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Behavioral insights to increase disaster preparedness and emergency response actions in Sri Lanka

A behavioral informed diagnostic

July 2021

Acknowledgments

Contents

0. Executive Summary

This document presents the findings of a behavioral diagnostic on enablers and barriers to preparedness and response decisions and actions among Sri Lankans following a behavioral approach. Sri Lanka is highly vulnerable to hazards, including floods, landslides, cyclones, storms, droughts, and high winds. Hazards cause losses that have long-lasting consequences. Although some of these consequences can be prevented**,** evidence from past disasters suggests a lack of community preparedness and slow response in the face of disasters. A behavioral approach focuses on underlying factors affecting decisions and actions among individuals, with particular emphasis on the interaction between structural factors and behavioral ones. This note focuses on understanding barriers related to the adoption of preparedness measures (preparedness) —and response actions (response) and identifies key entry points to enable people to prepare and respond in a timely manner to natural hazards.

The analysis presented is based on an extensive desk review, quantitative data, and preliminary primary qualitative data. Following a comprehensive desk review of existing literature and documentation of disaster preparedness and response behavior, an online survey was conducted between December 2020 and February 2021. A total of 1,426 completed all 30 questions included in the survey. Following the survey, four phone interviews were conducted with respondents who completed the English survey and agreed to be recontacted.

Findings from the diagnostics revealed and confirmed several barriers to preparedness and response decisions and actions. Vulnerable people protect themselves more and are more likely to follow EW instructions. Older respondents (55+) are an exception. They may have lower access to information than younger generations or may dismiss information due to more previous experiences. In terms of income and education, those with lower income or less education seem to be less likely to prepare and respond than those with middle incomes, perhaps due to the lack of resources or access to information. Interestingly, no positive effects are seen for those in the upper end of the income brackets. In their case, wealth might trigger a sense of overconfidence or optimism bias. Social factors are strong determinants. Those who believe few people or none around them behave positively are less likely to adopt measures or evacuate. How the information is framed, the content, the channel, the messenger, and the timing of messages have been shown to have an effect on preparedness and response behaviors. For instance, impact-based messages trigger more positive intentions compared to forecast-based. Communication channels that are seen as more immediate (e.g., social media, sirens, television) fare better than delayed ones (e.g., newspapers). Finally, a lack of trust in the government's ability to predict the weather has a strong negative effect on adopting protective actions.

Five main policy recommendations are provided to improve the adoption of preparedness and response decisions and actions. Two recommendations are focused on communications, both to increase preparedness awareness and actions and behavioral responses. Strategies include designing targeted messages for specific groups, simplifying the content of the messages, making them more action-oriented, and identifying appropriate channels. To increase the adoption of preparedness measures specifically, we recommend well-designed monetary schemes to help the poorest deal with the financial resources needed to get prepared. To ensure a resilient future, we recommend activities with youth and children. Finally, given that the most vulnerable may struggle to evacuate, detailed mapping and regular evacuation drills with this population are suggested.

Behavioral Diagnostic Note

Behavioral insights to increase disaster preparedness and emergency response actions in Sri Lanka

1. Introduction

Natural hazards are common in Sri Lanka. The country is highly vulnerable to hazards due to its low elevation and high dependence on natural resources. The most common hazards are floods and landslides (caused by heavy rains), followed by cyclones, storms, droughts, and high winds (UNDRR, 2019). In addition, the country experiences significant threats from extreme heatwaves. While tsunamis are infrequent, the impact can be devastating when they happen (e.g., the 2004 Indian Ocean tsunami). Most of the country is exposed to natural hazards. For example, droughts affect most of the country, but other hazards see regional variations. Flooding following monsoon season affects the Southwestern, Eastern, Northern, and Northcentral provinces the most. The Southern inland regions are part of the 20 percent of the country area considered vulnerable to landslides (DMC, 2016), while coastal areas are at risk of tsunamis (CFE-DMHA, 2021).

Climate change will continue increasing extreme weather events' frequency and intensity. During the last decade, the frequency of these events has increased, and the future projections are discouraging. For instance, the World Bank indicates that nine out of 10 Sri Lankans may live in areas that could become moderate or severe hotspots in terms of floods or droughts by 2050 (World Bank, 2018). An increase in intensity for extreme rainfall events is likely, and the projected changes are expected to impact the poorest and most marginalized communities most strongly, exacerbating poverty and inequality (World Bank; Asian Development Bank, 2020).

Losses caused by disasters are high and have long-lasting consequences. According to the Climate Risk Index (CRI), Sri Lanka ranked as the 2nd most-affected country globally in 2017, and it ranked 23rd for the period between 2000-2019 (Germanwatch, 2021). The CRI measures exposure and vulnerability to extreme weather events, including fatalities and economic losses. Between 1990-2018, estimates indicate that damages reached a total of $ U.S. 7 billion (UNDRR, 2019). Hazards affect property and loss of lives and people's livelihoods (e.g., assets, livestock, and crops), severely hurting small business owners and farmers, especially the poorest. In addition, key drivers of the Sri Lankan economy, such as tourism, commercial agriculture, and manufacturing, are vulnerable to extreme weather, and this threatens the country's gains in economic growth and poverty reduction in the last decades (CFE-DMHA, 2021).

Evidence from past disasters in Sri Lanka suggests a lack of community preparedness and slow response in the face of disasters (MoNPEA; MoDM, 2016) to be among the barriers faced in disaster resilience. Efforts by the Sri Lankan Government on disaster risk management (DRM) have focused on warnings and insurance against losses, among others. In 2005, the Disaster Management Act was established, along with the National Council for Disaster Management (NCDM) formulation and its operative office, the Disaster Management Centre (DMC). In 2010, the National Disaster Management Policy (NDMP) was adopted, acting as the primary governing system for managing disasters (UNDRR, 2019) (see Box 1 on Disaster Risk Management (DRM) context In Sri Lanka). Since then, actions such as establishing a risk

insurance program, improvements in disaster response infrastructure, and others have taken place. Several efforts have focused on improving Early Warning Systems (EWS) to ensure that Sri Lankans receive a timely early warning (E.W.).

Box 1: DRM context in Sri Lanka

Operating model. Figure 1 sets out the governing structure of the NCDM, which includes a wide range of stakeholders for DRM decision-making that are then managed and implemented by the DMC. The DMC acts as the centralized stakeholder for all DRM. Their responsibilities can be broken down into three areas: mitigation, preparedness, and emergency response. Among their core responsibilities are coordination, direction, and monitoring the preparation of disaster preparedness and response plans; promotion of public awareness on disaster management; and E.W. dissemination.

Figure 1. Governing structure of the NCDM
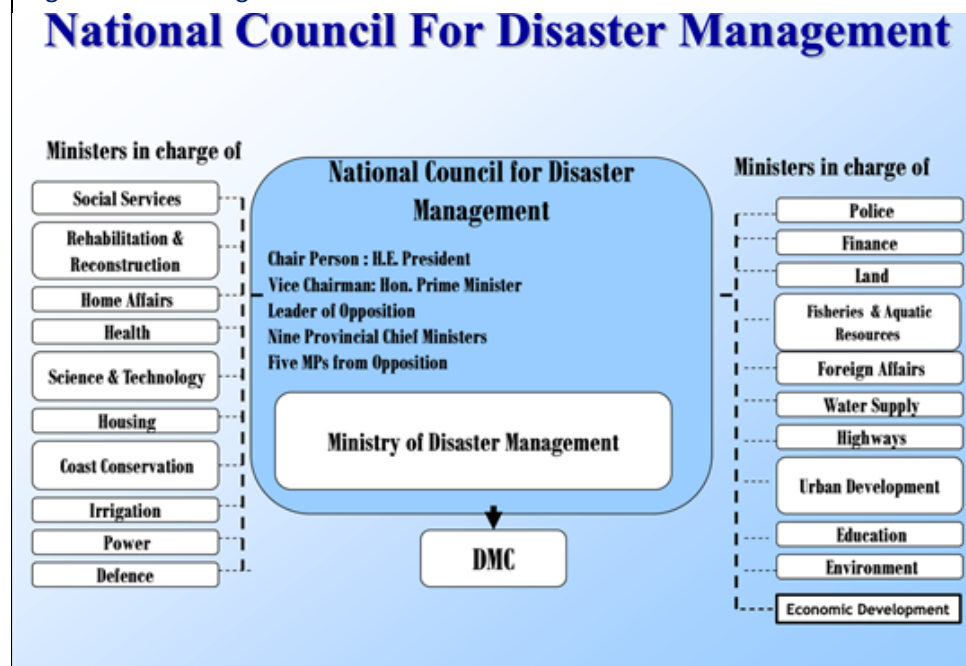
Source: Sri Lanka Disaster Management Centre (dmc.gov.lk)

EWS process. Although it varies depending on the type of disaster, it is the DMC's responsibility to coordinate with different government bodies. Haigh et al. (2020), through a series of interviews with stakeholders within the Sri Lankan government, have developed an estimated framework of what the E.W. response process is for tsunamis.[1] Figure 2 illustrates the process. In this example, the Department of Meteorology (DoM), acting as the National Tsunami Warning Centre (NTWC), first receives information and warnings from the California Integrated Seismic Network (CISN). The DoM then confers this information with that from the United States Geological Survey (USGS) and with earthquake messages from the Indian Ocean Tsunami Service Providers (TSP). At the same time, the Sri Lanka Geological Survey and Mines Bureau (GSMB) will also analyze information from its regional centers to further understand the location, depth, and magnitude of the seismic activity. The DoM utilizes information and analysis from all these sources to

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[1] Note that the EWS process for each disaster type was unclear. The team was able to find the EWS process for tsunamis from Haigh et al. (2020), who had to conduct a series of interviews with public officials to develop a framework.

determine whether to issue a tsunami warning bulletin to the DMC.[2] The DMC then issues the warning and evacuation orders through multiple channels to national and local stakeholders, including the media and the District Disaster Management Centres (DDMCs), that will then disseminate the information to the general population through different channels (Haigh et al., 2020).

Figure 2. Overview of the EWS structure in Sri Lanka for tsunamis

| CISN, TSP, and USGS | → | DoM (acting as the NTWC) | → | DMC | → | Media and DDMCs | → | General population |

Source: Own elaboration based on Haigh et al. (2020)

This note aims to understand, through a behavioral approach, the main barriers that limit preparedness and response decisions and actions among Sri Lankans. The goal of the diagnostic work was to identify key entry points to improve EWS and enable people to prepare and respond on time to natural hazards. A behavioral approach focuses on underlying factors affecting decisions and actions among individuals, with particular emphasis on the interaction between structural factors (e.g., programs, infrastructure, etc.), and behavioral ones (e.g., psychological (beliefs, mindsets), cognitive, emotional, cultural, and social factors that affect people's decisions and actions). For example, across different domains, research has shown that simply receiving information does not necessarily translate into action (Thieken et al., 2007; Miceli et al., 2008). The way the messages are framed, the content, the channel, the messenger, and the moment the person receives the messages are all relevant factors that influence people's decision-making and actions. Similarly, biases and mindsets may cause individuals, communities, and organizations to under-protect themselves against low-probability but high-consequence events such as hazard-related disasters. In particular, this note focuses on understanding barriers related to the adoption of preparedness measures (preparedness) — i.e., actions taken to increase one's ability to respond when a disaster occurs — and response actions (response) — i.e., actions carried out immediately before, during, and immediately after a disaster impact.

The analysis presented is based on an extensive desk review, quantitative research, and preliminary primary qualitative data. A comprehensive desk review of existing literature and disaster preparedness and response behavior documentation informed the planned data collection. Following on that and adapting planned research to COVID-19 related restrictions to conduct data collection, an online survey was conducted in two rounds: the first pilot round took place during December 2020, and the second main round took place during February 2021.[3] A total of 37,514 respondents completed at least one question of the online survey, but only 2,223 respondents completed the 'core' set of 17 questions of interest, and 1,426 completed all 30 questions included in the survey. This report focuses on the complete

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[2] This decision is guided by the specifications provided by UNESCO and the Indian Tsunami Early Warning Centre, which suggests a warning should be made if the magnitude of the earthquake is greater than 6.5, the depth from the epicenter is less than 100km, and that it is nearshore or offshore of the Indonesian region or Makran Zone (DMC 2015).

[3] Details on the data collection process and methodology are in appendix 1.

set of responses. Following the survey, four phone interviews were conducted with respondents who completed the English survey and agreed to be recontacted.

The diagnostic note is structured in four main sections. Section two describes the main framework guiding the study. Key findings from the diagnostic are described in section three. Finally, section four concludes with key entry points to improve EWS and enable people to prepare and respond to natural hazards.

2. Framework and literature review

The study framework builds on elements of the three main models within the literature that have been developed to better understand both the process that individuals go through when deciding whether to adopt protective action, as well as common decision-making biases that apply across topics and are related to underinvestment in future protective actions by an individual, the community and organizations. The three models are the Theory of Planned Behavior (TPB), Protective Action Decision Model (PADM), and protective motivation theory.

As noted in the introduction, the report covers both disaster preparedness and response. The term protective action will be used as an umbrella term to include both preparedness measures (preparedness)- i.e., actions taken to increase one's ability to respond when a disaster occurs-, and response actions (response)- i.e., actions carried out immediately before, during, and immediately after a disaster impact.

1. Theory of planned behavior

One of the most popular generalized psychological models of behavior, the TPB, attempts to link beliefs to behavior by focusing on three components; attitude, subjective norms, and perceived behavior control (Ajzen, 1991). Applied to protective action, these components can be understood as:

- **Attitude:** This refers to how the individual perceives the behavior and its outcome and whether they are viewed favorably or not. E.g. Will protective actions lead to a positive outcome?
- **Subjective norm:** Whether an individual's peers view the behavior favorably and whether they adopt the behavior themselves. E.g., Are other people in the community adopting protective actions?
- **Perceived behavioral control:** This relates to the concept of perceived self-efficacy of the individual and how capable they think they are to execute a behavior. E.g., Does an individual feel like they can successfully implement the protective action?

All three of these components interact with one another and form intentions that are assumed to lead to the behavior, although it is essential to note that intentions do not necessarily lead to behavior changes. Interventions to promote protective actions, based on TPB, therefore need to encourage people of the desirability of protective actions while highlighting the skills and means to implement them (Najafi et al. 2017).

Figure 3. Model of Theory of Planned Behavior (Ajzen 1991)

Theory of planned behaviour
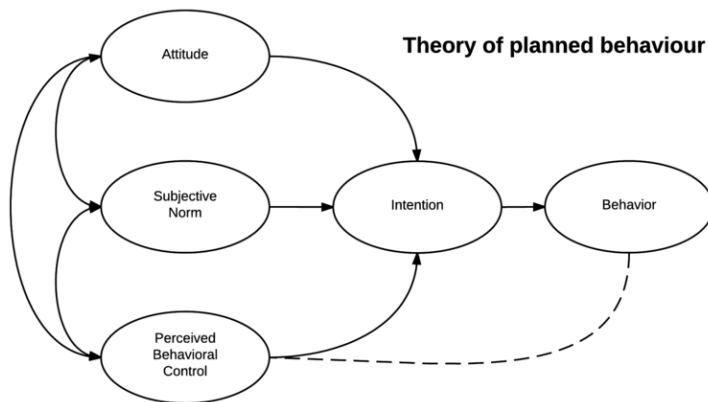
2. Protective action decision model

While TPB has been widely adopted due to its generalizability and flexibility, it lacks domain specificity in understanding protective action. Expanding on TPB, Lindell and Perry (2011) proposed the PADM, which breaks down the process of decision making about protective action and highlights the various components that can affect it:

- **Environmental and social context.** This refers to the physical and social environment cues that make an individual aware of an impending hazard event. This might be an E.W. message from the government, or it might be physically seeing the environmental cues of a natural disaster such as the funnel cloud of a tornado. The source and content of these cues can play a crucial role in triggering the subsequent stage.
- **Psychological process**. Once aware of the potential disaster, the individual goes through three stages of information processing (i) *Pre-decision processes*, which entails processing the external cues; (ii) *Perceptions of threats, protective actions, and stakeholders*, which entails interpreting the threat itself as it interacts with internal perceptions and understandings of threat, interpreting the actions that need to be adopted (similar to TPB's attitude component), and interpreting what other people (e.g., peers, experts or authority figures) are doing; (iii) *Protective action decision making*, which combines the information and perceptions of the previous two stages to develop an internal assessment and action plan for protective action.
- **Situational impediments and facilitators.** Finally, the actual implementation of the behavioral response depends not only on the individual's intentions but also the conditions of the physical and social environment that can impede or facilitate the behavior, e.g., lack of transport to an evacuation shelter. The degree to which the individual controls these factors may vary.

Figure 4. Protective Action Decision Model (Lindell & Perry 2011)
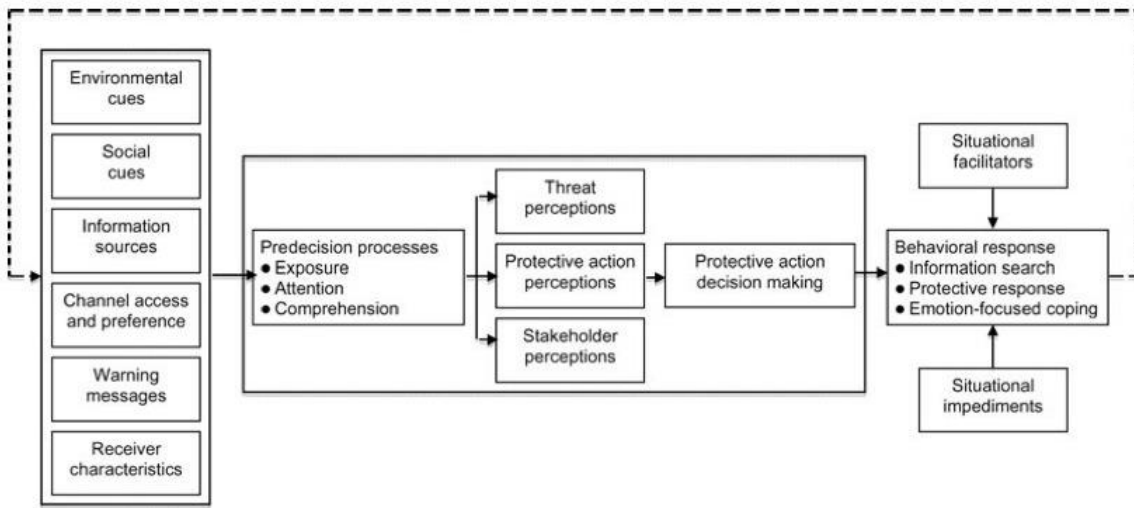
3. Protective motivation theory

This model was initially developed to understand the mechanisms and effectiveness of using fear messages to change people's behaviors (e.g., cancer threats to discourage smoking). The model consists of two paths of emotional assessments that help to determine the likelihood of behavior change. The first is threat assessment, which balances the degree and probability of harm from a threat with the reward or positive aspect of pursuing unhealthy behavior (e.g., the probability of getting cancer balanced against the reward of the pleasure of smoking). The second is the coping assessment, which balances one's self-efficacy and the efficacy of the solution behavior with the physical or psychological cost of the solution behavior (e.g., how effective quitting smoking would be in avoiding cancer and the level of confidence one has in their ability to quit balanced with anxiety that may come from quitting smoking). While it has mostly been applied in the context of personal health, it has also been applied to the adoption of protective action (Botzen 2019; Babcicky & Seebauer 2019).

Figure 5. Protective Motivation Theory (Rogers 1983)
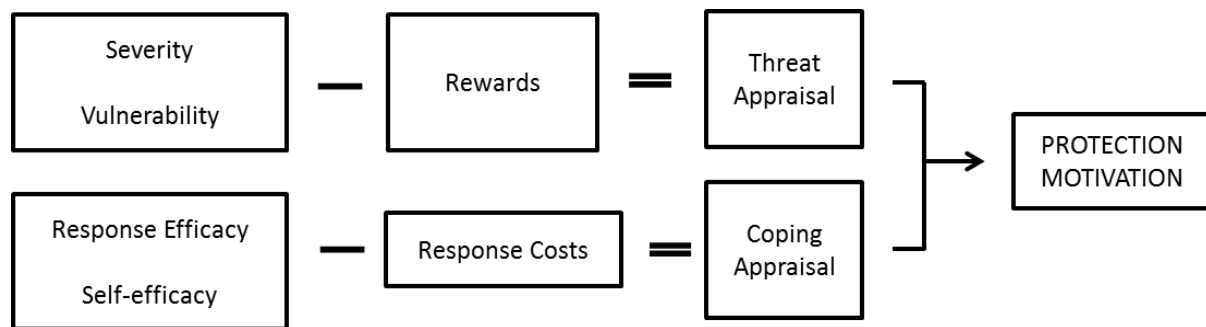
All three models have common or overlapping concepts that contribute to understanding how individuals make decisions for both preparedness and response actions. These models guided this diagnostic work, particularly in terms of assessing the social environment, past experiences and perceived risks, and their relation with subjective and motivational elements. These models focus on the processes and interactions of elements. One prominent factor across all models is self-efficacy, or the belief that one can implement protective action.

Combining these models with common decision-making biases that cause individuals, communities, and organizations to underinvest in protective action helped us identify four main assumptions that guided the diagnostic work to identify behavioral factors affecting protective action in Sri Lanka. These are:

Assumption 1. Previous experiences of disasters affect one's likelihood to prepare for future events. Past experiences are typically integral to help guide us for future actions. However, individuals often struggle to correctly calculate probabilistic outcomes, leading to a biased weighting of those past events. For example, Lindell and Hwang (2008) found that people who experienced floods were much more aware of the threats than those who had not experienced floods. Furthermore, the size of damages incurred by the individual from the disaster positively correlates with the amount of preparedness adopted (Stojanov et al., 2015). This relates to the availability heuristic: an individual's ability to recall a recent event—the availability of an event in one's mind—could also skew a person's perception of the likelihood of it occurring again (Tversky & Kahneman 1974). Larger, more dramatic events are likely to be more salient or present in one's mind, and thus people may overestimate the risk from it, while smaller, less dramatic, but maybe more frequent events get underestimated. However, this effect dissipates as more time passes between events, irrespective of the event's severity.

Assumption 2: Changes in the personal context and structural elements can affect risk preferences and risk assessment. When it comes to structural elements, certain factors have been found to affect the likelihood of adopting protective action. This includes, owning a car, having children or other people to care for, household income, or more precisely, the affordability of the protective action (Sarwar et al. 2018; Lindell & Hwang 2008). These structural barriers can interact with cognitive barriers. For example, having a child or significant other typically lowers one's risk tolerance, disrupting the effects of optimism bias or inertia explained below (Ghassemi et al. 2020). By extension, having pets or livestock could also motivate preparedness but might limit response behaviors, mainly if it entails evacuating without the means of transporting or housing the animals. Relatedly, having a car could increase one's sense of self-efficacy when it comes to evacuating.

Assumption 3. Behavioral biases may reduce preparedness levels for some, including those not exposed to disasters or those who experienced dissonance between expected severity and actual severity. Although behavioral biases are likely to affect the whole population, they are likely to more negatively impact those who have not experienced a disaster or who have experienced dissonance between expected and actual severity (i.e., expectation and preparation for a severe disaster that does not materialize). These biases include:

- **Gambler's fallacy:** This bias suggests that if a particular event has occurred frequently in the past, it is less likely to occur again in the future, and vice-versa (Tversky & Kahneman 1974). This means that if someone has recently experienced a disaster that does not regularly occur, i.e., a 1-in-100 year event, they may believe that they are safe because another event will not occur for a while, even when there is the same probability of that event occurring again the following year.

- **Peak-end-rule**: This bias suggests that people judge an experience mainly on how they felt during the peak or the end of the event, based on their memory, rather than based on the sum or average of every moment of the event (Kahneman et al. 1993). Therefore, the slow and gradual recovery from a disaster may erroneously lead people to believe that the disaster may not have been too bad, thus leading to less motivation to adopt protective action.

- **Pluralistic ignorance:** Related to social norms, this bias suggests that an individual will not prepare under the assumption that others are also not preparing and will pass a negative judgment if someone were to do so (Miller and McFarland 1987). In this case, if a person does not think that others are adopting preparedness measures, it may limit their tendency to do the same. The same is true in taking protective action: If individuals think and/or know that everyone else has adopted a behavior or that everyone thinks a behavior is good, this increases the likelihood that they would adopt it themselves.

- **Optimism bias:** This bias causes individuals to wrongly believe that they are less likely to experience a negative event (Sharot 2011). This occurs for different reasons, from having a strong desire of the end state (e.g., not being affected by disasters and not needing to put in the effort of adopting preparedness measures) to simply enjoying believing in the self-enhancing notion that only positive events will happen. Optimism bias is especially powerful when not adopting protective action is much easier than the effort of doing so. This is known as inertia and plays a decisive role in discouraging people from taking costly action when the status quo is much easier or cheaper (Gal 2006).

Assumption 4. Protective action behaviors are affected by the type, source, and format of information received and our ability to process and act based on that information. Aside from lack of access to EWS, which can prevent individuals from processing the severity of the disaster itself, thus leading to a reduction in immediate response, other factors related to information are at play:

- **Education and awareness** regarding disasters and their impact have been assumed to play a critical role in determining the adoption of protective action, especially regarding preparedness (Raajamkers et al. 2008; King 2000). However, some studies have shown that an increase in knowledge and information does not necessarily correlate with increases in protective action (Thieken et al., 2007; Miceli et al., 2008). This might be because knowledge and awareness do little to overcome the negative effects of some of the cognitive biases discussed above, or because individuals may use information about the dynamic nature of the disaster to evaluate for themselves when and whether to evacuate (Sarwar et al. 2018).

- **Trust** in the source of information also plays a critical role in determining protective action. For example, commentary from an individual's social or political group regarding the validity of messages can have detrimental effects. In a study looking at evacuation behavior in the U.S. during Hurricane Irma in 2017, researchers found that conservative media dismissals of hurricane advisories led to conservative voters being 10 to 11 percentage points (pp) less likely to evacuate than liberal voters (Long et al. 2020). For the same disaster, in a survey of people affected by Hurricane Irma in 2017, respondents suggested that they trusted text alerts and radio reports significantly more than information from social media (Parker et al., 2018).

- **Social media**. With growing interconnectedness brought on by the rise of social media, the role of social networks and thus social influence on behaviors is critical in predicting the likelihood of adopting protective action (Widener et al., 2013). Individuals may validate the information they receive through their social networks to determine whether to act upon it or not. It is important to note that validation also occurred before social media. However, social media allows for a quicker and easier way to validate. There are additional social media challenges for validating beliefs and information, e.g., echo chamber, prevalence, and sharing of misinformation.

- **Information framing and overload**. When too much information is made available, people tend to pay attention to only a few factors selectively they deem relevant (Schwenk 1984) and thus negatively affecting their likelihood to act. Additionally, while it is often assumed that fear is a

strong motivator, more recent research of protective action sugges that framing messages as threats (fear) is more strongly associated with non-protective action (Babicky & Seebauer, 2019). E.g., overwhelming risks and fear make people avoid negative emotions and responsible actions associated (Milne, Sheera, and Orbell 2000).

Findings in the next section will be organized according to these assumptions and corresponding decision-making biases. Based on the quantitative and qualitative data collected in Sri Lanka, we will assess whether these assumptions are present among Sri Lankans and identify specific behavioral and structural factors affecting protective action in Sri Lanka.

3. Disaster preparedness and emergency response barriers affecting Sri Lankans

This section reports the main findings of the primary data collection conducted in Sri Lanka between December 2020 and February 2021. The main objective of the data collection was to inquire about factors that enable or limit actions around preparedness measures and emergency response. As noted earlier in this report, preparedness measures are defined as the actions taken to increase the ability to respond when a disaster occurs. Response actions are carried out immediately before, during, and immediately after a disaster impact. These are aimed at saving lives, reducing economic losses, and alleviating suffering. The survey focused on understanding factors that influence the adoption of preparedness measures and two response actions, following E.W. instructions and following evacuation warnings.

The survey was conducted online between December 2020 and February 2021 by RIWI.[4] A total of 37,514 respondents completed at least one question of the online survey. Of these respondents, 5.9% (2,223) completed a subset of 'core' 17 questions, and 3.8% (1,426) completed the 30 questions of the survey. Findings in this section are reported for the sample that completed all 30 questions, allowing for a consistent analysis throughout different specifications.[5] Results are weighted based on age and gender to make the analysis more representative of the larger Sri Lankan population. Weights specifications can be found in Annex 1. In addition to the quantitative findings, complementary findings from the four qualitative interviews are summarized in Box 2.

1. Who answered the survey?

Table 1 summarizes the main demographic characteristics of the respondents. A bit over half of them are male, they tend to be 35 years of age or older (over 2/3 of the sample), and most have children living within their households. Respondents skewed more educated, with over 60% having post-secondary education. Although there are significant variations in the monthly income reported, only 23% of the

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[4] See annex 1 for details on the methodology and data collection.
[5] The main results presented remain unaltered when using all of the respondents. Results using the partial samples are available upon request.

households have incomes above the country's median.[6] More than half of the respondents rent the place where they live.[7] The vast majority of respondents (88.6%) live in the Western Province where the commercial capital, Colombo, is situated, followed by the Central Province (4.8%) and the Sabaragamuwa Province (2%).

Table 1. Summary demographic characteristics of the sample

Variable	Values	% of sample	Variable	Values	% of sample
Age	18-24	11.8	Monthly income[8]	Less than 10,000	23.3
	25-34	20.4		10,000-19,999	15.3
	35-54	38.4		20,000-39,999	22.5
	55+	29.4		40,000-59,999	16.1
Gender	Female	47.7		60,000-79,999	7.3
	Male	52.3		More than 80,000	15.6
Children in household	None	41.3	House tenure	Owned by household	43.4
	1-2	34.8		Not owned by household	56.6
	3+	23.9	Language of survey	English	28.2
Education	Primary or less	12.8		Sinhala	61.1
	Secondary	25.4		Tamil	10.7
	Collegiate or university	61.7	*N*		*1,426*

2. Who are the compliers and the non-compliers?

In order to assess who the typical compliers of our target behaviors are, we conducted a profiling analysis (Table 2).[9] Results indicate that those with higher education, median- income, and that report that either themselves or anyone in their families would experience additional challenges in case of evacuation (e.g., because of being sick, older, pregnant, or having a disability)- we will refer to them as 'the vulnerable' throughout this document- are more likely to report taking up preparedness measures while those living in the Western Province are less likely. Regarding following E.W. instructions, we find that those with higher education, with up to two children living in the household and that report that either themselves or anyone in their families would experience additional challenges in case of evacuation, are more likely to follow any E.W. instructions while those not owning their houses are less likely. Finally, for evacuation, we see that other factors are at play. While males are more likely to evacuate, those 55+ and those living in the Western Province are less likely.

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[6] The median household income per month in Sri Lanka was 43,511 LKR in 2016 in the Household and Expenditures Survey (HIES).

[7] This includes homes that are rented, rented but without themselves paying rent (paid by employer), encroached, or another form of rental.

[8] As of May 2021, 10,000 LKR is equivalent to 50.75 US$.

[9] Findings in this section are based on a simple multivariate OLS regression that includes basic household characteristics.

Table 2. Results from the profiling analysis

Reported behavior	More likely	Less likely
Take-up of preparedness measures	Educated (secondary +) Median- income Vulnerable: With challenges to evacuate	Living in Western Province
Follow E.W. instructions	Educated (collegiate or university) # of children in the household (1-2) With challenges to evacuate	Not owners of household
Evacuate	Males	Old (55+) Living in Western Province

3. Experience with disasters

Two-thirds of respondents have experienced at least one disaster in their lifetime. Their experiences are primarily with heavy rains and floods (34% of those having experienced a disaster). Only 28.9% report having been seriously affected by a disaster, including lost a family member, suffered a severe injury, or suffered significant financial loss. Figure 6 shows which disasters participants report experiencing the most during their lifetime and the disasters respondents are most concerned about. Regarding their concerns, participants are primarily concerned with floods/heavy rains, which is aligned with their experiences, followed closely by tsunamis. While tsunamis are of serious concern, respondents do not report experiencing them as often. Heat waves, on the contrary, seem to be of less concern compared to their reported frequency. Cyclones, landslides, and droughts do not seem to be experienced as frequently as heatwaves or floods/heavy rains, nor are they of serious concern.

Figure 6. Disasters most experienced vs. concerns
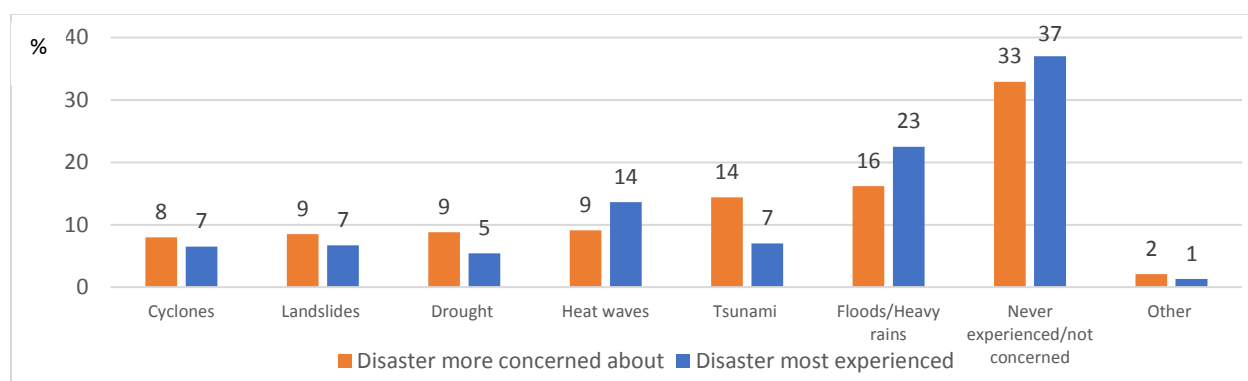
When asked about reasons for being concerned about disasters (respondents could select up to two), the top two reasons selected were fear of a) losing their lives or the life of a family member or b) losing access to public services such as roads, water, or electricity. Both reasons were selected by 26% of respondents.

4. Preparedness measures

Nearly 59% of respondents reported taking or having taken actions to protect their properties or families from the potential effects of disasters.[10] Among those that have taken preparedness actions, most (70%) are individuals who have a previous experience with a disaster, in particular floods/heavy rains. When asked about the main reason for taking actions (see Table 2, Panel A), the main drivers are protecting their families (35%) and protecting economic or work assets, including homes (22%). Notably, about 9% of respondents reported acting to protect themselves from disasters because the government told them to. Additionally, 6% indicated they protect their families and valuables because they believe their neighbors adopt them as well; this reason would indicate that "social cues" play a role in behaviors. Only 5% indicate that they take these actions because they are less expensive than the repairs needed in case of a disaster.

On the other hand, those that reported not taking any actions to protect their homes and family from potential effects of disasters identified lack of money (15%) as the top reason (see Table 3, Panel B). They believe that there is nothing they can do in the face of a disaster (13%),[11] that it is not that pressing (10%) or that they lack time to get prepared (6%). Other responses (all are below 5%) include forgetting, not having anything worth protecting, believing that repairs are not costly, and the result of previous experiences, i.e., not being worried about it because there was minor damage last time.

Table 3: Reported main reason for/against adopting preparedness measures

Panel A. Reasons to adopt measures (% of respondents)		Panel B. Reasons for not adopting measures (% of respondents)	
Protect their families	35	Lack of money	15
Economic/work assets, home	22	Nothing they can do	13
Government request	9	Not that pressing	10
The belief that neighbors do	6	Lack of time	6
Less expensive than repairs	5		
Other	23		

When asked about what would encourage them to adopt actions to protect their properties and families against disasters (respondents could select all that applied) (see Table 4 below), respondents indicated primarily that they would like to have more and better information. More concretely, the type of information respondents would like to receive are: which measures would protect their property and family the most (16%), which exact measures to take (15%), more certainty of the damage a disaster would cause (14%), and if they knew with more precision when the disaster would occur (12%). In addition, they

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[10] Although this is a high number of people declaring taking preparedness measures, it should be noted that these results are self-reported and thus subject to response bias. This bias occurs when the person responding to the survey is untruthful. This may happen because they know what the "correct" answer is. This indicates that actual actions taken may be lower than is reported. While the survey was online, though reducing the risk, which is higher in face-to-face interviews, we cannot know the impact this self-reported response bias may have on actions taken in reality.

[11] This can reflect learned helplessness or the belief about the inability to take action, albeit that action being possible.

also mention the availability of government funds (12%) and if they knew that other people were taking protective action (9%).

Table 4: Reported main motivators to adopt preparedness measures

Motivators to adopt measures (% of mentions)	
Knowing which measures would protect their property and family the most	16
Knowing which measures to take	15
Certainty of the damage	14
When the disaster would happen	12
Government funding	12
Information that others had taken measures	9
Other	22

5. Response actions

Only 66% of respondents reported ever receiving an E.W. message. Over 90% of those report following the instructions provided in the message.[12] When explicitly asked about the type of E.W. messages they had received, these include, for the most part, a message about being prepared or weather information (Figure 7). As shown in Figure 7, 30% of respondents identified specific actions included in the messages, such as staying indoors, avoiding specific areas, or a call for evacuation.

Figure 7. The main content of E.W. messages received
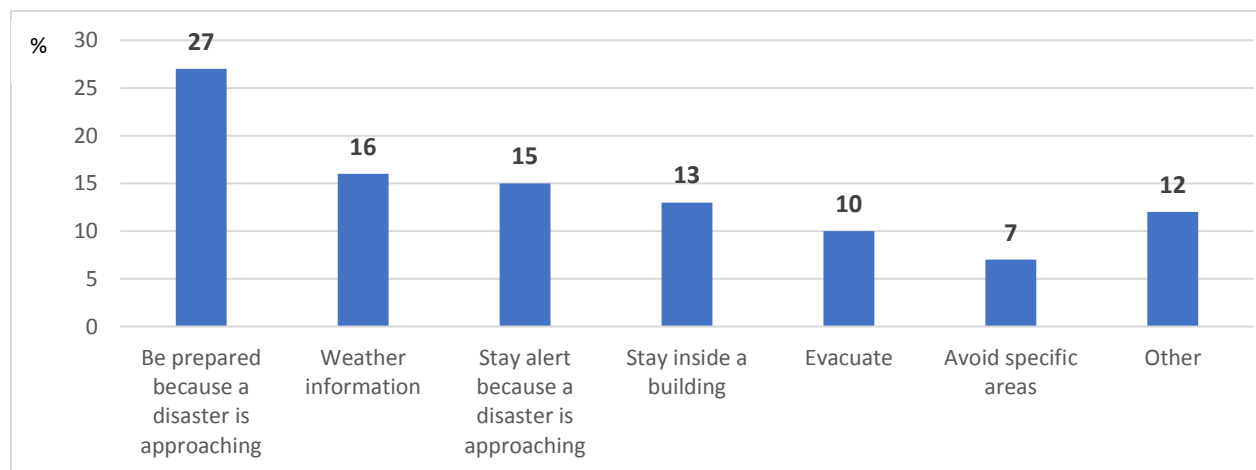
The top three reasons cited for acting in response to the E.W. messages (respondents could select up to two) were: trust in the government (e.g., "I always listen to what the government advises me") (18%), worries about their own family's safety (18%), and past experiences (13%) (Panel A of Table 5 includes all other reasons with responses above 9%). Among the top 3 reasons cited for <u>not</u> following instructions

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[12] The rate of following instructions could also be much lower because of response bias around self-reporting.

and acting in response to E.W.'s messages were: believing that others were not taking action (29%), thinking that the message was unclear (28%), and believing the message was irrelevant (10%).

Table 5: Reported reasons for/against following instructions in early warning messages (share of responses among those who reported receiving messages)

Panel A. Reasons to follow instructions (% of mentions)		Panel B. Reasons not to follow instructions (% of mentions)	
Trust in government	18	The belief that others did not follow	29
Concern about family's safety	18	Unclear message	28
Past experiences	13	Irrelevant message	10
Instructions were clear	12	Unable to follow instructions	9
Serious disaster approaching	11		
Feared sanctions	10		

When it comes to acting vis-à-vis an evacuation alert, 57% of respondents that had received such a message, reported either immediately evacuating or going home to collect their families and then evacuated, while 21% reported waiting to see if other people were evacuating first or to see how bad the situation got and not evacuating at all.[13] For the few that did report not evacuating at all (5%), the top four reasons cited for not evacuating were (respondents could select up to three); believing the message was irrelevant to them (13%), believing the evacuation shelter was unsafe (8%), a lack of information regarding where to evacuate (8%), and thinking God would protect them (8%).[14]

Among all respondents, 41.9% reported that, in case of evacuation, they would experience additional challenges evacuating because of physical, mental, intellectual, or sensory impairments or disabilities of themselves or family members (e.g., sick individual, older persons, pregnant women, other disability).

To support a future decision to evacuate, respondents indicated the following information needs (respondents could select up to three): how much time they have to evacuate before the hazard reaches their area (20%), clear instructions on what to do (e.g., where to go, when, with whom) (18%), a description of the consequences/impact of the upcoming disaster (14%), information about the shelter (e.g., location, supplies, amenities, safety), an estimated time of how long they would need to stay evacuated (10%), and access to transportation (5%).[15]

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[13] An additional 19% reported 'other'.

[14] Other reasons provided included: not trusting the source, not believing others were evacuating, believing the message was wrong, having family members that could not travel, did not want to leave assets behind, not having safe means of travel, and thinking it was too late to evacuate. 37% of responses were none of the above.

[15] An additional 19% of responses indicated 'other.'

6. Do our assumptions hold when it comes to behavioral barriers to disaster preparedness and response in Sri Lanka?[16]

Finding 1. In line with our assumption, Sri Lankans that experienced a disaster in the past are more likely to adopt preparedness measures. As previously stated, two-thirds of respondents have experienced at least one disaster in their lifetimes, such as tsunamis, floods, cyclones, landslides, droughts, or heat waves. Those who have previous experience with a disaster are 15.8 percentage points (p.p.) more likely to report taking any actions to protect their homes and families from potential effects than those who have never experienced a disaster (see Figure 8, Panel A). The effect is even greater (21.2 p.p.) when we look at those that have been seriously affected by disasters in the past (e.g., lost a family member, suffered a serious injury, or suffered a great financial loss) (see Figure 8, Panel B). Individuals who have experienced a disaster and are seriously affected by it may negatively remember the event and thus may get the motivation needed to invest in preparedness measures against future disasters. Many studies have shown that prior experience influences preparation decisions (Milch, Broad, Orlove, & Meyer, 2018).

Figure 8. Effect of previous disaster experience and being seriously affected on the adoption of preparedness measures[17]
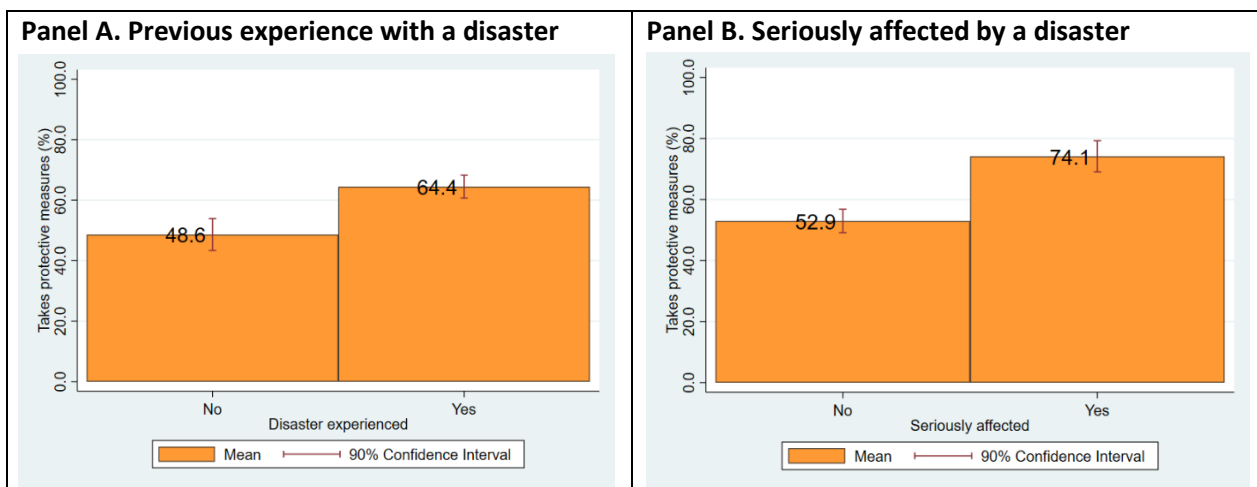
Finding 2. Several structural elements affect protective action behaviors: vulnerability, income, and education.

Vulnerability. As much as 42% of respondents report that either themselves or anyone in their families would experience additional challenges in case of evacuation.[18] Those reporting a vulnerability are 14.6 p.p. more likely to report taking actions to protect their homes and families and 7.3 p.p. more likely to report having followed E.W. instructions. However, the effect fades when enquiring specifically about evacuation (see Panels A&B of Figure 9). Those with a disability or living with someone with a disability

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[16] Findings in this section are based on simple bivariate OLS regressions. Results reported are the coefficient of interest along with heteroskedasticity-robust standard errors.

[17] The interpretation of Panel A of Figure 8 and consequent ones should be made as follows: On average, 48.6% of those who have not experienced a disaster in the past take preparedness measures compared to 64.4% of those who have experienced a disaster in the past. The difference between the two groups is statistically significant.

[18] Examples such as a sick, elderly, pregnant woman or having a disability were added to the question.

may have greater reasons to invest in preparing themselves for potential disasters. The logistics to evacuate, for example, are more complicated, and they have a more limited ability to respond at the moment without preparations.

Those with 1-2 children in the household are 5.6 p.p. more likely to follow instructions compared to those without children, probably driven by a need to care for them. Older respondents 55+ are 11.4 p.p. less likely to adopt measures than the youngest age group (18-24). One possibility is that young people, in addition to being more educated, have more access to social media and other information channels, which may play a key role in their engagement with protective actions, although its important to mention that this is already a biased sample given that the survey was online and thus older respondents in our sample had access to internet. Again, those 55+ are 14.7 p.p. less likely to report having evacuated when instructed compared to the youngest group.[19] This can be due to logistical hassles to evacuate for the older population compared to younger groups, past experiences driving their behaviors, and a stronger attachment to place and assets. In terms of gender, there are only significant differences regarding evacuation: males are 7.8 p.p. more likely to evacuate when asked compared to females. Although research indicates that women report being more willing to evacuate than men, women are usually less capable of doing so, given their traditional caretaking roles of children, the elderly, and those with disabilities (MacDonald R 2005).

Figure 9. Effect of having a vulnerability on protective action behaviors
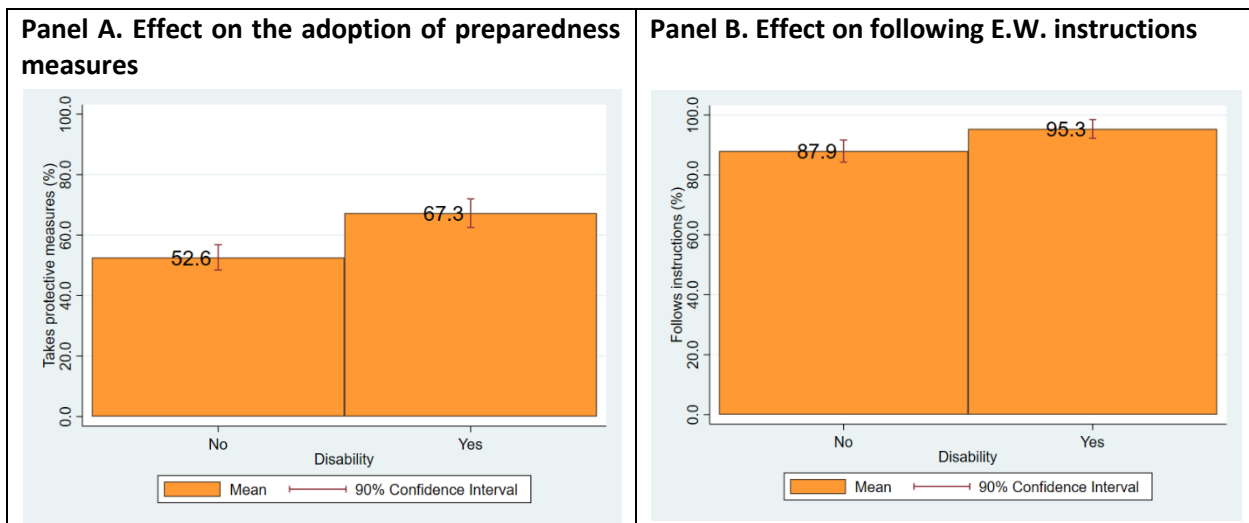
Income and education. People whose household monthly income is in the middle of the income range in the survey are between 12.4 p.p. and 18.2 p.p. more likely to adopt measures and 9.9 p.p. more likely to follow instructions compared to those with monthly incomes below 10,000 LKR. Similarly, those who do not own their house are 8.7 p.p. less likely to follow preparedness instructions than homeowners, although there are no differences in following evacuation actions. Impoverished communities are usually more vulnerable to climate-related shocks, and they also have fewer resources to prepare for disasters. Moreover, present bias could also be preventing long-term planning of preparedness decisions for this

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[19] For those 55+, the effect fades when looking at results that include the total sample.

group (see Box 2 on findings from qualitative interviews). Similarly, non-owners might be less interested in protecting the properties where they live.

In terms of education, respondents that reported secondary school or a collegiate/ university degree are 20 p.p. and 17.6 p.p. more likely to adopt measures, respectively, and between 14.1 (for those with secondary school) and 16.2 p.p. (for those with collegiate or university degree) more likely to follow instructions (these populations represent the bulk of the respondents in the sample). Interestingly, when it comes to evacuation, education does not make a meaningful difference in the likelihood to evacuate.

Box 2. Findings from qualitative interviews

Following the initial survey, respondents were asked if they would participate in a follow-up interview and if so, to provide their contact information. The objective was to explore their experiences and perspectives more in-depth regarding disasters in-lieu of a larger scale on the ground qualitative data collection.

Of the 234 respondents that provided contact information, four successfully responded to an invitation of interview. They were asked to answer eight questions via email or telephone. These four respondents came from different provinces (Western, Central, Eastern, and Northern provinces). All were male and lived with their families with children. Three of the respondents had experienced disasters firsthand, including two who experienced the 2004 Indian Ocean tsunami. Below we describe general findings around disasters and perceived barriers to low preparedness and response actions based on their responses.

General findings around disasters
- Perceived general lack of awareness and concern: While some people do not care at all and do not do anything to protect themselves against hazards, awareness and concern are perceived to increase for the most vulnerable; the sick, the elderly, and school-going children.
- Insufficient disaster mitigation measures, such as clearer signage near fast-flowing rivers, zoning, promotion of land-use practices such as soil testing before construction, planting more trees, and the implementation of building codes.
- Poor response rates to government warnings: There is a perception that the majority does not follow evacuation orders.
- Perceived high social cohesion: When in crisis, the community comes together to help each other, providing support such as shelter and aid. This might also reflect increased community awareness and a preparedness or response norm.

Perceived barriers contributing to low preparedness
- Lack of resources: Impoverished rural communities are less engaged with protective actions, in part due to a lack of education and awareness training, but also due to poverty and present bias preventing long-term planning of protective action. This is exacerbated by the fact that there is a lack of support (cash or in-kind) from the government to the poorest.
- Lack of access to information: There is a perception that people generally do not know how to protect their homes and families from hazards.
- Unclear information/enforcement: Imprecise guidelines and legislation that lead to unclear action plans and houses built on poor soil prone to landslides (lacking proper plans and licenses).
- Normalcy bias: People assume the best will happen because they do not want to think about more negative alternatives, leading to underestimating the likelihood of a disaster and thus not adopting protective measures. This is perceived to be prevalent in high caste populations with access to education. Pride, wealth, and status lead many to believe that they will not be affected, in addition

to the fact that privileged people have other properties/homes they could escape to if one home were affected by a disaster.

Perceived barriers contributing to low immediate response

- Lack of access to E.W.: There is a perception that E.W. does not reach everyone. For instance, younger generations are better connected to information online, and they are more connected to weather forecasts and thus are more engaged compared to older generations.
- Ineffective warning systems: A general perception that warnings and weather reporting from the government are inadequate, unreliable, inconsistent, and prone to disruptions. Moreover, the information is not always given in the local language. Perceived lack of clarity regarding processes, particularly evacuation processes.
- Lack of trust in the messenger: Although with mixed results, there was some sense of community distrust of the local and national governments.
- Having impairments: Having impairments--physical, mental, intellectual, or sensory—is perceived as an additional challenge to evacuation decision-making. This applies to those who may not identify as being a person with a disability, such as an older person or a pregnant woman.

Finding 3. Behavioral biases such as pluralistic ignorance and optimism bias are found among Sri Lankans. Although most respondents reported adopting preparedness measures (59%), around 48% believe that few people or none around them take similar measures. This group is 25.5 p.p. less likely to adopt preparedness measures and 11.2 p.p. less likely to report having evacuated when instructed compared to those that believe that everyone or most people around them take measures. This demonstrates that correcting for the negative descriptive norms —telling people that the majority does take preparedness or evacuation measures —may be a good strategy for behavior change in Sri Lanka (see Figure 10, Panels A&B).

Figure 10. Effect of having negative descriptive norms "believing few people or none take measures" on protective action behaviors

Panel A. Effect on the adoption of preparedness measures

Panel B. Effect on evacuating
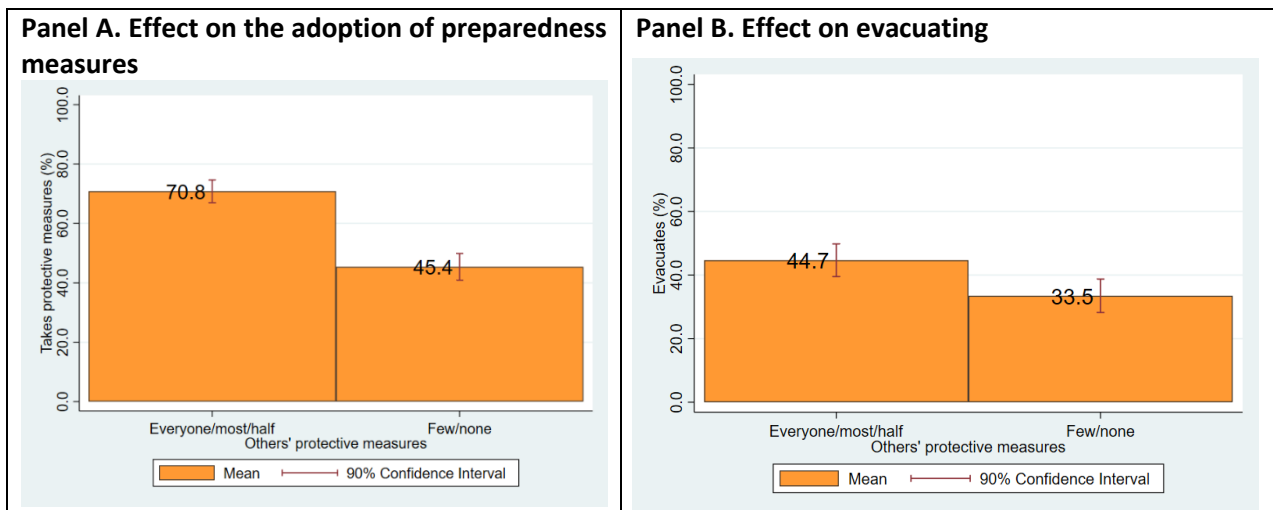
Given that households with a higher income do not show any statistical differences regarding the outcomes compared to those with middle incomes, this indicates that there may be an optimism bias or overconfidence. Since they have sufficient resources, they may believe they are more protected or at least

have alternatives (other properties/homes they could escape to if one home were affected by a disaster) in case of a negative event. This finding was confirmed during the qualitative interviews (see Box 2).

Finding 4. In Sri Lanka, we find evidence that the type of information people have access to and how it is received makes a difference in how people respond to preparedness and E.W. To assess the effect of the content and format of the information on the likelihood of adopting preparedness measures, the team asked respondents to report on their likelihood to adopt actions to protect their families and homes in response to a specific warning message. Respondents received one of two types of messages assigned randomly to their survey: a forecast-based message and an impact-based message (see Table 6). The forecast-based message was designed based on examples of messages received in Sri Lanka. Results show that, on average, 63% of respondents indicated they would take preparedness measures after seeing such a message. Those exposed to the impact-based message were 7.7 p.p. more likely to report that they would take preparedness measures, compared to those that were exposed to the forecast-based message. The differences are statistically significant.

Table 6. Randomized messages shown to the online survey respondents

Type of message	Message content
Forecast- based	Forecasts: Warning for next week: Southeasterly veering southwesterly 4 to 6, becoming cyclonic 5 to 7 for a time in north, perhaps gale 8 later in north
Impact-based	Heavy winds are arriving next week in the north. These winds will be strong enough to uproot trees and cause serious damage to your property. Take action now to protect your family and home

In communicating warnings, the channel of communication matters. Those who report receiving or seeing an E.W. in the past through social media are 6.5 p.p. more likely to report having followed the E.W. guidance than those who never received or saw a warning. When asked about most used social media platforms, Facebook, WhatsApp, and YouTube got 26%, 25%, and 24% of the responses. Regarding communicating an evacuation warning, we see that those that received the warning through bells, sirens, loudspeakers, or E.W. towers, and those that received the warning through television[20] are 14.2 p.p. and 8 p.p. more likely, respectively, to report having evacuated. On the contrary, those that read the evacuation warning in a newspaper are 13.6 p.p. less likely to report having evacuated. Panel A of Figure 11 shows reported channels of E.W. information. It is reassuring to observe that almost 21% of responses correspond to television and 15% to social media, while only 8% correspond to newspapers. Regarding bells, sirens, loudspeakers, or E.W. towers, respondents report receiving few warnings through this channel despite results showing that it is effective when conveying evacuation instructions. 35% of the warnings were about floods, 21% were about cyclones, and 17% were about Tsunamis (11% selected other).

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[20] For television, the effect fades when looking at results that include the total sample.

Figure 11. E.W. communication channels and timing

Panel A. Channels

Note: 18% of responses indicate never receiving or seeing a warning

Panel B. Timing of E.W. received vs. preference

■ Timing preference ■ Timing of EW
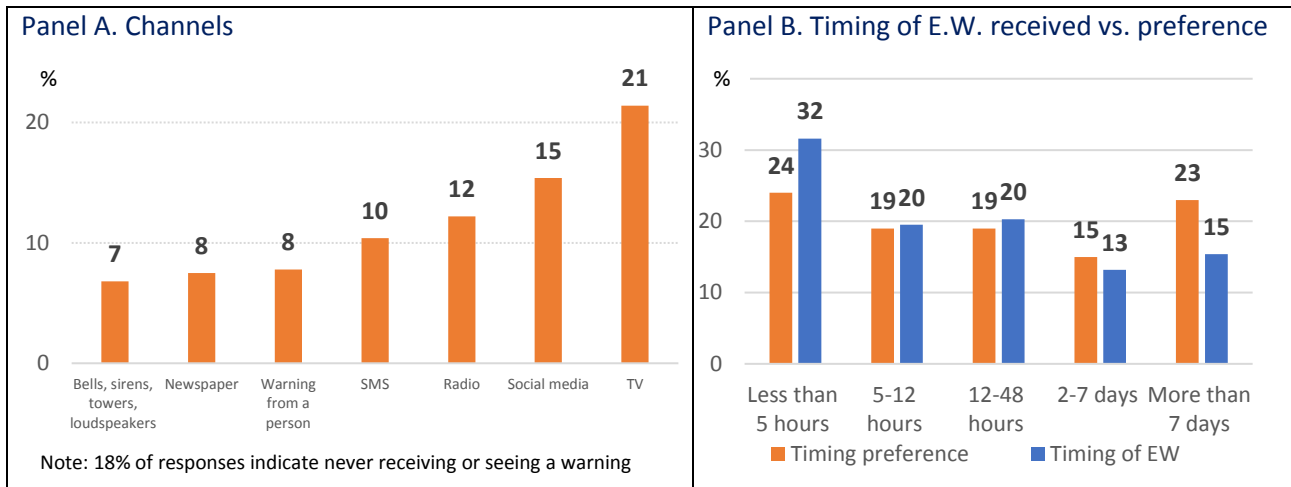
In terms of timing (Figure 11, Panel B), 32% of respondents received the E.W. less than 5 hours before the disaster occurred, while only 15% received it more than seven days before (see Figure 11). While data was not collected about the different times of messages and their effect on decision-making, a message far in the past might lose relevance, and a message too close to the needed action might not allow for sufficient time for preparedness actions. The divergence in preferences observed, with a quarter of respondents preferring a short notice and another quarter preferring a long notice, might depend on the type of disaster participants have experienced in the past and other factors.

Finally, lack of trust in the government's ability to predict the weather (in this case, in the source of information) reduces the likelihood of adopting protective action behaviors. Those that do not trust the government's ability to predict the weather are 12.8 p.p. less likely to adopt measures and 15.2 p.p. less likely to report having followed E.W. instructions than those that do trust the government, although we see no effect on evacuation orders (see Panels A&B of Figure 12).

Figure 12. Effect of trusting the government' ability to predict the weather on protective action behaviors

Panel A. Effect on the adoption of preparedness measures

Panel B. Effect on following E.W. instructions
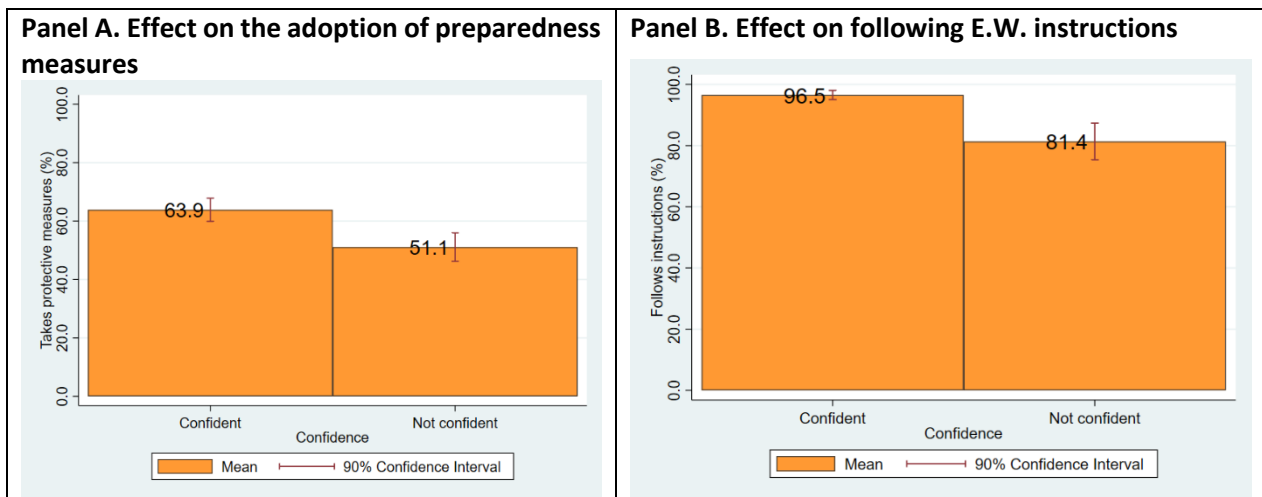
Summary of main barriers

When there is uncertainty about the potential benefits of our actions, in this case, in adopting preparedness measures or in following evacuation warnings, we tend to maintain the status quo: we do not adopt any actions, nor do we seek refuge. Survey results shed light on some of the behavioral and structural barriers to decision-making that may be contributing to the status quo. For instance, while previous experiences with disasters have an effect on the adoption of preparedness measures (and even more pronounced when being seriously affected by the disaster), we also find that several structural elements affect protective action behaviors.

Those more vulnerable either because they have a disability or because they live with someone they need to care for, protect themselves more, and are more likely to follow E.W.'s instructions. The exception here are older respondents (55+), but as discussed, they may have fewer access to information than younger generations or may be dismissing information due to more previous experiences. In terms of income and education, those with lower income or less education seem less likely to prepare and respond (maybe due to lack of resources or access to information), but interestingly, those in the upper end of the income brackets are equally less likely to prepare. In their case, wealth might trigger a sense of overconfidence or optimism bias.

Social factors are strong determinants. Those who believe few people or none around them behave positively are less likely to adopt measures or evacuate (pluralistic ignorance). We know this might be an incorrect belief that can be adjusted by communicating with the population that neighbors and other community members are taking action through their responses. The effect of how the information is framed, the content, the channel, the messenger, and the timing of messages have shown to have an effect on preparedness and response behaviors (information framing). For instance, impact-based messages trigger more positive intentions (vs. Forecast-based), communication channels that are seen as more immediate (e.g., social media, sirens, television) fare better than delayed ones (e.g., newspapers). Finally, a lack of trust in the government's ability to predict the weather has a strong negative effect on adopting protective actions (lack of trust).

4. Key entry points to improve preparedness and response actions

This section presents five recommendations for policy actions to address some of the barriers that interfere with Sri Lankans' preparedness and response actions. The recommendations are divided by targeted behavior: disaster preparedness and disaster response. To increase uptake of preparedness measures, recommendations focus on effective communications, monetary schemes for the poor, and early awareness-raising. For response actions, effective communication interventions are also top of the list as well as some specific strategies for the most vulnerable. These recommendations do not intend to be exhaustive, but instead are intended to complement or improve ongoing efforts to support Sri Lankans to become more resilient to hazards.

A. Recommendations to increase take-up of preparedness measures

1. **Behaviorally informed communications to increase preparedness awareness and actions.** About two-thirds of survey respondents reported taking or having taken actions to protect their property or families from the potential effects of disasters. Further efforts are needed to both ensure everyone in Sri Lanka adopts a preparedness mindset and to do so more effectively. Social and behavior change communication efforts can support this goal by:

   a. **Diversifying messages and delivery to target specific groups that are less likely to adopt measures.** Different segments of the population differ in their ability or willingness to adopt preparedness measures. Survey findings revealed that in Sri Lanka, older people (55+), those who have not experienced a disaster first-hand, and those less educated are less likely to adopt preparedness measures. Targeting these and other groups where preparedness is low would be essential. Strategies should include: messages that appeal to individual characteristics (identity, things they value/matter to them), the use of persona references by peers or people they identify with (e.g., storytelling by those that have had a bad experience with disasters for those without previous experience), and identifying trusted channels for communication (e.g., trusted channels for people over 55 might be different than for the young) as well as trusted messengers (e.g., who is likely to be listened to, respected, believed).

   b. **Making messages content easy, simple, context-specific, and action-oriented.** Communications can be made more effective by ensuring they adopt a format and content presentation that makes it easier for individuals to act based on the information received. For example, messages that are explicit about the actions (preparedness measures) that the population should take and present them in an accessible form that makes it easier to decide what to do. For example, messages with clear guidance regarding which measures would protect their property and family the most, which ones are easy to implement immediately, and which ones will take multiple steps, and for those, list those steps). [21] 31% of survey respondents indicated that having clarity on what measures, against what, and their level of effectiveness would encourage them to adopt preparedness measures. These types of messages could also support self-efficacy by increasing people's beliefs in their ability to be protected and protect their families against hazards.

   c. **Making preparedness social and not only individual.** An important insight from the survey is that preparedness is not always visible, and it is lower among those that think that the majority does not take measures. However, these beliefs are not accurate as most survey respondents declared adopting measures. Communications should correct these wrong beliefs by making preparedness more visible and socializing it. Actions here can include traditional communications and social recognition efforts (e.g., stickers signaling protected

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[21] For example, an intervention in Tanzania that informed farmers through local radio stations on specific techniques to improve their farming practices to adapt to and prepare for climatic and environmental changes resulted in 31% of listeners reporting taking action after listening to the radio program (BBC Media Action, 2017).

houses or others given by a local authority), community-level awards or competitions, sponsor collective purchases of items schemes, or others.[22]

2. **Well-designed monetary schemes to help the poor get prepared.** Findings from this diagnostic show that those survey respondents on the lower income brackets were less likely to report adopting measures compared to those in the middle of the income distribution. While not all preparedness measures require significant monetary investments, availability of financial resources for preparedness or schemes to support channeling some resources to these actions would be necessary. For the most part, whether small grants, matching schemes, or another model, their design and access modality would be critical to ensure take-up and use (e.g., if it is too costly or cumbersome in time and the process required to apply) as the information about them. If, for example, resources are provided for specific items that are difficult to procure (e.g., construction materials), considering the provision of the materials themselves could also be an alternative.[23]

3. **Starting early to ensure a resilient future.** Although this recommendation does not address specific barriers found in this diagnostic, as part of societal awareness of the value of preparedness, children and youth are important actors. Early learnings can leave lasting traces for adult lives, children can make their parents accountable for preparedness, and early learnings can be transferred to future generations as they become part of the norm for today's children. As with other issues such as environmental protection, preservation of cultural traditions, and more, disaster awareness and preparedness discussions and activities at the school level can be integrated as part of their regular activities. From content and discussions, activities to protect schools, easy exercises to do at home, and more can be implemented, particularly in disaster-prone areas.[24]

B. Recommendations for increasing timely response actions

4. **Behaviorally informed E.W. communications to trigger behavioral responses.** The vast majority (90%) of survey respondents that reported having received an E.W. message indicate that they followed the instructions contained in the message. However, only 57% of those that received an evacuation alert followed the instruction. The barriers to acting vis-à-vis an E.W. message (e.g., take cover, avoid specific areas, etc.) and those preventing people from evacuating are likely to be different and/or vary in intensity. As with preparedness, how and when information is conveyed will be critical to trigger the desired behaviors. E.W.s can only protect people when the warning is received on time, when the content of the warning is well understood, the actions required are clear and seen as relevant for the receiver, and when the appropriate actions are taken. As with preparedness,

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[22] In Bangladesh, a national television program modeled how communities acted together to take preparedness actions, resulting in 47% of viewers naming actions that they had taken after watching the program (BBC Media Action, 2017).

[23] Hirvonen and Hoddinott (2021) find that in Ethiopia, for a cash or food transfer, preferences were consistently on receiving at least a share on food transfers partly as a function of markets, but also for self-control regulation among recipients.

[24] In various Asian countries, children have successfully participated in mapping hazards, raising awareness through radio and games, and influencing other children, teachers, parents, and communities to reduce disaster risks (UNISDR, 2012).

recommendations cover adequate adaptations to specific target populations, content design, channels, and messengers. Specific recommendations for E.W.s and evacuation include:

    a. **Targeting.** Women and older people (55+) were the least likely to report evacuating when receiving such a message.[25] People's roles and responsibilities in the household, access to technology and means of information, differential channels of information, and physical ability to evacuate might affect their ability to act. As with preparedness, for the elderly, this combines with previous experiences with disasters. Targeting these specific audiences based on their characteristics and ensuring these groups get timely and appropriate information is as important as informing them of the support options for evacuating they can access.

    b. **Reframe the design of the messages.** Even the most sophisticated information system can be rendered ineffective if the information is not communicated clearly, on time, and in a way that allows users to act appropriately. Complex warning messages (even if accurately phrased) may prevent everyone from understanding them; the tone, action prompts, and the messages in general need to be clear, simple, specific, and easy to follow. For example, findings from the survey show that impact-based messages triggered a stronger action response over the more commonly utilized forecast-based messages. Impact-based messages move away from what the weather will be (observations) to what the weather will do (impacts) in a clear and evident way for the receivers. Citizens expect information about what to do to ensure their safety and protect their property; impact-based messages enable those at risk to take appropriate actions (WMO, 2015). Multiple messages by multiple agencies that are phrased differently can generate confusion or trust issues. Having a standard frame, content design, and target audience for all E.W. messages irrespective of the sender might help strengthen their impact. This includes trusting the content as well as the sender.[26] Finally, highlighting levels of compliance (if high) with E.W. actions or evacuation and potential losses or gains from such actions can strengthen the effectiveness of the messages.[27]

    c. **Identify appropriate channels through which warning messages will be disseminated to different target audiences.** According to our survey findings, the most effective channel for communicating broad E.W. in Sri Lanka is social media. However, access to social media platforms varies by age and level of education. For instance, almost 50% of those with low education levels and over 31% of older respondents reported not using any social media platform (i.e., Facebook, Instagram, WhatsApp, Twitter, YouTube). While older respondents report using Facebook and YouTube the most, those will low education frequent WhatsApp

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[25] A 2005 survey found that, during the 2004 tsunami, four times as many women than men were killed in Indonesia, Sri Lanka, and India. Among the reasons cited, women's responsibility for children, the disabled, and the elders may have slowed their flight. Additionally, men were taught how to swim and climb trees at young ages, while women were not, so they found their way to safety faster. (MacDonald R, 2005)

[26] Among survey respondents, those that reported not trusting the government were less likely to follow E.W. instructions. Depending on the context, local institutions might have more substantial impacts over national ones (e.g., the Disaster Management Center of the Eastern Province instead of the Disaster Management Center), as people may relate and trust more local institutions or see them as being closer to the ground, etc.

[27] Baer et al. (2019) discuss how different interpretations of a call to evacuate by neighbors in the same area in the U.S. were driven by a differential perception of hazards and preparedness.

more. We, therefore, suggest using specific channels for different target groups. When it comes to evacuation warnings, bells, sirens, loudspeakers or E.W. towers, and television are the most effective in triggering evacuation.

5. **Set-up specific strategies for the most vulnerable, including a detailed mapping and regular evacuation drills.** Survey respondents defined as vulnerable in this report are more likely to adopt measures and follow general E.W. instructions but not to evacuate. For the vulnerable, evacuation logistics are more complicated, and they face more substantial limitations to rapidly respond, even more if they have not prepared in advance. Local authorities will need to set up specific plans for these groups, such as a roster with their location, a plan for action, among others, and these preparations need to be communicated clearly to the target groups. Setting up periodic evacuation drills will also help visualize the challenges they may experience and find solutions before the actual disaster.

C. Next steps

This research has shed some light on how some people in Sri Lanka think and behave in the face of a hazard and what strategies might help them take specific actions. Understanding people's beliefs and risk perceptions, their trust levels, and enablers and barriers to protective actions, among others, is key to design effective recommendations to improve preparedness and response actions.

Before rolling out a communications campaign or newly designed E.W. messages, specific actions to assess their impacts can be critical and more cost-effective in the long run. These include pre-test the messages (qualitatively or quantitatively) with both experts and intended recipients representing the intended audience to ensure that the content of the messages is well understood, triggers the intended effects, and does not have harmful or sensitive implications. Also, a test of the delivery mechanisms and frequency of content (a message that is not received or not received on time would be ineffective) would be advisable, as it is a combination of messages content, frequency, and messengers. Early troubleshooting of communications is critical.

Further research could complement the findings presented here with in-depth (and ideally in-person) data collection with a broader group of population and those whom an online survey was less likely to capture. Complementing this research with an in-depth qualitative assessment will allow a better understanding of the elements that enable or restrain Sri Lankans when considering taking action. It will also provide a better understanding of the nuances to certain beliefs and behaviors people experience, which are key to expand the profiles of respondents to those that were not included in the survey sample and to design effective solutions.

Finally, exploring the detailed E.W. process could help better understand how the entire process chain for production and delivery of E.Ws works in practice for each of the most common disasters in Sri Lanka and could better inform how to improve the processes.

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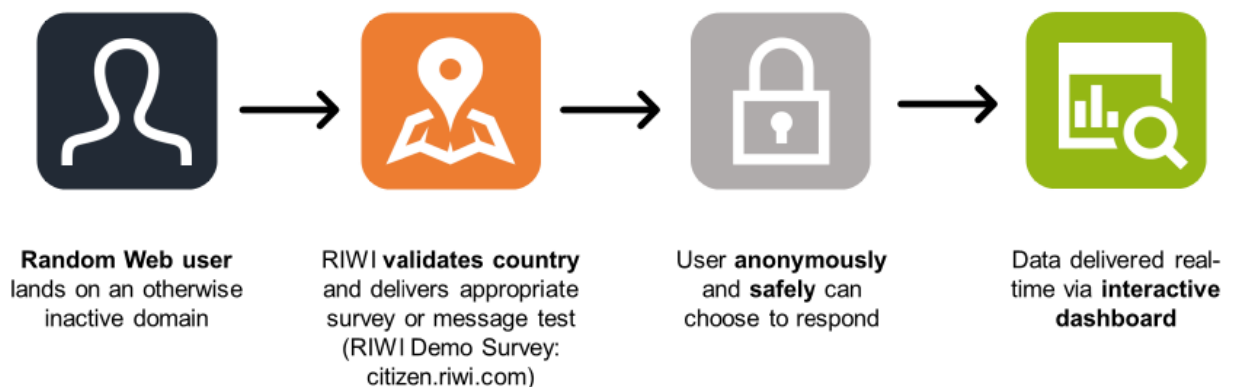
Appendix A. Description of data collection

This diagnostic report is based on quantitative primary data collected through an online survey that is then complemented with four qualitative interviews conducted among survey respondents. We will first describe the data collection process and methodology of the quantitative data collection followed by the qualitative one.

a. Quantitative data collection

The quantitative data used for the analysis of this report comes from an online survey that was conducted by RIWI in two rounds: the first pilot round took place during December 2020, and the second main round took place during February 2021. A total of 37,514 respondents completed at least one question of the online survey, but only 2,223 respondents completed the 'core' set of 17 questions of interest and 1,426 completed all 30 questions included in the survey. This report focuses on the complete set of responses, allowing for a consistent analysis throughout different specifications. The main results presented remain unaltered when using all of the respondents.

To make the analysis more representative of the larger Sri Lankan population, we weight observations using demographic characteristics. The weighting process was undertaken by the data collection firm, RIWI. RIWI obtains its sample from Internet users that land in one of the thousands of web domains that RIWI controls, either by mistyping a website name or because a link they select no longer exists. When this occurs, these individuals are invited to participate in a survey, which is this case offered the option of completing it Sinhala, Tamil, or English. After selecting the preferred language, respondents enter an interactive dashboard that does not collect any personally identifiable information. All the data captured is fully compliant with laws in terms of security and usage. Figure A.1 below summarizes the data collection process.

Figure A.1 RIWI's data collection methodology

Random Web user lands on an otherwise inactive domain

RIWI **validates country** and delivers appropriate survey or message test (RIWI Demo Survey: citizen.riwi.com)

User **anonymously** and **safely** can choose to respond

Data delivered real-time via **interactive dashboard**

This approach involves a trade-off, with strengths and limitations. Regarding strengths, its ability to capture a random sample of the internet-using population of a country, since mistyping a website name could be considered a completely random event. On the other hand, limitations of this methodology include its inability to reach the population with no access to the internet, and the

possibility of leaving the survey at any time which could generate a significant proportion of incomplete responses.[28] This last point was addressed analyzing only complete responses.

The data collected through this process resulted in a sample with a significantly higher proportion of young males, which is different from the observed in Sri Lanka's national demographics. The weighting strategy applied generated weight values using a raking algorithm whose objective was to match the age and gender profile of the latest census drawn from the U.S. Census Bureau.[29] Table A.1. below shows the demographic characteristics of our survey sample, before and after weighting.

Table A.1. Demographic statistics (% of respondents)

Variable	Values	Completed survey Q30 (unweighted)	Completed survey Q30 (weighted)
Age	18-24	35.1	11.8
	25-34	30.5	20.4
	35-54	25.2	38.4
	55+	9.2	29.4
Gender	Female	30.2	47.7
	Male	69.8	52.3
Children in household	None	44.7	41.3
	1-2	33.8	34.8
	3+	21.4	23.9
Education	Up to primary school	14.9	12.8
	Secondary school	22.6	25.4
	Collegiate or university	62.4	61.7
Monthly income	Less than 10,000	26.3	23.3
	10,000-19,999	17.0	15.3
	20,000-39,999	20.6	22.5
	40,000-59,999	15.5	16.1
	60,000-79,999	6.3	7.3
	More than 80,000	14.3	15.6

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[28] No economic incentives were offered to respondents.
[29] https://www.census.gov/data-tools/demo/idb/#/country?YR_ANIM=2021&FIPS_SINGLE=CE

House tenure	Owned by household	42.0	43.4
	Not owned by household	58.0	56.6
Language	English	28.5	28.2
	Sinhala	59.9	61.1
	Tamil	11.6	10.7
Province	Central Province	5.3	4.8
	Eastern Province	0.3	0.2
	North Central Province	0.8	1.4
	North Western Province	0.9	0.6
	Northern Province	0.8	0.9
	Province of Uva	0.4	0.7
	Sabaragamuwa Province	1.7	2.0
	Southern Province	0.6	0.4
	Western Province	89.1	88.6
	None	0.2	0.3
N		1,426	1,426

For the profiling analysis, we run a simple multivariate OLS regression with main household characteristics. In Table A.2., we report the coefficient of interest along with heteroskedasticity-robust standard errors.

Table A.2. Regression results from the profiling analysis

Variable	Values	Take-up preparedness measures	Follow E.W. instructions	Evacuated, when asked
Demographics				
Gender	Male	0.0130 (0.0388)	0.0309 (0.0305)	0.0807* (0.0477)
Age	25-34	-0.0151 (0.0375)	0.0264 (0.0257)	-0.0790 (0.0493)
	35-54	-0.0392 (0.0412)	0.0105 (0.0333)	-0.0432 (0.0540)
	55+	-0.0833 (0.0532)	-0.0555 (0.0440)	-0.138** (0.0675)

Province	Western Province	-0.0905*	-0.0159	-0.174**
		(0.0546)	(0.0305)	(0.0771)
Education	Secondary school	0.178***	0.108	0.0615
		(0.0643)	(0.0723)	(0.0873)
	Collegiate or university	0.168***	0.129*	0.0946
		(0.0578)	(0.0729)	(0.0814)
Monthly income	10,000-19,999	0.0726	0.0446	0.0326
		(0.0621)	(0.0522)	(0.0823)
	20,000-39,999	0.0658	0.0360	0.0180
		(0.0627)	(0.0480)	(0.0763)
	40,000-59,999	0.120*	0.00368	-0.0843
		(0.0648)	(0.0608)	(0.0794)
	60,000-79,999	-0.0735	0.00448	-0.00303
		(0.0901)	(0.0894)	(0.130)
	More than 80,000	0.00145	-0.00494	-0.118
		(0.0677)	(0.0686)	(0.0869)
Children in household	1-2	0.0105	0.0553*	0.0361
		(0.0423)	(0.0303)	(0.0541)
	3+	-0.0386	-0.0449	0.000750
		(0.0519)	(0.0515)	(0.0628)
House tenure	Not owned by household	-0.0135	-0.0717***	-0.0186
		(0.0392)	(0.0276)	(0.0463)
Disability	Reported	0.124***	0.0531*	0.0209
		(0.0380)	(0.0279)	(0.0464)
N		1,290	872	848
R-squared		0.060	0.102	0.048

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

For the second analysis (where we confirm/reject our initial hypotheses), for each pair of an outcome variable and a potential explanatory variables, we run a simple bivariate OLS regression and report the coefficient of interest along with heteroskedasticity-robust standard errors (see Table A.3).

Table A.3. Regression results

Variable	Values	Take-up preparedness measures	Follow E.W. instructions	Evacuated, when asked
Other relevant characteristics				
Disability	Reported	0.146***	0.0739**	0.0333
		(0.0383)	(0.0293)	(0.0466)
Seriously affected by natural disaster in the past	Yes	0.212***	0.0471	0.0771
		(0.0389)	(0.0289)	(0.0498)
Confidence in government to predict weather	Not confident	-0.128***	-0.152***	-0.0578
		(0.0381)	(0.0376)	(0.0469)
Natural disaster experienced	Yes	0.158***	0.0448	0.0554
		(0.0394)	(0.0333)	(0.0514)
Thoughts on others taking up protective measures	Few people/none do	-0.255***	-0.0229	-0.112**
		(0.0360)	(0.0302)	(0.0447)
Channels of early warning	Bells, sirens, towers, loudspeakers	0.114*	-0.0244	0.142**
		(0.0597)	(0.0414)	(0.0647)
	Newspaper	-0.0286	0.00663	-0.136**
		(0.0623)	(0.0340)	(0.0591)
	Social media	0.0139	0.0654**	-0.0130
		(0.0459)	(0.0281)	(0.0444)
	Television	0.00886	0.0274	0.0800*
		(0.0471)	(0.0311)	(0.0464)
	Radio	0.0375	-0.00180	0.0228
		(0.0537)	(0.0337)	(0.0504)
	SMS	0.0762	0.0611**	0.0166

		(0.0567)	(0.0265)	(0.0544)
	Community member /person warned me	-0.00338	-0.0415	0.0655
		(0.0563)	(0.0425)	(0.0583)
Demographics				
Age	25-34	-0.00747	0.0257	-0.0735
		(0.0348)	(0.0224)	(0.0455)
	35-54	-0.0298	0.0207	-0.0375
		(0.0372)	(0.0255)	(0.0471)
	55+	-0.114**	-0.0646	-0.147**
		(0.0533)	(0.0457)	(0.0644)
Gender	Male	0.0435	0.0202	0.0782*
		(0.0385)	(0.0309)	(0.0468)
Children in household	1-2	0.0449	0.0564**	0.0530
		(0.0424)	(0.0273)	(0.0518)
	3+	-0.0626	-0.0602	-0.0300
		(0.0520)	(0.0517)	(0.0617)
Education	Secondary school	0.200***	0.141*	0.0370
		(0.0603)	(0.0748)	(0.0783)
	Collegiate or university	0.176***	0.162**	0.0548
		(0.0529)	(0.0700)	(0.0708)
Monthly income	10,000-19,999	0.124**	0.0732	0.0578
		(0.0615)	(0.0561)	(0.0776)
	20,000-39,999	0.127**	0.0999**	0.0574
		(0.0581)	(0.0494)	(0.0725)
	40,000-59,999	0.182***	0.0625	-0.0499
		(0.0585)	(0.0588)	(0.0759)
	60,000-79,999	-0.0274	0.0633	0.0282
		(0.0855)	(0.0895)	(0.119)
	More than 80,000	-0.00590	0.0241	-0.107

		(0.0665)	(0.0668)	(0.0781)
House tenure	Not owned by household	-0.0651*	-0.0873***	-0.0326
		(0.0388)	(0.0286)	(0.0462)
N		1,426	1,426	1,426

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

b. Qualitative data collection

To gain a deeper understanding of responses to the survey, a total of four follow-up interviews were conducted. At the end of the survey, respondents were asked if they agreed to be contacted by our research team with some follow up questions. Respondents that agreed were asked to share either their email address or phone number. Of the 234 respondents that provided contact information, four successfully responded to an invitation of interview. They were offered to do so either over a phone call or by email.

Table A.4 below shows the eight interview questions that were developed based on an initial analysis of survey responses to help either fill any gaps or gain deeper insights on the initial findings. Two interviews were conducted by email and two over the phone. Each of these four respondents came from different provinces (Western, Central, Eastern, and Northern provinces). All were male and lived with their families with children. Three of the respondents had experienced disasters firsthand, including two who experienced the 2004 Indian Ocean tsunami. Thematic analysis was applied to the interview data to highlight common responses. Suggestions and perspectives were also highlighted to help better contextualize the quantitative data analysis.

Table A.4. Interview questions

	Questions
	Questions
1	Can you confirm which district and province you live in?
2	Do you live alone or with your family? Who are your family? *(probe: Would you or anyone in your family experience additional challenges in case of evacuation (sick, elderly, pregnant women, disability, etc)?*
3	Would you mind telling me about your experiences with natural disasters? Have you experienced any? • If yes: when was it, and can you tell me a bit about what happened, and what you did? Did you have to evacuate? How did you learn that you had to evacuate? What were the challenges to evacuating for you or for others? What do you think would make people evacuate when needed? • If no: do you recall any experiences that someone close to you has experienced? Can you tell me about their experience?
4	Do you think natural disasters are an issue that people in your community are generally concerned about? Do you think this is different for some people? Who are the ones most worried?

5	In the survey you answered we asked about protective actions against natural disasters. Can you tell us what you or people you know have done to protect themselves? Are there things that you think people should be doing?
6	Why do you think some people do not take any actions to protect their family and homes from natural disasters? What do you think would make them do more?
7	Thinking about people that live in areas frequently affected by natural disasters, why do you think some don't protect themselves/their things'?
8	When there is a natural disaster coming, what do you think the government should do to help people be prepared and respond to it? (*probe: What do they currently do that could be improved?)*