Preparing for Urban Floods in Mozambique
A Field Experiment on Risk Communication

Pre-Analysis Plan

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Abstract

This document describes the design and analysis plan for evaluating the impact of a disaster information campaign designed to raise flood risk perceptions and promote mitigation behavior among vulnerable urban households. The information campaign provided community leaders and households with contextualized, actionable information related to flood risk through videos shown during home visits and text messages. I evaluate the effect of the interventions on perceptions and behavior, as well as how these changes in behavior reduce flooding and the impact of flooding.

The goal of this document is to outline the key research questions and the specifications to be used in the empirical analysis. This document was written before collection of follow-up survey data and updated after a pilot of the follow-up survey. I do not exclude the possibility to conduct additional exploratory analyses. When reporting results I will mark all analyses not planned ex-ante and therefore not included in this document.

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1 Introduction

Climate change has increased the frequency and intensity of extreme weather events such as heatwaves, heavy precipitation, droughts, and tropical cyclones (IPCC, 2021). These natural disasters undermine sustainable development and challenge efforts to reduce poverty. They destroy homes, assets, public facilities, and infrastructure. Moreover, they can have severe health impacts for the affected population, including loss of life. The associated economic losses disrupt livelihoods and adversely impact social and economic outcomes. The poor are most affected and least able to cope with disaster-related losses, making it more difficult for them to escape poverty (Carter et al., 2007; Morduch, 1994). Improving individual and community resilience to disasters is, therefore, crucial to promoting inclusive and sustainable economic growth (Benson, 2016). It is important to consider how cities address the risks associated with natural disasters and climate change, considering the rapid urbanization of Sub-Saharan Africa. In particular, small and medium-sized low-income cities are vulnerable to extreme climate events. Rapid population growth, limited financial resources, and low state capacity exacerbate the problem.

The management of risks related to climate and natural disasters requires local involvement and understanding. For facilitating this, information dissemination can be a powerful tool to guide, educate, and capacitate households in preparation for inevitable shocks affecting their livelihoods. Rational behavior is expected in response to information about disaster-related risks and, in particular, early warning messages (e.g., in the form of preparation or evacuation).[1] However, risk information and accurate forecasts do not always bring about the desired preparedness action from communities at risk of natural disasters (Ayeb-Karlsson et al., 2019). For example, in the case of the 2019 Cyclones Idai and Kenneth in Mozambique, even with accurate forecasts and warnings, many people failed to fully comprehend the storms' potential intensity and impacts and did not know how to take concrete actions to protect themselves and their livelihoods (Norton et al., 2020). Possible explanations for such failure of risk communication include problems with the design and delivery of the information, lack of trust in authorities, and misunderstanding of the risk perceptions of communities (Ayeb-Karlsson et al., 2019). When these issues are overcome, preparedness action can be improved. For example, while limited awareness and low literacy levels cause difficulties in understanding risk insurance in low-income countries (Churchill, 2007), Gaurav et al. (2011) showed that an intensive education campaign could improve risk insurance demand.

The objective of this study is to provide evidence on the effectiveness of a disaster awareness campaign aimed at addressing the challenges associated with risk communication. Specifically, I evaluate a set of interventions disseminating information through videos and text messages about flood risk, the impact of flooding, and guidance on preparation. The design of the videos and text messages is informed by the idea that risk information is

[1] Early warning systems warn citizens about the arrival of storms, flooding, or other disaster events and provide instructions.

particularly effective if bundled with practical information on protecting against floods (Haer et al., 2016; Wong-Parodi et al., 2018). The interventions differ in the people speaking and featured in the videos, the scale of implementation, and the inclusion of text messages as method of dissemination. I evaluate the effect of the interventions on flood risk perceptions and mitigation behavior, as well as how these changes in behavior reduce flooding and the impact of flooding. Measurements include multiple sources of data: two rounds of surveys with households and chiefs and surveys conducted during the scale-up visiting of households, a behavioral experiment, behavioral measures based on SMS technology, pictures along drainage canals and at random locations across city blocks, and SAR satellite images.

The context of this evaluation is the coastal city of Quelimane, located in the central region of Mozambique and vulnerable to a multiplicity of climate threats, such as cyclones, flooding from rain, storm surge, and rising sea levels. The results of this study will support both local and national policy makers in optimizing disaster risk management strategies.

The remainder of this pre-analysis plan is organized as follows. Section 2 provides a detailed overview of the research design. Section 3 explains the hypotheses to be tested. Section 4 describes the data and the estimation strategy is described in Section 5.

2 Experimental Design

2.1 Interventions

I evaluate a set of interventions disseminating information through videos and text messages about flood risk, the impact of flooding, and guidance on preparation.

2.1.1 Videos

I designed two six-minute videos, a *public officials* video, and a *flood victims* video. The videos were incorporated into surveys with the target population, which took place from September to November 2021. Both videos contained the same information. The visuals in the videos alternate between the speakers, images, and video recordings that help convey the message. Publicly available images and recordings of local news outlets were used for this purpose. The same visuals were used in both videos. The standard Portuguese versions of the videos were also dubbed in Chuabo, the most common local language, to promote inclusiveness among all ages and education levels. In the *public officials* video, the information was delivered by local government officials (one man and one woman) responsible for disaster risk management. The *flood victims* video featured two residents (one man and one woman). These actors drew on their recent flooding experience to deliver the information. Finally, to measure the effectiveness of the interventions, I created a *placebo* video. This six-minute video contained general information about Quelimane, its history, and its main economic activities. This information was delivered by residents, contained images and video recordings, and was also made available in Chuabo. Appendix A provides the scripts used in each video.

2.1.2 Text messages

I designed a set of six text messages summarizing the key points of the videos. The text messages were sent daily to chiefs and households in selected city blocks from November 19 until November 24, 2021. Appendix B provides the scripts used in each text message.

2.2 Sampling and Randomization

The study takes place in the coastal city of Quelimane, located in the central region of Mozambique. A mapping exercise was conducted in preparation for the experiment for which all Quelimane's city blocks were visited from July to August 2021. During these visits, GPS data points were collected to establish the blocks' limits, and an interview with the block chief was conducted. The chief's assistant or neighborhood secretary was interviewed for blocks without a chief, due to either traveling or not existing. This activity resulted in a map with 508 blocks, excluding three neighborhoods for which block limits and chiefs were unspecified at the time of field work. From this list, the following selection criteria were applied. First, given the importance of chiefs in formal information dissemination, I only selected blocks for which the chiefs were available, and they could only participate for one block.[2] Second, I excluded one administrative post and four other distant neighborhoods. These neighborhoods can be characterized as rural given their low population density, the large number of farms, and lack of connection to the city's water drainage infrastructure. Finally, I excluded three relatively highly developed neighborhoods with multistory apartment buildings and an advanced water drainage infrastructure. This exclusion procedure resulted in 330 blocks.

The 330 blocks were randomly allocated into the *Placebo*, *Public officials*, *Flood victims* video groups stratified by neighborhood. The objective was to revisit at least 300 blocks. Therefore, 30 of these blocks were assigned as substitutes and were visited only if a chief could not be interviewed due to traveling or rejecting the interview. In total, 21 chiefs could not be revisited, 20 because of their absence and one because of rejection.[3] Besides the chiefs, two households were visited in each block. The two households were selected by randomly selecting houses using satellite imagery based maps. During each visit, the head of household or spouse was interviewed. Within each block, a man and a woman were interviewed to ensure the collection of gender-disaggregated data. The households were selected by randomly selecting "male" and "female" houses using satellite imagery. In total,

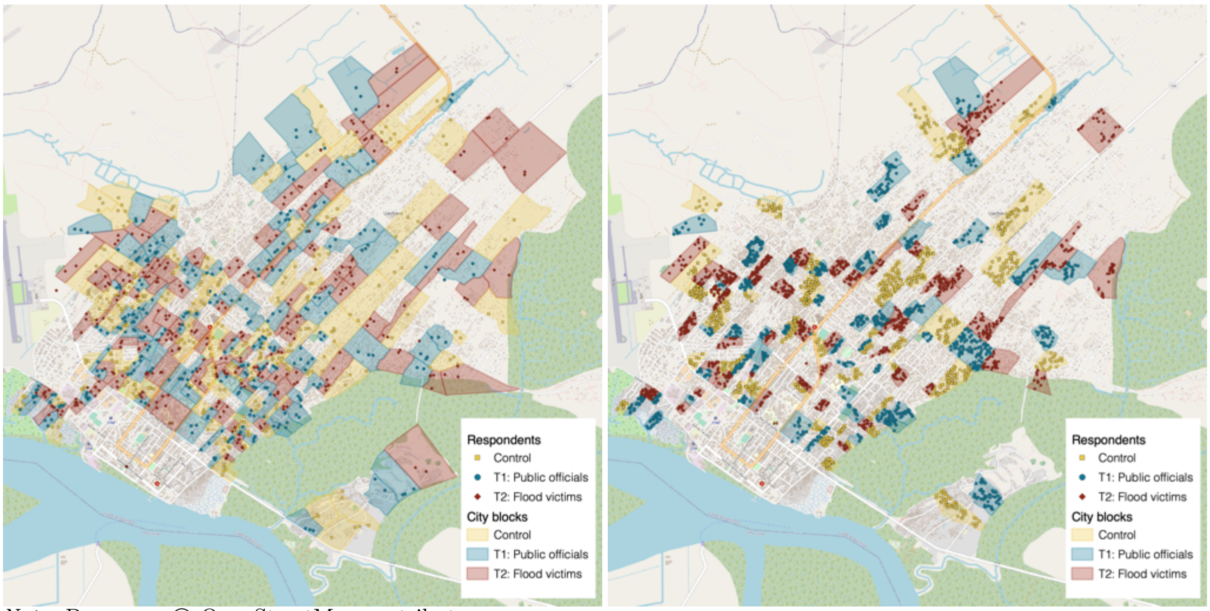
[2]Five chiefs were responsible for two blocks. In these cases, only the block in which the chief lived was eligible.

[3]The attrition is similar across the groups (*Placebo* video: six cases, *Public officials* video: seven cases, *Flood victims* video: eight cases) and cannot be attributed to the videos since these were only shown during the interviews.

321 blocks were visited, resulting in 642 household and 300 chief interviews. Figure 1a shows the locations of the enumeration areas and interviews by treatment.

Figure 1: Enumeration Area: City Blocks and Respondents by Treatment Group

(a) Household and Chief Surveys (b) Scale-up Surveys



Note. Basemap: © OpenStreetMap contributors.

Next, the treatment and placebo visits were scaled up in 150 city blocks randomly selected from the 300 city blocks in which chief surveys were successfully conducted. The random allocation to scale-up was stratified by the initial video treatment assignment, neighborhood and a set of city block characteristics including area size, Normalized Difference Vegetation Index (NDVI), number of houses, the chief's gender, age, and literacy, past flood experience and the presence of drainage infrastructure in the block.[4] Each city block maintained its initial video treatment status, but, now, 30 percent of the houses were randomly selected for a visit using satellite imagery. These were visits of about 20 minutes on average, during which the enumerators showed the assigned video and conducted a survey. These visits reached a significant portion of the population. In total, 3,536 visits were completed. Figure 1b shows the locations of the enumeration areas and visits by treatment. Upon completion of the scale-up visits. All consenting chiefs and households in the scale-up city blocks received text messages repeating the key points conveyed in the treatment videos.

To summarize, the 300 city blocks considered for follow-up data collection can be divided into 6 groups:

T0: The *control* group in which the chief and two households were shown the *placebo* video

[4]The NDVI is a dimensionless index that describes the difference between visible and near-infrared reflectance of vegetation cover and can be used to estimate the density of green on an area of land (Weier and Herring, 2000). NDVI is a factor used to determine flood susceptibility (Powell et al., 2014).

T1: The *text messages* treatment in which the chief and about 30 percent of the households were shown the *placebo* video and received the treatment text messages.

T2: The *public officials* treatment in which the chief and two households were shown the *public officials* video

T3: The *public officials (scale-up)* treatment in which the chief and about 30 percent of the households were shown the *public officials* video and received the treatment text messages.

T4: The *flood victims* treatment in which the chief and two households were shown the *flood victims* video

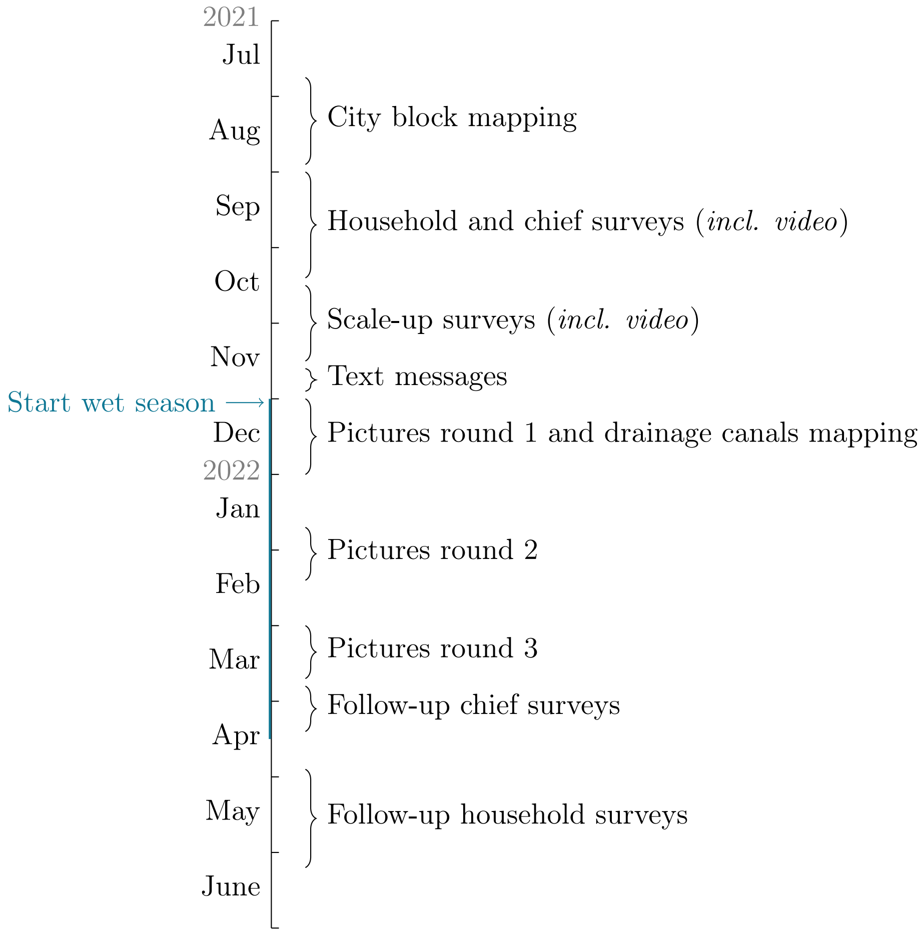
T5: The *flood victims (scale-up)* treatment in which the chief and about 30 percent of the households were shown the *flood victims* video and received the treatment text messages.

For each city block I plan to complete the following follow-up data collection activities:

- Pictures taken and observations made by enumerators on cleanliness and flooding during the wet season across city blocks and along drainage canals.
- SAR data obtained from the Sentinel-1 satellites.
- Surveys with chiefs and households that completed the household survey in the first round of data collection.
- Surveys with 8 additional heads of households or spouses. They are selected by randomly selecting houses using satellite imagery based maps. Similar to the first round household surveys, four men and four women will be interviewed.

See Figure 2 for an overview of the timeline of field activities.

Figure 2: Project Timeline



2.2.1 Attrition

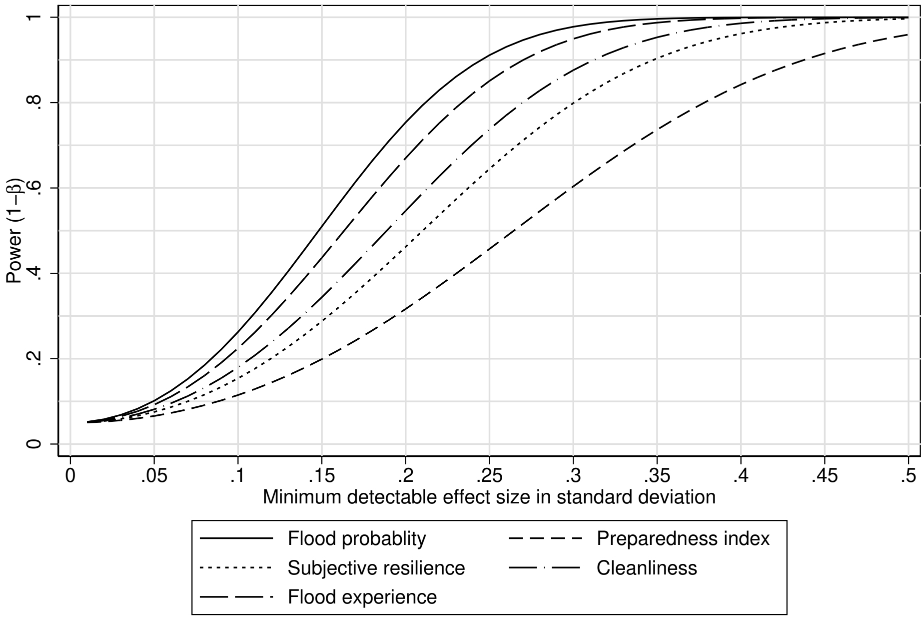
Overall, I expect relatively low attrition among chiefs and households surveyed during baseline. Between the mapping exercise and baseline chief surveys attrition was 7 percent. This is expected to be lower with more time and resources available to find chiefs and households. To minimize attrition, I build flexibility into the follow-up surveys to schedule interviews with chiefs and households at the time of their convenience. Moreover, the field teams will have access to contact information of the respondents, their relatives, neighbors, and friends. During baseline, I also collected the geolocation of where the interview was conducted which was 98 percent of the time at the residence of the respondent.

Since overall attrition is expected to be low, differential attrition by treatment groups is also less likely. Nevertheless, I plan to test for any differential attrition in baseline characteristics. Moreover, any loss of power for household survey outcomes is compensated by the additional data collection among 8 households per city block.

2.2.2 Statistical Power

The resulting overall survey samples consist of 300 chiefs, 600 households with baseline, and 2,400 households without baseline, divided in six groups of 50 city blocks. I calculate the minimum detectable effect expressed in terms of standard deviation for a clustered randomized controlled trial with 50 clusters per group, 5 percent significance level and 80 percent power. The intra-cluster correlation coefficient is calculated for each type of outcome variable using household baseline data from the *placebo* video group. Figure 3 illustrates the power calculation results.

Figure 3: Statistical Power Estimations



Note: Significance level is 0.05, both groups have 50 clusters and the sample standard deviation is 1. The average cluster size is 10. The intra−cluster correlation varies by outcome variable and is calculated using the baseline control group.

Flood probability is the reported likelihood of being affected by flooding during the next wet season, the preparedness index includes indicators for having taken the mitigation measures proposed in the treatment videos, subjective resilience is a self-reported measure for preparedness in case of a flood event tomorrow, and flood experience is a proxy for being affected by a flood using experience since 2019. The results show that the experiment is powered to detect treatment effects of 0.21-0.23 standard deviation for flood probability and experiencing a flood. The minimum detectable effect size for cleanliness and subjective resilience are 0.27-0.30 standard deviation. The minimum detectable effect size for the preparedness index is the highest with 0.38 standard deviation. Preliminary analysis of the baseline data showed a large effect on the intention to prepare, therefore, the relatively large minimum detectable effect size is acceptable.

3 Hypotheses

3.1 Main Hypotheses

The motivation behind this experiment is that if people are made aware about the risk they are facing, they will be more concerned about it and in response take preparatory action (Raaijmakers et al., 2008). This is particularly true when risk information is bundled with practical examples of mitigation actions to take. Protection Motivation Theory (PMT) suggests that the appraisal of mitigation measures could play an important role in this context (Rogers, 1975; Maddux and Rogers, 1983; Bubeck et al., 2012). PMT identifies how communication can change risk perceptions and behavior. Two cognitive processes are distinguished: *threat appraisal* and *coping appraisal*. *Threat appraisal* describes how risk exposure is evaluated by an individual. It is composed of *perceived vulnerability* and *perceived severity*, and is also referred to as *risk perceptions*. At a certain level of threat appraisal, an individual will consider to implement mitigation actions by evaluating the perceived effectiveness (*response-efficacy*), the perceived ability of implementation (*self-efficacy*), and *response-costs*. This is referred to as *coping appraisal*. The combination of treat appraisal and coping appraisal motivates people to engage in mitigation behavior. The studied interventions aim to positively impact both cognitive processes and as a result increase mitigation behavior. I distinguish between private and collective mitigation behavior. As a result of taking private mitigation actions, households are expected to become more resilient and suffer lower disaster impacts. With respect to collective action, individuals are motivated to engage in proper waste management and cleaning public locations such as streets and drainage canals. If successful, these actions could lead to less flooding in treated location and result in a lower flood impact on livelihoods. I test the impact of the interventions on the various steps in the described process. All outcome variables are discussed and presented in Section 4. The experiments' main hypotheses follow:

Hypothesis 1 *The interventions raise flood threat appraisal.*

Hypothesis 2 *The interventions raise flood coping appraisal.*

Hypothesis 3 *The interventions increase private flood mitigation behavior.*

Hypothesis 4 *The interventions increase collective flood mitigation behavior.*

Hypothesis 5 *The interventions lead to less flooding.*

Hypothesis 6 *The interventions lead to lower impact of flooding on livelihoods.*

There might exist differential treatment impacts across treatment groups. Depending on trust in authorities, knowledge and professional experience of the government officials in the *public officials* video is expected to contribute to the acceptance of the information. In contrast, the *flood victims* video is possibly more persuasive because it features speakers similar to the viewers (Bernard et al., 2015) and might affect social norms. Moreover, the scale-up treatment groups could trigger observational and peer learning more easily, as well as motivate collective action. However, treating the chiefs could be sufficient given the existing institutions.

3.2 Secondary Hypotheses

Next, I test secondary hypotheses to study mechanisms. Specifically, I test the role of social norms, maladaptive coping, flood related concerns, and the perceived cost of response. The latter is included as a secondary hypothesis (in stead of a primary hypothesis) because the interventions were not specifically designed to reduce the cost of mitigation measures. Nonetheless, the interventions might have had an effect on perceptions.

Hypothesis 7 *The interventions improve social norms regarding mitigation action.*

Hypothesis 8 *The interventions reduce maladaptive coping.*

Hypothesis 9 *The interventions raise flood related concerns.*

Hypothesis 10 *The interventions reduce the perceived cost of response.*

Finally, I also examine the effect of a negative experience on future preparedness in a behavioral game setting. The behavioral experiment is explained in Subsection 4.1.2.

Hypothesis 11 *Recent flood experience increases preparedness action.*

3.3 Heterogeneous Effects

I will conduct subgroup analyses to determine some of the underlying mechanisms. While allowing for exploratory work, the main subgroup analyses include:

a) Previous recent flooding experience (2019-2021)

b) Gender

c) City block connected to drainage canals

d) Timing of data collection (*Pictures and SAR data are collected across different moments during the wet season. Given the variability and uncertainty in rainfall, it is relevant to look at treatment effects at different moments in time.*)

4 Data

Measurements include multiple sources of data: two rounds of surveys with households and chiefs and surveys conducted during the scale-up visiting of households, a behavioral experiment, behavioral measures based on SMS technology, pictures along drainage canals and at random locations across city blocks, and SAR satellite images.

4.1 First round of data collection

4.1.1 Household and Chief Surveys

The household survey questionnaire was divided into four parts. The first part included detailed questions about the household's composition, economic status, access to public services and financial instruments, flooding experience, and trust. The second part was the video, and the third part included detailed questions about risk awareness, concern, preparedness, and risk and time preferences. The final part of the questionnaire was the behavioral experiment. The chief survey was similar to the household survey. Although the same topics were covered, there were two main differences. First, the chief and block characteristics were collected during the mapping exercise and, therefore, not included in the chief survey. Second, questions were framed to cover knowledge and perceptions about the city block rather than the household. See Table 1 for the household and chief survey-based outcome variables.

4.1.2 Behavioral Experiment: Insurance Game

The behavioral experiment was conducted with all household and chief survey respondents and was incentivized. All respondents received 100 meticais as a token of appreciation for their participation.[5] They could gain additional 200 meticais by playing an insurance game. In this game, the participant played six identical rounds for which one would be selected for payment. While the outcome of each round did not impact the outcome of other rounds, the outcome was revealed immediately at the end of each round. In each round, the participant was given 200 meticais and needed to choose to play without or with insurance. Next, the participant was asked to roll a six-sided die. If the participant played without insurance and rolled 1, they would lose the 200 meticais. However, for any other result (rolling 2–6), the participant would keep the 200 meticais. If the participant played with insurance, they would pay 100 meticais for the insurance and keep 100 meticais independently of the result of rolling the die. Payments were made through mobile money platforms one day later. The objective of this game was to measure whether the experience of rolling 1 had an impact on the behavior in the following rounds.

4.1.3 Behavioral Measure using SMS

The household and chief survey measures were also supplemented with behavioral measures based on SMS technology. After the survey, I sent respondents two different invitations through text messages to the phone numbers provided by the respondents. The first invitation, which took place the day after the interview, offered some useful information about the cyclone warning system currently active in Quelimane. Respondents had to reply "yes" to receive the information. Responses were processed until one week after the last interview took place. The second invitation asked respondents to send anonymous

[5] As of September 2021, 100 meticais is around $1.6.

feedback and suggestions about disaster risk management to the local government. This invitation was sent one week after the last interview and included a reminder two days later. Responses were processed for one week. These text messages involve costly actions, are unlikely to be influenced by the enumerator, and are, therefore, less likely to be subject to social desirability bias relative to survey questions.

4.1.4 Scale-up Visit Surveys

The scale-up surveys included questions before and after showing the video. Gender, age, flooding experience, and exposure to the previous round of visits (household and chief survey visits) were recorded before showing the video. After the video, the survey covered a subset of the risk perception questions. This survey also included a new set of questions about the intention to prepare for flood risk. See Table 1 for the scale-up survey-based outcome variables.

Table 1: Survey-based outcome variables (initial rounds)

Threat appraisal and risk awareness	
At risk[H,C]	Do you live in an area prone to flooding at the moment? Scale: *no (0), yes (1)*
Probability[H,C,S]	How likely is flooding to affect your household during the next wet season? Scale: *not at all likely (0), unlikely (1), likely (2), very likely (3)*
Flood damage[H,C]	Imagine a year when your house is flooded, how big would the impact be? Scale: *none (0), small (1), average (2), large (3)*
Frequency (city)[H,C]	How often do floods occur in Quelimane? Scale: *never (0), less than once a year (1), once a year (2), several times a year (3)*
Frequency (block)[H,C]	How often do floods occur in your city block? Scale: *never (0), less than once a year (1), once a year (2), several times a year (3)*
Risk concern	
Flood concern[H,C]	How concerned are you that flooding will affect your household's <*item*>? Items: *(a) health, (b) assets, (c) access water/food, (d) income, (e) relationships* Scale: *not concerned (0), little concerned (1), concerned (2), very concerned (3)*
Flood concern[S]	How concerned are you that flooding will affect your household? For example, regarding your household's safety, assets, and access to water/food Scale: *not concerned (0), little concerned (1), concerned (2), very concerned (3)*
Preparation perceptions	
Fatalism[H,C]	It is not always necessary for me to plan far ahead because many things turn out to be a matter of good or bad luck. Scale: *strongly agree (1) - strongly disagree (5)*
Response-cost[H,C]	It is too expensive/difficult to take flood protection measures that limit flood damage. Scale: *strongly agree (1) - strongly disagree (5)*
Social norms[H,C]	People in my direct environment would approve of me taking steps to prepare for a flood. Scale: *strongly agree (1) - strongly disagree (5)*
Share info[H,C]	Considering your knowledge about floods and disaster risk management, how likely are you to share this with a neighbor? Scale: *not at all likely (0), unlikely (1), likely (2), very likely (3)*
Preparation intentions	
Private and collective[S]	How likely is your household to <*measure*> in the next 2 months? Measures: *(a) gather more preparation information (b) prepare an emergency plan, (c) safely store valuables and documents, (d) make home improvements, (e) identify evacuation routes/shelters, and (f) drainage canal cleaning* Scale: *no (0), yes (1)*

Note. (H) Household survey, (C) chief survey, and (S) scale-up survey. Chief survey outcomes are framed to cover knowledge and perceptions about the city block rather than the household.

4.2 Follow-up data collection

4.2.1 Household and Chief Surveys

The follow-up chief survey questions are incorporated into the baseline survey with chiefs of a project on urban migration. The household survey will be conducted independently. Besides respondent and household characteristics (including before 2022 flood experience), the surveys contain primary outcome variables (Table 2) and secondary outcome variables to study mechanisms (Table 3). Finally, to confirm mitigation behavior the household survey includes several less conventional methods of measurement, including visual confirmation, picture taking and knowledge tests (Table 4).

Table 2: Survey-based primary outcome variables (follow-up)

Threat appraisal	
At risk[H,C]	Do you live in an area prone to flooding at the moment? Scale: *no (0), yes (1)*
Flood probability[H,C]	How likely is flooding to affect your household during the next wet season? Scale: *not at all likely (0), unlikely (1), likely (2), very likely (3)*
Flood damage[H,C]	The impact of floods is different across city. In some parts it is very big, leading to dangerous situations and great losses. In other parts it may be less. Imagine a year when your household is affected by flooding, what would the impact be on your household? Scale: *very small (1) - very big (5)*
Coping appraisal	
Mitigation awareness[H,C]	What steps can you take to reduce the impact of floods on your household? Options: *all private and collective measures* *Continuous variable of the number of described measures mentioned*
Self-efficacy[H]	Which of the following measures is your household capable of implementing? Options: *all private and collective measures* *Indicators and continuous variable of the number of described measures mentioned*
Response-efficacy[H]	Which of the following measures would be effective in reducing the impact of flooding on your household? Options: *all private and collective measures* *Indicators and continuous variable of the number of described measures mentioned*
Private and collective mitigation behavior	
Own behavior[H,C]	In preparation for the wet season, have you or any household member <*measure*>? Scale: *no (0), yes (1)*
Collective action[H,C]	Since December, the beginning of the wet season, how often did households get together for preparation activities? Scale: *never (0), rarely (1), sometimes (2), often (3)*
Observed by chief[C]	What kind of preparation have you seen happening among the households in your block? Options: *all private and collective measures*
Subjective resilience[H,C]	If a flood were to occur tomorrow, how likely is it that your household would be well prepared in advance. Scale: *not at all likely (0), unlikely (1), likely (2), very likely (3)*
Flood impact	
Affected[H,C]	Has your household been affected by floods during the past wet season since December? Scale: *no (0), yes (1)*
Impact[H,C]	Since December, the beginning of the wet season, how much has/have the <*item*> of household members been affected by floods? Items: *(a) health, (b) assets, (c) access water/food, (d) income, (e) relationships* Scale: *not at all affected (0), little affected (1), affected (2), very affected (3)*
Affected households[C]	Approximately how many households were directly affected? Scale: *None (0), 1-10 (1), 11-20 (2), ..., 81-90 (9), 91-100 (10), specify for more than 100*
Damage assessment[H]	How much do you estimate the monetary damages caused by flooding? Scale: *0MT (0), More than 0 but less than 1.000MT (1), 1.000-1.999MT (2), 2.000-3.999MT (3), 4.000-5.999MT (4), 6.000-9.999MT (5), 10.000-24.999MT (6), 25.000-49.999MT (7), 50.000-99.999MT (8), 100.000-199.999MT (9), 200.000MT or more (10)*

Note. (H) Household survey and (C) chief survey. Chief survey outcomes are framed to cover the city block rather than the household. For the coping appraisal of chiefs the list of measures is reduced to only *organizing cleanings*. For the mitigation behavior of chiefs the list of measures is: *(a) collected information, (b) identified shelter, (c) shared information, (d) attended DRM meetings, (e) monitored alerts, (f) shared alerts, and (g) organized cleanings.* Private mitigation measures of households: *(a) prepare an emergency plan, (b) safely store valuables and documents, (c) make home improvements, (d) elevating yard (e) prepare a food/water kit, and (f) identify shelter.* Collective mitigation measure of households: *drainage canal and street cleaning*

Table 3: Survey-based secondary outcome variables (follow-up)

Social norms	
Social norms[H]	People in my direct environment would approve of me taking steps to prepare for a flood. Scale: *strongly agree (1) - strongly disagree (5)*
Maladaptive coping	
Avoidance[H,C]	I avoid thinking about the threat of flooding during the wet season. Scale: *strongly agree (1) - strongly disagree (5)*
Fatalism[H,C]	It is pointless to prepare for flooding, it is a matter of good or bad luck. Scale: *strongly agree (1) - strongly disagree (5)*
Concern	
Flood concern[H,C]	How concerned are you that flooding will affect your household's <*item*>? Items: *(a) health, (b) assets, (c) access water/food, (d) income, (e) household relationships* Scale: *not concerned (0), little concerned (1), concerned (2), very concerned (3)*
Coping appraisal	
Response-cost (time)[H]	Which of the following measures would take too much time to implement? Options: *all private and collective measures* *Indicators and continuous variable of the number of described measures mentioned*
Response-cost (money)[H]	Which of the following measures would be too expensive to implement? Options: *all private and collective measures* *Indicators and continuous variable of the number of described measures mentioned*
Consumption	
Consumption index[H]	In the last month (30 days), how much money has your household spend on <*item*>? Items: *(a) food at home, (b) airtime, and other phone expenses, (c) travel/transport, (d) coal, (e) electricity, (f) water* Scale: *0MT (0), 1-15MT/day or 1-450MT/month (1), 16-30MT/day or 451-900MT/month (1), 31-60MT/day or 900-1,800MT/month (2), 61-100MT/day or 1,800-3,000MT/month (3), 101-200MT/day or 3,000-6,000MT/month (4), 201-400MT/day or 6,000-12,000MT/month (5), 401-600MT/day or 12,000-18,000MT/month (6), more than 600MT/day or 18,000MT/month (7)*
Mental health	
Mental health index[H]	In the last month, how often have you been upset because of something unexpectedly? In the last month, how often have you felt not in control of important things in life? In the last month, how often did you feel nervous, tense or worried? In the last month, how often did you feel sad? In the last month, how often did you have trouble concentrating on what you were doing? In the last month, how often did you have confidence in the future? Scale: *never (0), rarely (1), sometimes (2), often (3)*
Financial coping	
Repair[H]	Since December, how much has your household spent approximately on repairs and necessary property replacements? Scale: *0MT (0), More than 0 but less than 1.000MT (1), 1.000-1.999MT (2), 2.000-3.999MT (3), 4.000-5.999MT (4), 6.000-9.999MT (5), 10.000-24.999MT (6), 25.000-49.999MT (7), 50.000-99.999MT (8), 100.000-199.999MT (9), 200.000MT or more (10)*
Loans[H]	Since December, has your household received loans from family or friends that do not live in your home? Scale: *no (0), yes (1)*
Loans value[H]	What was the total value of these loans approximately? Scale: *0MT (0), More than 0 but less than 1.000MT (1), (...), 200.000MT or more (10)*
Remittances[H]	Since December, has your household received money from family or friends that do not live in your home? Scale: *no (0), yes (1)*
Remittances value[H]	How much money has your household received from family or friends approximately? Scale: *0MT (0), More than 0 but less than 1.000MT (1), (...), 200.000MT or more (10)*
Remittances (in-kind)[H]	Since December, has your household received any goods, for example, food, clothes or materials, from family or friends that do not live in your home? Scale: *no (0), yes (1)*
Remittances (i-k) value[H]	What was the total value of these goods approximately? Scale: *0MT (0), More than 0 but less than 1.000MT (1), (...), 200.000MT or more (10)*
Detailed flood impact	
Proportion sick/injured[H]	Since December, how many household members have been sick/injured? *Continuous variable of the share of household members that were sick/injured*
Basic needs[H]	Since December, how many times did your household go without <*item*>? Items: *(a) enough food, (b) potable water, (c) necessary medicines* Scale: *never (0), few times 1-10 (1), sometimes 11-20 (2), often 20+ (3)*
Asset impact[H]	Since December, which of the following items and assets have been damaged by flooding? Items: *(a) radio, (b) television, (c) smartphone, (d) simple phone, (e) mattress, (f) official document, (g) book* *Continuous variable of the share of household items that were damaged by flooding*

Note. (H) Household survey and (C) chief survey. Chief survey outcomes are framed to cover the city block rather than the household. For the coping appraisal of chiefs the list of measures is reduced to only *organizing cleanings*. For the mitigation behavior of chiefs the list of measures is: *(a) collected information, (b) identified shelter, (c) shared information, (d) attended DRM meetings, (e) monitored alerts, (f) shared alerts, and (g) organized cleanings.*

Table 4: Outcome variables to confirm mitigation behavior (follow-up)

Prepare an emergency plan	
Emergency planning[H]	Unforeseen situations such as natural disasters (e.g., floods or cyclones) happen at less expected times. Sometimes it can happen when we are with our families and sometimes not. This forces us to make some immediate decisions. Imagine an emergency situation that prevents you from returning home. Q1: Where would you go to meet up with other household members? There are moments or circumstances in life that lead us to look for trusted people or places to ask for some kind of immediate support. For example, food, advice or a temporary stay. Q2: Who is the main contact person outside the household to be trusted and contacted? *Questions are repeated separately for two randomly selected household members* *Continuous variable of the number of household members confirming the main respondent's answers*
Make home improvement	
General[H]	Please, list and show the home improvements made in preparation of the past wet season. Scale: *unconfirmed (0), confirmed (1)*
Flood specific[H]	Have you elevated your yard or home to prevent them from flooding? Please show. Scale: *unconfirmed (0), confirmed (1)* *Enumerator takes pictures*
Collect more information	
Name block chief[H]	What is the name of the current chief of your city block? Scale: *unknown or incorrect (0), correct (1)*
Name neighborhood chief[H]	What is the name of the current chief of your neighborhood? Scale: *unknown or incorrect (0), correct (1)*
Household info requests[C]	During the last 6 months, how often did households come to you for flood preparedness advice/information? Scale: *never (0), rarely (1), sometimes (2), often (3)*

Note. (H) Household survey and (C) chief survey.

4.2.2 Pictures

During the wet season, three rounds of observational data are collected. Each round enumerators take pictures and make observations at pre-specified locations along 42.8 kilometers of drainage canals and within the sampled city blocks. At each location, enumerators take five pictures, one of the location and four more at the location to cover a 360 degree view of the surroundings. Next, observations are made about the degree of cleanliness (*very clean (0) - very dirty (10)*) and flooding (*no flooding (0), 0-10cm (1), 10-25cm (2), 25-50cm (3), 50cm-1m (4), 1-2m (5), more than 2m (6)*) at the location. Finally, the enumerator is asked to evaluate whether any preparation actions have taken place at the location. The cleanliness variable and indicators for any flooding and flooding of at least 10cm will be considered as outcome variables.

Drainage canals. The first round took place in December 2021 and was focused on mapping the drainage canals. First, I created a system of possible drainage canals using satellite imagery and drainage system maps obtained from Quelimane's department for urban planning. Second, enumerators were instructed to collect data along the canals at 50 meter intervals. Third, all sampled city blocks were checked for missing drainage canals and these were added to the final map. In total, 69.4 kilometers of possible drainage canals were checked and data on 784 drainage system locations were collected.

During the second and third round, the confirmed drainage canals are revisited for observation. This activity started in January and finished in the end of March 2022. The number of locations visited in each follow-up round was 856. This number was higher than for the first round because of the canals that were not previously detected on maps.

Centroids. During the first round, observations were made at the geometric center of each city block, resulting in 300 observations. For the second and third round, respectively four and five locations per city block were visited. These locations were selected by partitioning each block into four and five equally sized divisions using k-means clustering and taking the centroid of each of these subdivisions. I used this method to avoid randomly selecting locations close to the border or clustered together by chance.

Data engineering. The collected pictures are resized (300 pixels), joint by location (1500 pixels), and labeled using the cleanliness variable and indicators for any flooding and flooding of at least 10cm. The three RGB color codes of each pixel are transformed into one grayscale value. The data is divided into two data sets, one for training (80 percent) and one for testing (20 percent).

Deep learning. A deep learning model is being designed to analyze the combined image with a logical structure and identify the degree of cleanliness and flooding. For this analysis, the deep learning application uses a layered structure of algorithms called an artificial neural network. Specifically, GoogLeNet will be used. This is a 22-layer deep convolutional neural network that is a variant of the Inception Network, a Deep Convolutional Neural Network developed by researchers at Google. The resulting image classification of cleanliness and flooding will be used as outcome variables.

4.2.3 SAR and rainfall data

To determine the extent of flooding in the enumeration area, I use SAR satellite imagery. Specifically, I download Sentinel-1 data from the Copernicus Open Access Hub. I use level-1 Ground Range Detected with high resolution (20x22m). The Sentinel-1 satellite constellation offers a 6 day exact repeat cycle at the equator. This is a big advantage given Mozambique's relative proximity to the equator. In the analysis I will focus on data collected during and after periods of heavy rainfall. These periods will be identified using daily rainfall data obtained from a local weather station in Quelimane part of the National Institute of Meteorology. I will be transparent in this identification and provide the necessary robustness checks.

The SAR satellite imagery is processed using a step-by-step procedure for mapping floods with radar imagery developed by the Space Research Institute NASU-SSAU, Ukraine, a UN-SPIDER Regional Support Office.[6] An important step in this process is the binarization step in which it is necessary to select the value that will separate water from non-water. This is done manually and I select the value as a function of accuracy checks using the picture data described in Subsection 4.2.2 and non-SAR satellite imagery if

[6]For the exact procedure see: Recommended Practice: Radar-based Flood Mapping

available and depending on cloud coverage.[7] This practice will result in a map with pixels that represent water or non-water. I then take the mean of these pixels at the city block level, representing the degree of flooding.

Using SAR satellite imagery for flood detection has several advantages, such as the high revisit time, independency from clouds, and easy detection of smooth water. However, flood detection in urban areas remains challenging because of the potential false positives from shadows and smooth objects (like roads). While these challenges are consistent across treatment and control, I plan to address the false positives by controlling for estimates based on a dry season image (November 2021) in the regressions.

5 Empirical Analysis

5.1 Balance tests

I will test for balance between the control and treatment groups. Specifically, I will run t-tests of equality of means on individual and city block characteristics.

5.2 First round datasets

The immediate impact of the videos can be evaluated by comparing outcomes across groups of respondents watching the same video in a simple regression framework. These outcomes are based on 642 household surveys, 300 chief surveys, and 3,536 scale-up surveys, as well as the behavioral measure using SMS for 642 households and 300 chiefs. The main estimation equation for survey outcomes is:

$$y_{i,b} = \alpha + \beta_1 \mathbf{V}_b + \delta_1 \mathbf{X}_{i,b} + \theta_1 \mathbf{Z}_b + \epsilon_{i,b} \tag{1}$$

where $y_{i,b}$ is the outcome of interest for individual i in city block b. V_b is a vector of two binary variables taking a value of 1 if the city block is assigned to the corresponding treatment video and a value of 0 otherwise. $\mathbf{X}_{i,b}$ is a vector of individual control variables, including the respondent's gender, age, education, and household size.[8] $\mathbf{Z}_b$ is a vector of block level control variables, including the number of houses, the area size in hectares, the number of meters of drainage canals, and neighborhood fixed effects.[9] Finally, $\epsilon_{i,b}$ is the usual idiosyncratic error term. Standard errors are clustered at the city block level. For subgroup analysis, the treatment indicators are made to interact with a binary indicator for the subgroup of interest. For the behavioral measure using SMS, I will present results

[7] For example, by using imagery from Norway's International Climate & Forests Initiative.

[8] To control for education, two indicators for completed primary and secondary education are included. Note that the scale-up survey did not include measures for education and the number of household members. Therefore, estimations using this data set do not include education and household size as controls.

[9] For all estimations, I will confirm for the robustness of the results to the exclusion of each control separately and present results for estimations only including neighborhood fixed effects.

for both households and chiefs combined in pooled regressions and show separate estimates by subgroup.

The insurance game is analyzed separately. I compare insurance take-up across participants that have rolled 1 for any of the previous rounds and those that have not. I run these regressions for each round. The specification looks as follows:

$$insurance_{t,i,b} = \alpha + \beta_2 \mathbb{1}(\sum_{n=1}^{t-1}(d_{t-n,i,b}) > 0) + \delta_2 \mathbf{X}_{i,b} + \theta_2 \mathbf{Z}_b + \epsilon_{i,b} \quad (2)$$

where $insurance_{i,b}$ is 1 if individual i in city block b bought insurance in round t and 0 otherwise. $d_{t-n,i,b}$ is 1 if individual i rolled 1 in round $t-n$ for $0 < n < t$. Moreover, I run the same regressions including indicators for the last round in which the participant rolled 1 to understand whether the effect of experience diminishes over time.

5.3 Follow-up datasets

The impact of the interventions, during and after the wet season, will be evaluated by comparing outcomes across treatment groups. These outcomes are based on 300 chief surveys, 600 household surveys previously interviewed, 2,400 additional household surveys, observations made by enumerators at locations across the city (3,000) and along drainage canals (2,496), and SAR data. City block, chief, household and location level regressions are specified as:

$$y_{i,b} = \alpha + \beta_3 \mathbf{T}_b + \delta_3 \mathbf{X}_{i,b} + \theta_3 \mathbf{Z}_b + \varepsilon_{i,b} \quad (3)$$

where $y_{i,b}$ is the outcome of interest for respondent or location i in city block b. T_b is a vector of five binary variables taking a value of 1 if the city block is assigned to the corresponding intervention and a value of 0 otherwise. $\mathbf{X}_{i,b}$ is a vector of individual control variables, including the respondent's gender, age, education, and household size. $\mathbf{Z}_b$ is a vector of block level control variables, including the number of houses, the area size in hectares, the number of meters of drainage canals, and neighborhood fixed effects.[10] Finally, $\varepsilon_{i,b}$ is the usual idiosyncratic error term. Standard errors are clustered at the city block level. For subgroup analysis, the treatment indicators are made to interact with a binary indicator for the subgroup of interest.

The individual impact of the videos on visited households can be estimated comparing outcomes across groups of respondents watching the same video with respondents that did not watch any video, while taking into account whether an individual is part of a scale-up block. The specification looks as follows:

$$y_{i,b} = \alpha + \beta_4 \mathbf{W}_i + \gamma_4 \mathbf{W}_i S_b + \eta S_b + \delta_4 \mathbf{X}_{i,b} + \theta_4 \mathbf{Z}_b + \nu_{i,b} \quad (4)$$

[10] Additionally, I plan to include dry season estimates of flooding for regressions estimating the treatment impact on flooding using SAR satellite imagery.

where $\mathbf{W}_i$ is a vector of three binary variables taking a value of 1 if the respondent or a household member watched the corresponding video and a value of 0 otherwise. $\mathbf{W}_i$ is known for the baseline household sample. For the remaining household surveys visited during the follow-up $\mathbf{W}_i$ is constructed using a question about whether the respondent or someone else in the household watched a video, the location of the household's residence, and matching the phone numbers of scale-up survey respondents with the follow-up sample.[11] S_b is an indicator for the scale-up assignment of the city block.

5.4 Spillovers

The study is set in a densely populated urban area. The city blocks are in close proximity to each other and boundaries are not always very clear. There is potential for spillover effects which could lead to underestimating the impact of the interventions. First, control households and chiefs could observe the behavior of households and chiefs in treated city blocks and copy this behavior. Second, control households and chiefs could hear about the content of the videos and text messages from neighbors across the city block borders. Third, control households and chiefs could coordinate collective action activities with households and chiefs from treated city blocks or through the neighborhood chief. Fourth, the proximity of city blocks means that poorly maintained drainage canals in one city block could lead to flooding in a neighboring city block. If the latter are treated, this would cause downward bias, or it could demotivate people in treated city blocks to take action. Similarly, well maintained drainage canals in one city block could lead to less flooding in a neighboring city block. This would also cause downward bias. To evaluate the existence of spillovers across city blocks I estimate the following equation just for untreated city blocks:

$$y_{i,b} = \alpha + \beta_5 \mathbf{borderT}_b + \lambda_5 borders_b + \delta_5 \mathbf{X}_{i,b} + \theta_5 \mathbf{Z}_b + \upsilon_{i,b} \tag{5}$$

where $\mathbf{borderT}_b$ is a vector of five binary variables taking a value of 1 if the city block borders with a city block assigned to the corresponding intervention and a value of 0 otherwise. $borders_b$ is the number bordering city blocks.

To evaluate the existence of spillovers within city blocks, I estimate Equation 3 for individual households, while excluding treated households.

To evaluate the robustness of results for observations along drainage canals, I estimate Equation 3 for locations excluding any location where the drainage canal is shared between two project city blocks with different treatment allocations. Similarly, I will compare drainage canal locations on the border of both control and treatment blocks with control blocks that do not exhibit such conflicts.

[11] I will also examine the stricter approach of not assigning treatment to those where someone else in the household watched a video.

5.5 Multiple hypothesis testing

Since I plan to examine various outcomes, treatment arms, and dimensions of heterogeneity, I must account for multiple comparisons. I address this in two ways. First, I reduce the number of hypothesis by combining outcomes into standardized indices using the first eigenvector of a principal component analysis. Specifically, I create indices for outcomes that include multiple items (e.g., flood concern and private mitigation behavior). Moreover, I present results for individual outcomes and indices combining outcomes that belong to the same pre-specified outcome groups. Second, I will present adjusted p-values using the Westfall-Young step-down procedure that controls the family-wise error rate (Westfall and Young, 1993). I will adjust p-values using the pre-specified outcome groups. The adjusted p-values will control the family-wise error within those groups.

5.6 Data transformation

In order to limit noice caused by variables with minimal variation, I do not use in the empirical analysis any variable for which more than 95 percent of observations have the same value.

I treat "do not know" and "refuse to answer" answers as missing. The only exception is for questions that check for knowledge (see e.g., "block chief name" in Table 4), for which "do not know" answers are treated as wrong answers. I do not perform any imputation for missing data from item non-response.

During the scale-up visits, respondents in one city block were not shown the correct video. Instead of watching the assigned *placebo* video, the respondents watched the *flood victims* video. Therefore, I will exclude this city block from the analysis.

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Appendix

Preparing for Urban Floods in Mozambique
A Field Experiment on Risk Communication

Pre-Analysis Plan

Stefan Leeffers

This appendix contains the following sections. Section A provides the scripts used in each video. Section B provides the scripts used in each text message.

A Appendix: Video Scripts

A.1 *Public officials* video script

Man My name is (. . .), I have been an employee of the Municipal Council of Quelimane since 2013, as director of the environment and climate change department. I have 6 years of experience in disaster risk management. Today I'm going to talk a little about natural disasters, risk management and what families should do to be prepared in the event of a disaster event. The city of Quelimane is located in a low-lying area, which makes flooding more frequent compared to other cities in the province. By floods I mean exceptionally high-water level events that can affect the city block where you live, thus harming the dwellings, goods, resources, or other valuable items of your household.

Woman My name is (. . .), I have been an employee of the Municipal Council of Quelimane since 2012. I have been director of EMUSA since 2019. I have 6 years of experience in disaster risk management. You are viewing this video because you live in an area prone to flooding. Every year, we have neighborhoods that suffer from flooding in the wet season from December to April and, in times of major storms, almost the whole city is flooded due to the poor drainage of rainwater and high tide. The combination of these threats has resulted in health problems such as malaria and cholera, loss of life, and destruction of infrastructure and livelihoods. The scientific community warns that cyclones and extreme storms are increasing in frequency over the years and predicts that storms will become increasingly intense due to the change in seawater temperatures associated with global warming.

Man Our main concern as an institution is to prepare families for the periods before disasters occur (through preventive measures); in the period of the occurrence (through alerts) and after the occurrence (monitoring of diseases and social reintegration). Before the occurrence of disasters, it is important to adopt preventive measures such as:

a) creating an emergency plan which must be known to all family members;

b) creating food, medicine, and water reserves in easily accessible places, to use if you are stuck for a few days;

c) know the evacuation routes and centers defined for each neighborhood;

d) keep valuables, such as personal documents, bank cards, and schoolbooks, in a safe place; and

e) make improvements to the house, such as reinforcing the roof, doors, and windows.

Woman As we may know, garbage and debris block the drainage canals in the city of Quelimane. To this end, we must keep the canals other water ways clean. To facilitate the flow to the sea, we must avoid throwing garbage and solid waste in the drainage ditches and create activity plans that allow us to keep our city block and the ditches always clean. It is expressly forbidden to throw garbage in the ditches or deposit it in the streets.

To gather specific information about flood hazards within your block or neighborhood, you can contact your community leader; either the block chief, neighborhood secretary, or local risk management committee. You should also monitor the emergency and alert information systems, for example on radio, television, mobile phone, or through the community leader. It is important that you familiarize yourself with your community's emergency plan. Talk to your neighbors and friends as it is essential to prepare the community to face the impacts of climate change and natural disasters.

Thanks for listening.

A.2 *Flood victims* video script

Man My name is (...), I am 42 years old, and I have lived in the Manhaua B neighborhood for over 8 years. I am the head of a household of a family of 4; with my 2 children and my wife. I work as a servant in a commercial establishment in the city center of Quelimane. Today, I would like to talk a little about my experience with natural disasters, risk management, and floods and what we should do to be more prepared in the event of a disaster event. The city of Quelimane is located in a low-lying area, which makes flooding more frequent compared to other cities in the province. You are viewing this video because you live in an area prone to flooding.

In January 2020, my family was affected by floods caused by the intense rains that were felt in the city of Quelimane. Our house was totally destroyed due to the flooding of water in the backyard; we lost several goods such as chairs, stove, beds, clothes, and other appliances. During the rainy season, the city block is completely flooded and isolated from the other part of the neighborhood, which compromises the well-being of my family. When this happened, we spent nights without electricity and without meals because all our food had been soaked. We were stuck on a table because the water in the house was knee-deep. Our clothes and blankets were totally wet. It was a very difficult experience for me and my family.

Woman My name is (...), I have lived in the Manhaua B neighborhood for over 5 years. I belong to a household consisting of 8 people, I have 7 children. I work as a peasant. Every year, we have neighborhoods that suffer from flooding in the wet season from December to April and, in times of major storms, almost the whole city is flooded due to the poor drainage of rainwater and high tide. The combination of these threats has resulted in health problems such as malaria and cholera, loss of life, and destruction of infrastructure and livelihoods. The scientific community warns that cyclones and extreme storms are increasing in frequency over the years and predicts that storms will become increasingly intense due to the change in seawater temperatures associated with global warming.

Man What happened to us could happen to you. Therefore, it is our responsibility together to protect our families, communities, and ourselves. Due to our negative experience, today our family is more aware of the risks of floods that may occur on our city block. We are on alert whenever we approach the wet season and in this way we can:

a) create an emergency plan, known to all my family;
b) know the nearest evacuation routes and centers;
c) store valuables, such as personal documents, bank cards, and schoolbooks, in a safe place;
d) make improvements to the house; and
e) have the possibility of conserving food, water, and medicines for times of crisis.

Woman As we may know, garbage and debris block the drainage canals in the city of Quelimane. To this end, we must keep the canals other water ways clean. To facilitate the flow to the sea, we must avoid throwing garbage and solid waste in the drainage ditches and create activity plans that allow us to keep our city block and the ditches always clean.

To gather specific information about flood hazards within your block or neighborhood, you can contact your community leader; either the block chief, neighborhood secretary, or local risk management committee. You should also monitor the emergency and alert information systems, for example on radio, television, mobile phone, or through the community leader. It is important that you familiarize yourself with your community's emergency plan. Talk to your neighbors and friends as it is essential to prepare the community to face the impacts of climate change and natural disasters.

Thanks for listening.

A.3 *Placebo* video script

Man My name is (...), I have been a resident of the Samugue neighborhood for over 20 years. I am the head of a household consisting of 9 people. I have 7 children. I am a teacher.

Woman My name is (...), I have been a resident of the Samugue neighborhood since I was born. I belong to a household of 9 people. I have 7 children. I'm a businesswoman and I have my own beauty salon. I would like to talk a little about our city of Quelimane.

Quelimane City is located in the central region of Mozambique, in Zambézia Province, Quelimane District. It is the capital and largest city of Zambézia Province. The city of Quelimane emerged as a small group of houses that belonged to large companies. All facing the river Rio Dos Bons-Sinais, on the waterfront, which functioned as a port, and was the center of social life. It should be noted that, at the time, the port was located on the avenue at the waterfront, served by railway lines and by landing ramps. Later, the trees and the railway lines disappeared, and the port was relocated to one of the avenue's ends. Meanwhile, the waterfront was becoming a space for walking and leisure, a place for young people who, sitting on its walls, stayed until sunset.

Man Since colonial times, Quelimane has grown a lot in administrative and commercial terms, thanks to the unusual agricultural wealth. In terms of urban beauty, it is possible to observe beautiful landscapes along the avenues and streets that reflect the combination of old and modern dwellings such as: the old town hall of Quelimane, the Governor's Office, the old submarine cable station, Catholic church, Hospital, Águia cinema, parks, harbor, and other views of the city of Quelimane.

Woman The housing, in both colonial and modern times, is characterized by traditional and improved houses for most of the population. The Quelimane has a tropical climate which is warm and humid and accentuated by its location on the bank of the Cua-Cua River and its proximity to the Mozambique Channel. The city has two distinct seasons, the hot season, and the wet season. The wet season takes place from December to April in almost every year.

Man Quelimane has tourist and transit infrastructures (Hotels, Pensions, Restaurants, Bar, Disco, Nightclubs, Take-Aways, etc.), and has the potential to grow with positive monetary benefits. Additionally, there are factories in Quelimane, which provide direct employment to thousands of employees and workers, and which have a significant local tax impact. The city of Quelimane, which has the port as one of its main economic activities, has seen a stark increase in the use of bicycles (taxi) that guarantee urban passenger transport in the city. This gives the city council a challenge. In the city of Quelimane, the bicycles play a prominent role in informal commerce. The circulation and flexibility of the bicycles allow these activities to be distributed along the roads and their intersections, close to schools, health units homes and especially in markets.

Thanks for listening.

B Appendix: SMS Scripts

The informative text messages were sent daily from November 19 until November 24, 2021. In total, each household and chief received six text messages. The topic of each message and exact content are presented below (translated from Portuguese to English).

Introduction **Household**. Hello, we are NOVAFRICA, on behalf of the Municipal Council of the City of Quelimane we would like to inform you that in the next few days you will receive messages about the preparation for the floods. The wet season will start soon, be prepared!

Block chief. Hello, we are NOVAFRICA, on behalf of the Municipal Council of the City of Quelimane we would like to inform you that in the next few days you will receive text messages about the preparation for the floods. The wet season will start soon, be prepared! As a chief, we ask you to share this information with all residents on your block.

Planning **Everyone**. NOVAFRICA: The area where you live is at risk of flooding during the rainy season. Sit down with your family and decide what to do in an emergency situation. For example, where to go and how to contact each family member.

Actions **Everyone**. NOVAFRICA: Other preventive measures you can take in preparation for floods: Create food, medicine and water reserves, know the evacuation routes and accommodation places, store valuables and documents in a safe place, and make home improvements, such as reinforcing the roof, the doors, and windows.

Cleaning **Household**. NOVAFRICA: Garbage and debris block drainage canals making it difficult for rainwater to flow. This can lead to flooding. Do not throw garbage on the ground or in the drainage canals. Join your neighbors and help clean the streets and drainage canals in preparation for the wet season.

Block chief. NOVAFRICA: Garbage and debris block drainage canals making it difficult for rainwater to flow away. This can lead to flooding. Do not throw garbage on the ground or in the drainage canals. As chief, we ask you to mobilize the residents on your block to clean streets and drainage canals in preparation for the wet season.

Information **Household**. NOVAFRICA: To gather more specific information about flood preparedness, you can contact your community leader. Secretary of neighborhood «*neighborhood*»: «*name*» (Tel. «*number*»). Chief of block «*block*»: «*name*» (Tel. «*number*»).

Block chief. NOVAFRICA: As block chief, it is your responsibility to ensure that all residents on your block are well informed about floods. We ask that you help them with their preparation and create action plans that will allow them to keep the block safe.

Recovery **Everyone**. NOVAFRICA: In order to make neighborhoods more resilient, report impacts from heavy rains and winds to the Municipal Emergency Operation Center. For example, health problems and damage to houses and infrastructure. Call the person responsible for disaster management: «*name*» («*number*»)