidence on ASP's role (particularly the adaptive components) in mitigating the differentiated impacts of disasters on men and women.

Finally, social protection programs can also provide systems for communicating early warning information, training and guidance on preparedness and adaptation, and directly informing preparedness action before a disaster. For example, beneficiaries of the 4Ps—the Pantawid Pamilyang Pilipino Program conditional cash transfer program in the Philippines—must attend monthly family development sessions, which include disaster preparedness training and offer information on how to recognize and address PTSD (Bowen 2015). The Sahel Adaptive Social Protection Program is working with ministries of finance to develop an early warning system methodology to identify and target the most food-insecure areas (World Bank 2018).

Table B4.1.1 • Social protection programs with adaptive components

Social protection program	Type of program and location	Adaptive mechanism
Hunger Safety Net Program	Direct cash transfer program in Northern Kenya	Scales up vertically and horizontally, based on observed weather-related shocks
Northern Uganda Social Action Fund	Seasonal public works program in northern Uganda	Scales up program based on observed weather-related shocks
Productive Safety Net Program	Public works and direct support in Ethiopia, part of the Food Security Program	Provides seasonal public work for the chronically food insecure and delivers additional assistance to people affected by shocks
Sahel Adaptive Social Protection Program	Cash transfers, training, and saving groups in Burkina Faso, Chad, Mali, Mauritania, Niger, and Senegal	Financial support to households affected by a shock based on predefined rules and triggers
Pantawid Pamilyang Pilipino Program (4Ps)	Conditional cash transfer program in the Philippines targeting the poorest households	Provides ad hoc support to poor households after natural shocks, such as Typhoon Yolanda
Temporary Immediate Employment Program (PETI)	A cash-for-work program in Mexico, part of Temporary Employment Program (PET)	Scales up engagements in areas affected by disaster

Sources: Ulrichs and Slater 2016, Pelham, Clay and Braunholz 2011, Ovadiya and Costella 2013

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Endnotes

1. There is limited evidence that female quotas are needed to assure female participation.
2. Authors' calculation based on (Monchuk 2014).

SECTION 5

Next steps

The strategy for mitigating differential disaster outcomes based on gender and improving results for all populations is to identify gender gaps that drive differential outcomes for men and women, and to identify policy actions to address or overcome those gender gaps. To enhance this agenda, governments and international organizations must enable the application of this strategy; this work can be organized around both analytical and operational priorities.

From an **analytical** perspective, there are challenges in identifying gender gaps, driven by a lack of both data and understanding of the channels through which gender dynamics can influence disaster impacts. By consolidating research and organizing it around a conceptual framework, this report contributes towards a better overall understanding of these channels. But it has also exposed important knowledge and data gaps.

Results in the report are primarily based on a set of case studies. One way to strengthen the evidence base in this area is to leverage global or regional data to scale up country- or subnational-level studies. For example, global historic disaster data could be leveraged to assess differential impacts of disasters on the long-term health consequences or educational attainment of boys and girls, following the methodology of country studies, such as Datar et al. (2013).

Some areas of interest for disaster risk management practitioners are understudied. For example, there is an important knowledge gap around how women and men receive, process, digest and respond to early warnings about disasters to build preparedness and understand discrepancies. Emerging new data and technologies are enabling new research that can help close important knowledge gaps. For example, the increasingly available mobility data from mobile phones provides an opportunity to understand evacuation behaviors, which can be linked to gender-based differences in access to shelters.

With good data, it is possible to develop an understanding of how disaster losses and postdisaster support are shared within a household, but collecting good data is both costly and time-consuming. An increasing body of research estimates resource allocation within households by combining household decision-making models with household survey data (Bargain, Lacroix, and Tiberti 2018; Brown, Ravallion, and van de Walle 2019; Cherchye et al. 2017; Bargain, Lacroix, and Tiberti 2014). Such methods could prove useful in understanding the role intrahousehold power dynamics plays in driving differentiated disasters outcomes for members of the same family. They could also be used to assess whether disasters can influence power relations inside the household.

The COVID-19 crisis has resulted in new challenges for development, including disaster risk management. Even as the public health and economic consequences of the pandemic continue to unfold, emerging research suggests that men and women are not affected equally (Cuesta and Pico 2020; Walsh et al. forthcoming). The pandemic has also complicated data collection, requiring innovative gender impact assessments that combine shorter phone surveys with pre-COVID-19 data sets, as used by GFDRR in its emerging analytical work.

Finally, enabling rigorous impact evaluations of policies and interventions in disaster risk management would help guide policy action and design while closing important knowledge gaps. Impact evaluations provide essential information on how an intervention affects different population groups, including women and children. Disaster risk management lags other sectors in undertaking rigorous impact evaluations, limiting innovation and insights into which policies and delivery methods best serve marginalized groups.

From an **operational** perspective, World Bank teams, governments and other relevant in-country actors need guidance on how to conduct gender gap assessments in disaster risk management. While this report can inform the design of gender gap assessments by providing a useful conceptual framework, literature and data sources, it cannot replace the need for local assessments. Agreeing a common framework will help achieve consistency in disaster risk management gender gap assessments—both in non-disaster and postdisaster times—would be an excellent starting point.

Three forthcoming or recently published regional reports on gender, social inclusion and disaster risk management will support the World Bank operational agenda:

- » Krylova et al. (forthcoming): a desk review comparing gender-responsive disaster preparedness and recovery efforts in the nine Caribbean countries
- » Limani et al. (forthcoming): covering 11 countries in Europe and Central Asia key, the report identifies gender gaps and opportunities for strengthening gender through disaster risk management operations in the region
- » World Bank (2021): focusing on social inclusion more broadly, the report covers five projects in five South Asian countries and pilots a set of project-specific Inclusive Resilience Action Plans, which identify practical entry points to enhance social inclusion for World Bank-financed disaster risk management projects.

Project teams and governments can use resources such as these to identify relevant gender gaps and understand how gender dynamics influence outcomes of natural disasters.

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