Stakeholders' Perspectives on Flood Risk and Vulnerability in Peru February 2021

WISCONSIN
UNIVERSITY OF WISCONSIN–MADISON

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Please Cite As: Roland, H.B., Lee, D., Wirz, C. D., Curtis, K.J., Malecki, K., Brossard, D., & Block, P. February 2021. Stakeholders' Perspectives on Flood Risk and Vulnerability in Peru. A report from the University of Wisconsin-Madison 2020 project: Development of a Forecast-based Flood and Health Risk Management System to Support Advanced Disaster Preparedness.

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EXECUTIVE SUMMARY

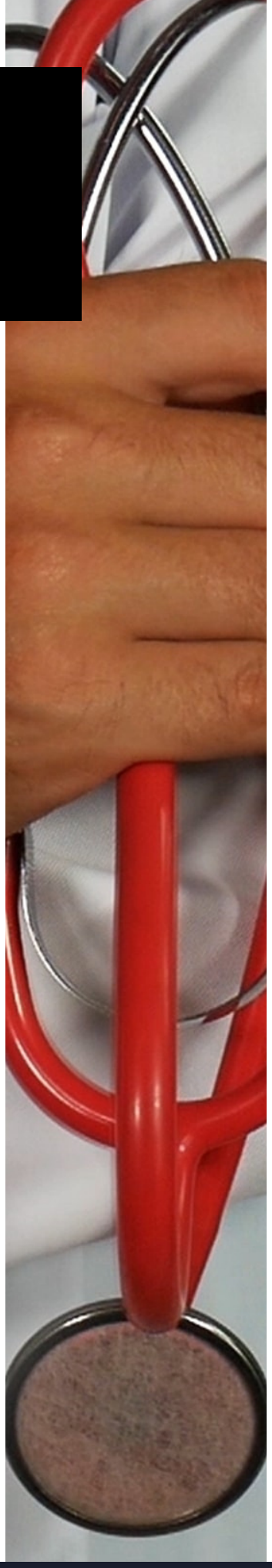
Climate change increases disaster-related risks, posing challenges for local, national, and international relief agencies and disaster management organizations across the globe. Research suggests that community perceptions of risk and social vulnerability shape responses to hazards posed by natural disasters, such as extreme weather events and flooding. These perceptions also inform stakeholders' decisions about mitigating adverse effects of climate-related disasters.

This project is part of a larger interdisciplinary initiative to evaluate the efficacy of season-ahead flood predictions, proactive management strategies, and communication efforts in disaster planning and relief efforts. Our research seeks to better understand: 1) how individuals working on flood management in Peru perceive flood-related risk and vulnerability; and 2) how these perceptions impact disaster preparedness and risk communication. This information, alongside the technical tools for hazard management, is critical for developing proactive preparation and response strategies.

In partnership with the Red Cross Climate Center, our team surveyed stakeholders from across Peru, including workers in disaster management, public health, climate science, engineering, forestry, and academia. We compared results between two groups of stakeholders involved in different aspects of disaster management: those working in climate modeling and those involved in disaster preparation and response. Since geography frequently shapes political context, we also compared responses from stakeholders working within and outside of Lima, Peru's capital. Of the 150 potential stakeholders solicited, 56 responded, and 36 completed most of the survey online between December 2019 and January 2020.

The findings discussed in this report are based on the perceptions of these respondents and should be interpreted with caution, as this was not a representative sample. They do, however, contribute to a greater understanding of how Peruvian stakeholders might view flood impacts and vulnerability, how stakeholders' perceptions might shape disaster preparation and response, of where discord in stakeholder perceptions may exist, and of the potential barriers that may limit the implementation of early warning tools.

CENTRAL FINDINGS



Respondents from multiple professional and geographic perspectives agreed that increasing flood warning time and developing longer-term forecasts were important in effective disaster response.

Respondents perceived poor communication and risk perceptions as barriers to implementing mitigation and adaptation strategies in vulnerable communities:

- **Respondents viewed residents' perception of risk as higher than residents' level of responsiveness to flood warnings.**
- **Respondents perceived communication between organizations and communities to be weaker than communication among organizations.**
- **Respondents working outside of Lima perceived communication among organizations and between organizations and communities as weaker than their Lima counterparts.**

When asked what flood impacts were of greatest concern, respondents across professional and geographic perspectives indicated public health-related outcomes (i.e., waterborne and infectious diseases and poor child nutrition) as more concerning than economic factors.

When asked what made communities most socially vulnerable to flooding, respondents ranked public health-related factors particularly high (i.e., waterborne disease incidence, malnutrition, and access to water and toilets). The factors most influential in creating vulnerability were related to economic disenfranchisement, poor governance and corruption, and environmental degradation and destruction.

Survey outcomes are intended to be informative to our team's multi-disciplinary partners in Peru, particularly those seeking to better understand how risk perception and ideas about population vulnerability are viewed differently among individuals working for agencies charged with disaster preparedness and response. These results also identify potential areas ripe for collaborative efforts to mitigate and respond to flood risks, a persistent and future climate hazard in Peru.

PROJECT & SURVEY BACKGROUND

Risk relates to the probability that an adverse event may occur. Social vulnerability refers to the multitude of factors that contribute to a population's likelihood to succumb to hazards that increase potential risk and ability to adapt to those hazards. Climate change is altering flood-related risks and it is important to think of social vulnerability in that context. Globally, flood catastrophes lead all natural hazards in terms of societal impact, causing billions of dollars in damages annually.[1,2] From 2005-2014, hydrologic disasters accounted for 51% of all natural disasters and 44% of global disaster victims.[3]

Although the predictability of floods has increased over the past decades, links with consequent action are still weak, partially due to top-down, one-way communication.[4] This can result in the general public and relief agencies being ill-prepared for devastating impacts. For instance, in 2016-2017, severe flooding in Peru killed over 100 people, directly affected over 1.2 million, and led to increases in vector-borne diseases. In response, the International Federation of the Red Cross and the Peruvian Red Cross launched an appeal for almost $5 million USD to aid those most affected.[5] However, as the Red Cross worked to identify the most socially vulnerable (i.e., where resources were most needed) and to support flood risk response across sectors, they realized several gaps in their ability to respond effectively. Primarily, there appeared to be a lack of understanding in how agencies perceived population social vulnerability and how communities respond to early warnings.

To address this need, researchers at the University of Wisconsin-Madison partnered with the Red Cross Climate Center to evaluate a forecast-based flood risk management system in select regions of Peru. By providing advanced preparedness and response strategies, such a forecast-based system might improve existing disaster management practices, save lives, and more effectively allocate resources. A forecast-based flood risk management system is created by combining global flood prediction models with local flood risk assessments and vulnerability indicators. While improving the accuracy and timeliness regarding future rain events and flood hazards is critical, considering other central elements is also necessary for effective management and response to flooding disasters. Many different agencies from disparate sectors– engineering, public health, climatology, and relief agencies- all play a role in preparation and response to flooding. Each agency is a stakeholder with different investments and priorities related to flood response. These different stakeholder perspectives (often dependent on historical and economic contexts) shape disaster response decision-making and efficacy.

Stakeholders that typically have the largest influence in disaster management policy, as well as in defining and assessing vulnerability, tend to be experts in a national capital with affiliations to international financial institutions.[6] However, stakeholders working in other areas, both professionally and geographically, may have different perspectives. For example, stakeholders working outside of Lima may have greater familiarity with a particular region or may differently value particular approaches to disaster management, such as technological fixes versus solutions grounded in traditional ecological knowledge.[7]

Since no systematic assessment of agency needs and perceptions had ever been conducted across sectors in Peru, this research was intended to serve as the first step in the process. **The goals of this project were to determine how stakeholders from key agencies responsible for flood management perceive three key dimensions of disaster preparedness and response: 1) current flood-related disaster preparedness in Peru; 2) factors that shape community risk and vulnerability; and 3) determinants of effective risk communication.** A better understanding of these factors may reveal opportunities for new tool development and the integration of forecast-based financing response efforts in the region.

To better understand multiple stakeholder perceptions of disaster preparedness and flood risk, the team partnered with the National Meteorology and Hydrology Service of Peru (SENAMHI) to host a workshop in June 2019. This brought together professionals in disaster management, public health, climate modeling, engineering, forestry, and academia to share research and relevant activities. A key component of this workshop was to present and assess the utility of new forecast-based models that would improve accuracy and timing of flood prediction. Additionally, we gathered insights into the network of agencies responsible for flood mitigation and response in Peru. Building on information shared at this workshop, we invited attendees and their colleagues in related networks to complete a survey covering specific aspects of disaster preparedness, risk communication, risk perception, flood impacts, and social vulnerability. The survey was intended to offer insight into how different groups of stakeholders think about factors shaping flood risk and vulnerability, where discordance in stakeholder perspectives exists, and where barriers may limit implementation of early warning tools. The survey focused on the Iquitos region of Peru given that its geographic location and isolation create unique vulnerabilities and risks.

METHODS

The survey was conducted online between December 2019 and January 2020. Respondents were recruited via email from a list of the June 2019 workshop (Advancing Disaster Risk Management Through Forecast-based Financing for Flood Preparedness) attendees and the professional networks of Red Cross Red Crescent Climate Center and German Red Cross in Peru. This convenience sample was intended to encompass the wide range of stakeholders involved in disaster preparedness and response in Peru.

SURVEY FORMAT

Most questions were Likert scale responses with 5 rating scales. Results present response averages and histograms of response frequency distributions across the 5 ratings.

Of the 150 potential stakeholders contacted by email, 56 partially completed the questionnaire, yielding to a 37.3% response rate. Thirty-six respondents completed at least 95% of the survey.[8] Of these 36 respondents, 11 came from a disaster management background, 11 from climate modeling, 6 from engineering, 4 from public health, and 4 from other areas. These categories reflect the most common sectors responsible for flood disaster preparedness and response in Peru. It is important to note these sectors are diverse and often disparate, working in separate domains of disaster preparedness and response. Climatologists model the potential for hazardous events, engineers work on both mitigation and response to physical hazards, and public health workers respond to increased morbidity and mortality from disasters and other social consequences. While relevant, the sample included in this report is not representative of this professional community in Peru.

The survey was made up of three general sections. First, we asked respondents about the current state and existing abilities of agencies to respond to disasters. Most factors were ranked on a Likert scale from 1-very poor to 5-excellent. Questions were asked to determine what stakeholders felt were important facilitators of and barriers to flood response including communication channels within and between agencies, data, and tools available to accurately measure hazards, and resources for providing basic needs to communities.

Once a baseline understanding of the current response to flooding was determined, we asked questions about risk communication, communities' risk perception, and relationships between stakeholders and communities. These questions were meant to improve understanding of the role that communication between disparate response agencies played in response as well as how community perceptions of risk influence their overall preparedness and response.

Finally, we asked questions about how respondents themselves perceive different aspects of flood impact and flood-related social vulnerability. Social vulnerability is a construct that is important to understand to better identify the unique needs of communities and to help shape equity when the government and international relief agencies have limited resources to plan for and respond to disasters.

A complete list of the survey questions can be accessed here.

Data were analyzed using R statistical packages. Group averages and histograms were used to rank the importance of responses and show the distribution in the frequency of responses across all stakeholder groups.

A few considerations should be kept in mind while reviewing the results. First, some respondents met with a member of the University of Wisconsin-Madison team directly before taking the survey. Many of those conversations centered on risk communication related to disasters, which may be reflected in their survey answers. Additionally, others completed this survey as a follow-up to the June 2019 workshop at SENAMHI, and, thus, many respondents have a background in climate modeling. Third, most respondents (~70%) work in offices based in Lima. To better understand differences in responses to several questions, we categorized stakeholder responses by their area of work and geographic location. Finally, approximately half as many women than men completed the survey, which may skew responses to questions.

RESULTS

The State of Disaster Preparedness

According to respondents, the weakest aspects of disaster preparedness related to data, response timing, and adequate funding (fig. 1). Overall, reported perceptions of disaster preparedness in Iquitos rate between poor and acceptable.

FIGURE 1: HOW WOULD YOU RATE THE FOLLOWING AREAS OF NATURAL DISASTER PREPAREDNESS IN IQUITOS?

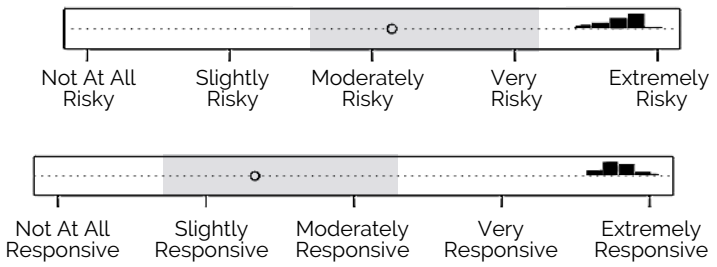
HOW TO INTERPRET FIGURES

- Circles represent response averages
- Histograms represent the distribution of responses

FIGURE 2: A) IN YOUR OPINION, HOW RESPONSIVE ARE PEOPLE IN IQUITOS TO WARNINGS ABOUT FORECASTED FLOODS? B) IN YOUR OPINION, HOW RISKY DO PEOPLE IN IQUITOS THINK FLOODS ARE FOR THEIR COMMUNITY? N=36

A) Iquitos Residents' Perception of Flood Risk

B) Iquitos Residents' Responsiveness to Warnings About Forecasted Floods

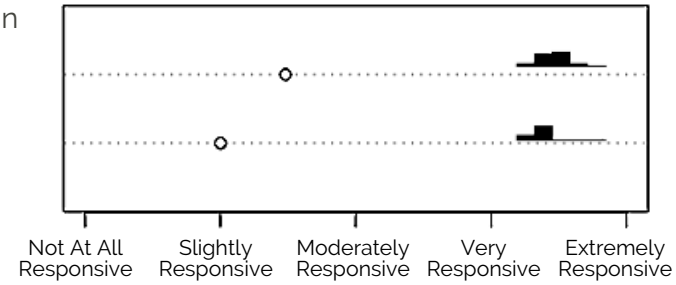


Respondents reported a disconnect between risk perception and warning response among residents (fig. 2). According to respondents, residents of Iquitos view floods as moderately to very risky to their community. At the same time, however, respondents perceived Iquitos residents as being only slightly to moderately responsive to flood warnings.

FIGURE 3: DIFFERENT STAKEHOLDER GROUPS' PERCEPTIONS OF IQUITOS RESIDENTS' RESPONSIVENESS TO WARNINGS N=36

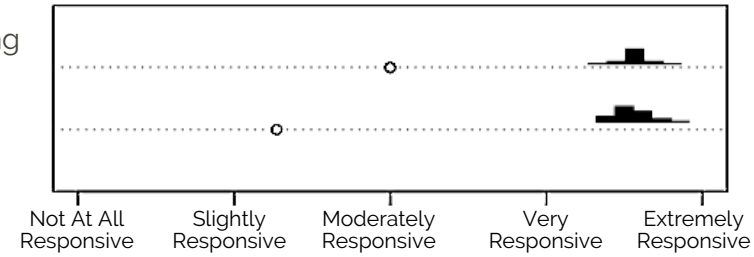
Stakeholders Working for Organizations Based in Lima

Stakeholders Working for Organizations Based Outside of Lima



Stakeholders Working in Climate Modeling

Stakeholders Working in Disaster Management

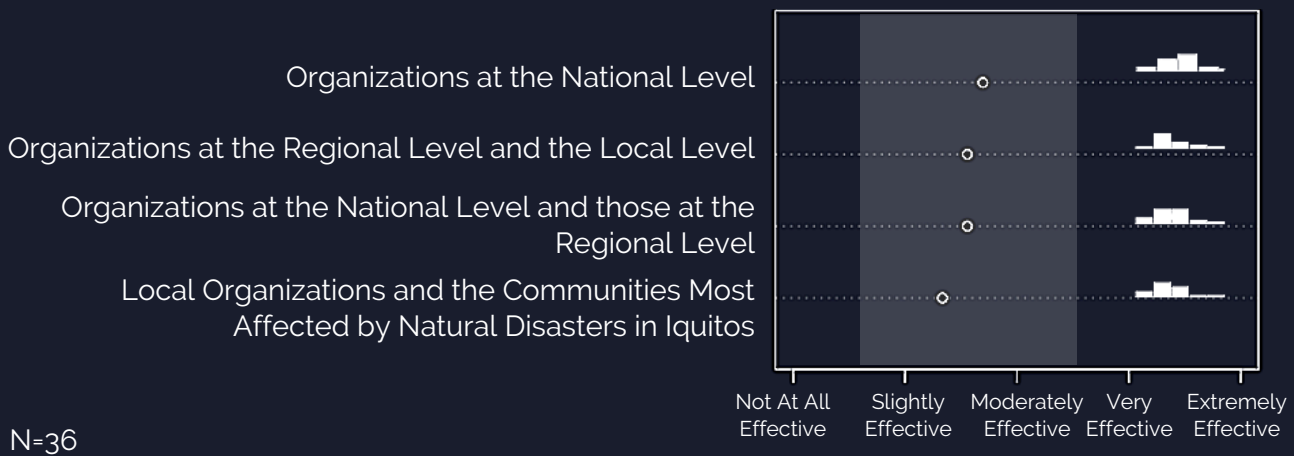


The closer contact respondents had with disaster management work and the community in question, the less optimistic they were about residents' responsiveness (fig. 3). Respondents working in disaster management and for organizations based outside of Lima, most of which are in Iquitos, had more negative perceptions of residents' responsiveness to flood warnings, compared to respondents working in climate modeling and for Lima-based organizations.

Risk Communication

Respondents indicated weaker communication and collaboration in disaster preparedness activities involving communities, compared to activities with other organizations (fig 1.). Respondents rated all disaster-related communication slightly to moderately effective, but communication between organizations and communities was perceived to be weaker than communication between organizations, particularly communication between organizations at the national level (fig. 4). Concerns about communication with communities was also a common theme in open-ended responses. Respondents expressed a desire for better communication with at-risk communities and shared that community members' perceptions of institutions' forecasting abilities are critical to responsiveness to flood warnings and the effectiveness of preparation and response actions.

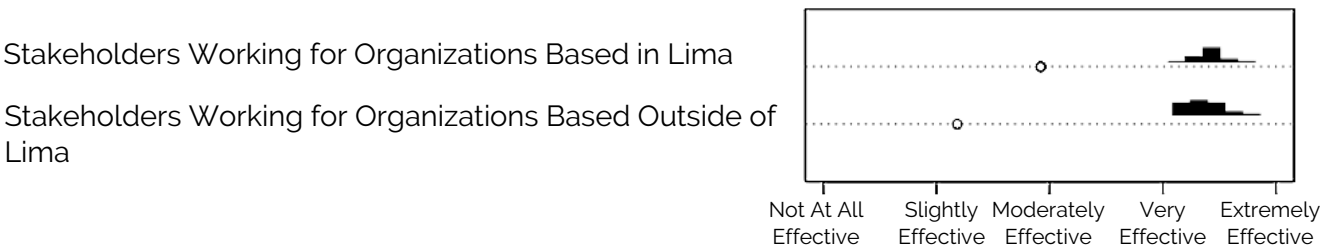
FIGURE 4: HOW EFFECTIVE DO YOU THINK THE COMMUNICATION SURROUNDING NATURAL DISASTER RESPONSE/PREPAREDNESS IS AMONG…



Respondents working in Lima were more positive about communication involving national-level organizations (fig. 5). Respondents working for organizations based in Lima rated communication among organizations as more effective than did respondents working in organizations based outside of Lima. This applied to communication between national organizations and between national and regional organizations.

FIGURE 5: LIMA AND NON-LIMA STAKEHOLDERS' PERCEPTIONS OF DISASTER COMMUNICATION N=36

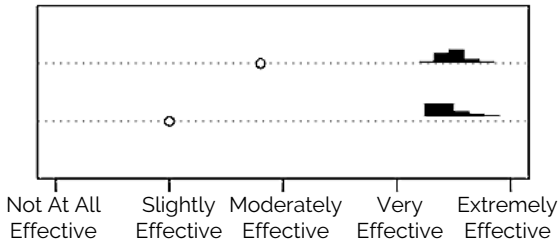
A) Effectiveness of Natural Disaster Response/Preparedness Communication Among Organizations on the National Level:



B) Effectiveness of Natural Disaster Response/Preparedness Communication Among Organizations at the National Level and Those at the Regional Level:

Stakeholders Working for Organizations Based in Lima

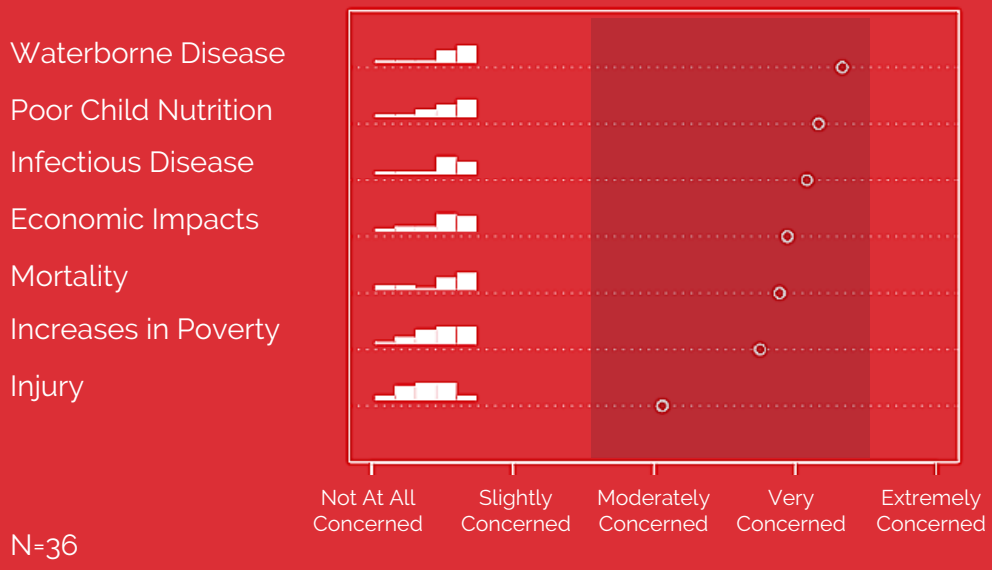
Stakeholders Working for Organizations Based Outside of Lima



Flood Impacts & Flood-Related Social Vulnerability

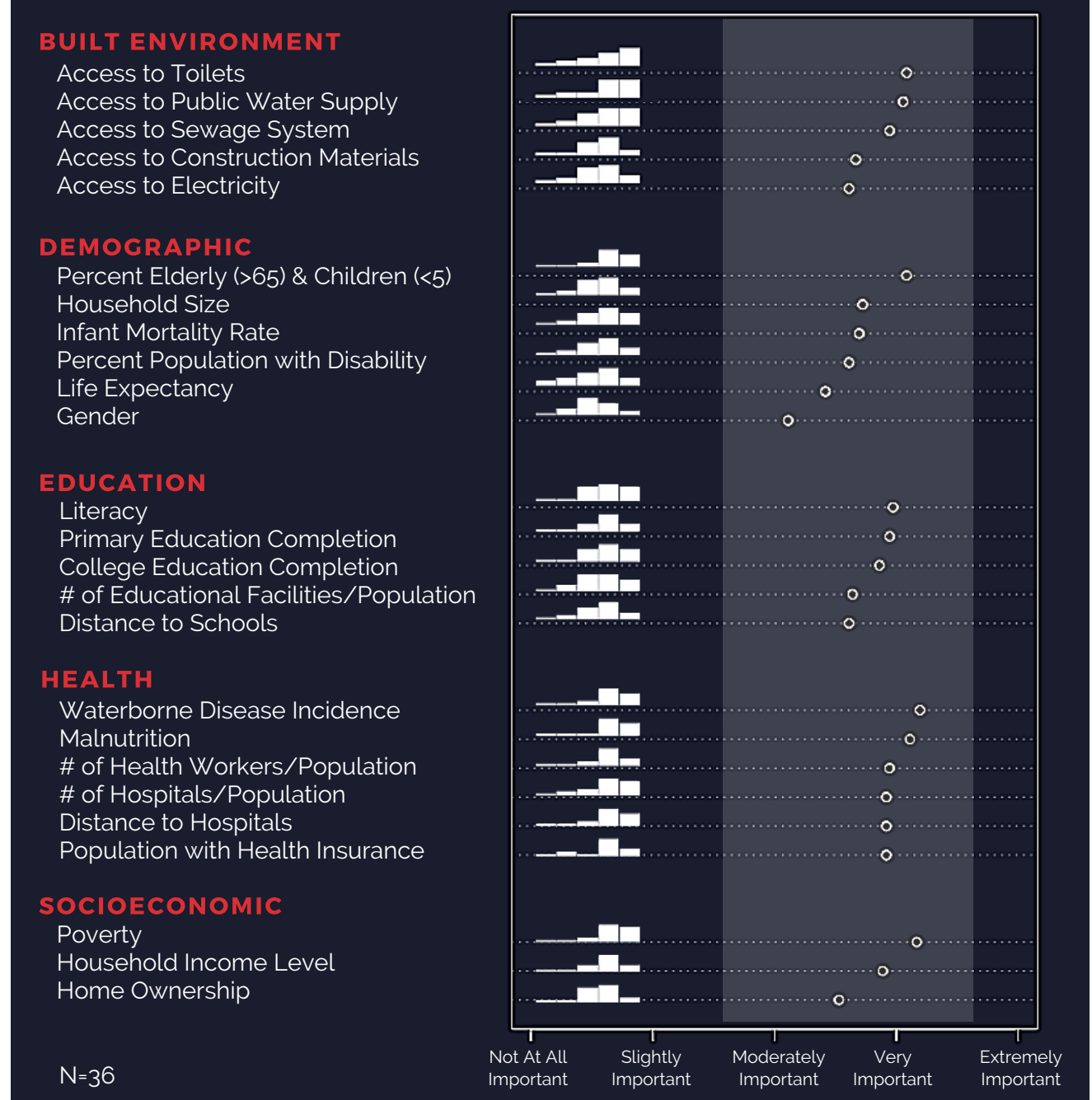
The most concerning flood impacts were public health-related (fig. 6). Respondents were most concerned with water-borne disease, infectious disease, and poor child nutrition impacts, although economic impacts and increased poverty were also very concerning. However, respondents' opinions on the importance of specific public health impacts differed by geographic location. For instance, respondents working for Lima-based organizations were more concerned with water-borne disease and mortality than respondents working for organizations outside of Lima. This variance may reflect differences in flooding impacts between coastal versus Amazonian regions, which was stressed in respondents' open-ended comments.

FIGURE 6: WHAT FLOOD IMPACTS CONCERN YOU MOST?



As a category, health factors (i.e., infant mortality, infectious diseases, access to care) were also rated the most important factors of flood-related vulnerability (fig. 7). Poverty, lack of sanitation (access to toilets), and the share of the population that are older adults and children were also considered very important. Within the built environment category, indicators relevant to public health were rated most important. Indicators deemed less important to overall flood-related vulnerability included home ownership and gender.

FIGURE 7: WHICH OF THE FOLLOWING SPECIFIC INDICATORS ARE IMPORTANT IN DETERMINING FLOOD-RELATED SOCIAL VULNERABILITY IN PERU?



According to respondents, both physical and social vulnerability were only moderately considered in disaster aid decision-making in Iquitos (fig. 8). These ratings suggest that factors other than physical and social vulnerability play a more prominent role in disaster aid decision-making.

FIGURE 8: TO WHAT EXTENT DOES DISASTER AID DECISION-MAKING IN IQUITOS CONSIDER:

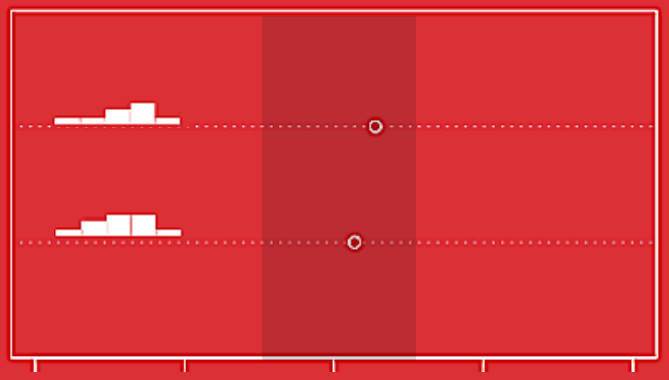
Physical Vulnerability

(potential hazards of a location, determined by factors like a place's susceptibility to floods and flood severity)

Social Vulnerability

(community abilities to cope with floods, determined by factors like economic and health status)

N=36



Root Causes of Vulnerability

FIGURE 9: HOW INFLUENTIAL ARE THE FOLLOWING FACTORS IN DETERMINING OR CREATING VULNERABILITY IN FLOOD-PRONE REGIONS IN PERU?

Poor Governance & Corruption

Environmental Degradation & Destruction

Limited Access to Resources

Inadequate Local Investment

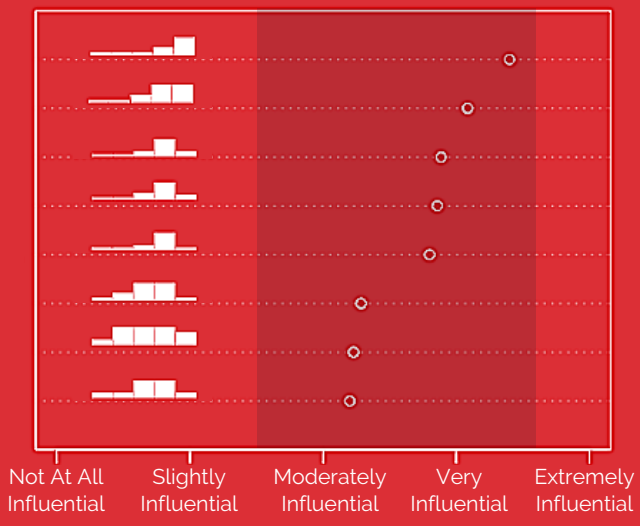
Difficult Livelihoods or Limited Livelihood Opportunities

Limited Access to Power

Discrimination

Flood Trauma (e.g. past exposure to floods)

N=35

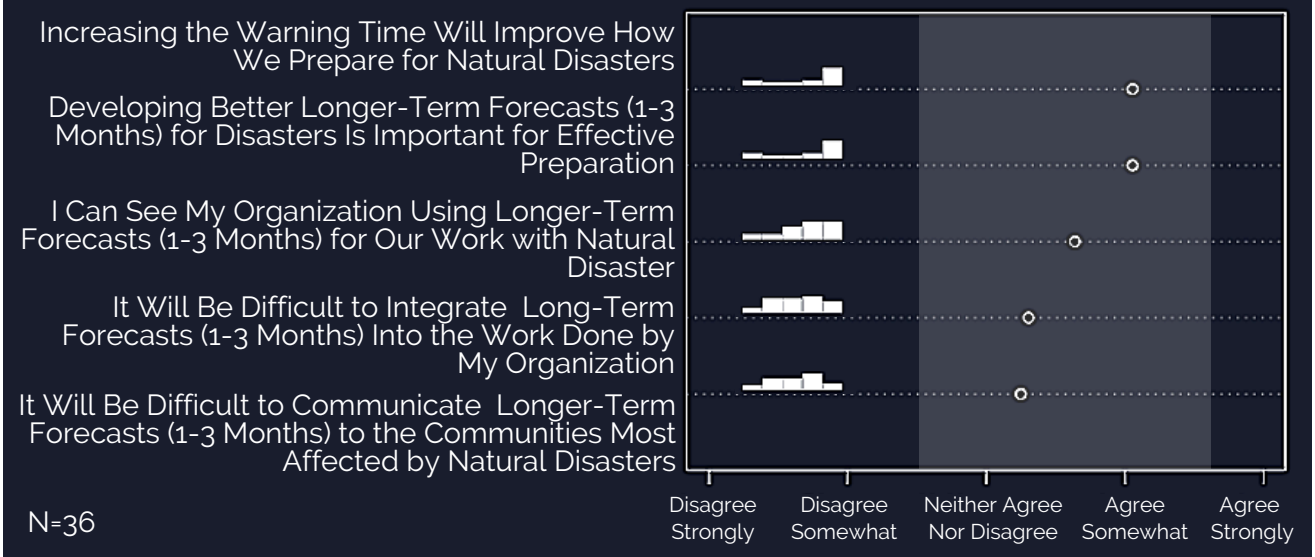


Respondents rated economic factors, poor governance and corruption, and environmental degradation and destruction most influential in determining and creating vulnerability (fig. 9).

Economic factors include limited access to resources, inadequate local investment, and livelihood challenges. Respondents also raised the importance of livelihood considerations in their open-ended responses, in reference to resettlement scenarios. Resettlement is a form of adaptation, but if migration destinations do not support livelihoods—for example, if a proposed resettlement area for a community that relies on a river for its livelihood is many miles from the river—then migration is not a tenable adaptation option.

Utility of Vulnerability Assessments & Long-Term Forecasts

FIGURE 10: HOW MUCH DO YOU AGREE OR DISAGREE WITH EACH STATEMENT?

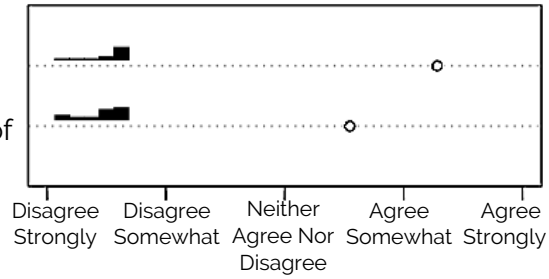


Increasing flood warning time by developing longer-term forecasts was considered important to effective disaster response (fig. 10). Additionally, respondents did not see integrating long-term forecasts into their work or into risk communication as overly difficult. However, respondent opinions on the use of long-term forecasts in disaster preparedness may differ by place of work and geographic location (fig. 11). Compared to respondents working for organizations outside of Lima, Lima-based respondents were more likely to agree that increasing warning time would improve disaster preparation. Compared to respondents working in climate modeling, respondents working in disaster-related fields were more likely to agree that developing better long-term forecasts is important for effective disaster preparation.

Vulnerability assessments were considered most useful when they are able to identify the most vulnerable populations within a geographic area and when results can be made accessible to at-risk community members and offer guidance to decision-makers (fig. 12). Similar to other responses, this suggests a desire for data to enhance flood preparedness communication and for collaboration with communities and other organizations and stakeholders.

FIGURE 11: DIFFERENT STAKEHOLDER GROUPS' PERCEPTIONS OF LONG-TERM FORECASTS' UTILITY N=36

A) Increasing the Warning Time Will Improve How We Prepare for Natural Disasters:



B) Developing Better Longer-Term Forecasts (1-3 Months) for Disasters Is Important for Effective Preparation:

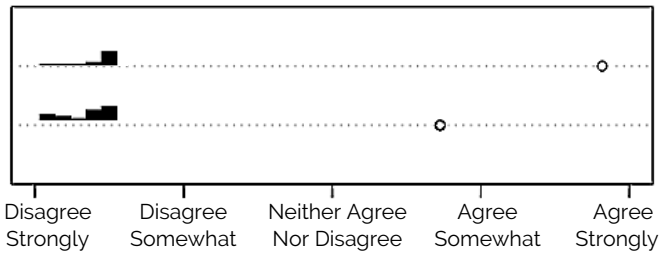
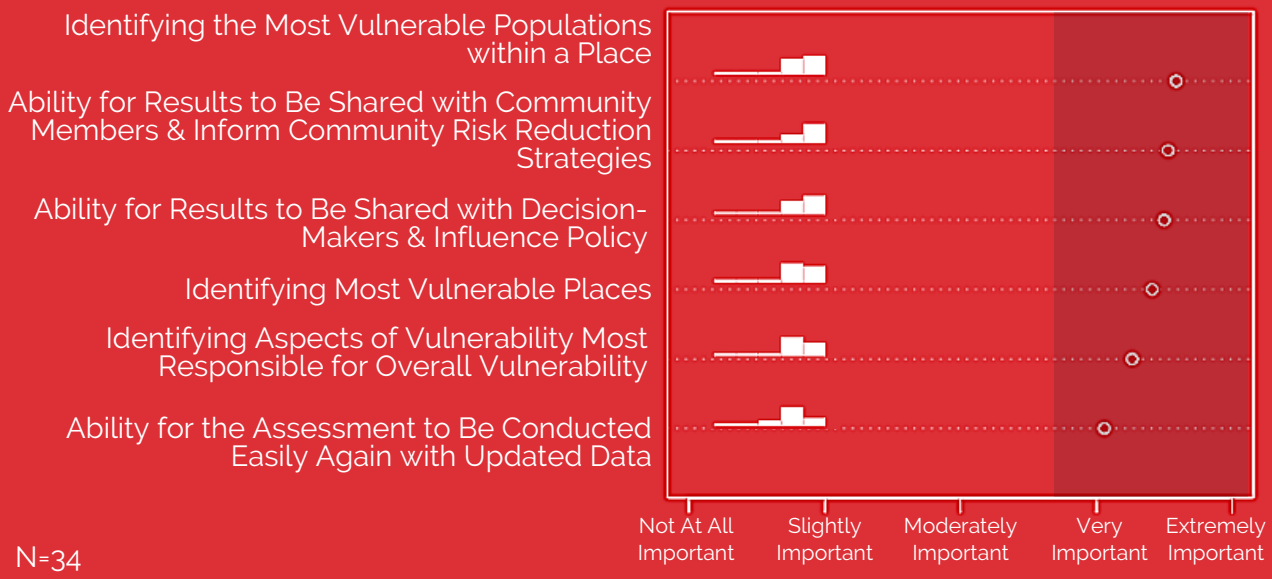


FIGURE 12: WHAT MAKES AN ASSESSMENT OF FLOOD-RELATED VULNERABILITY USEFUL?



N=34

SUMMARY & CONCLUSIONS

This research highlights stakeholders' perceptions of risk, vulnerability, and the state of disaster preparedness in Peru in the context of floods and is intended to be used by those in disaster management. Our results indicate where additional work is needed to support collaborative flood mitigation and response efforts, in particular enhanced hazard and risk prediction. These findings may be used to design context-appropriate flood-related vulnerability models and develop hypotheses for further study related to risk communication and differences in stakeholder perspectives.

Respondents identified indicators across several categories as being most relevant to flood-related vulnerability. These included poverty, percent of the population who are elderly and children, many health indicators, and built environment indicators related to public health, such as access to water and sewage services. These stakeholder ratings can inform and improve existing suites of vulnerability indicators used to shape disaster preparation and response. Further study may examine whether particular indicators are more relevant in certain geographic contexts, such as urban versus rural settings or different regional and ecological environments. For example, the percent of the population who are elderly and children may be particularly relevant to flood-related vulnerability in rural settings, as these populations are less mobile and may be more difficult to reach or evacuate in disasters.

In addition to perceiving public health measures as particularly important indicators of vulnerability, respondents also identified health outcomes as the most important impacts attributable to floods, including water-borne disease and poor child nutrition. This prioritization of health factors, in both determining vulnerability and as consequential impacts of flood events, suggests a circular process through which health vulnerability leads to increasingly severe health impacts and greater health vulnerability with each hazard event. Other public health crises may also exacerbate health vulnerability related to floods, just as floods compound other public health crises.

Regarding the root causes of vulnerability, respondents noted economic and political determinants as the most important sources of vulnerability. Recent research in Peru has noted socio-political and institutional characteristics, including centralization, sectoral division, and corruption, as undermining factors in disaster response.[9] Respondents' high rankings of related factors, including poor governance and corruption, limited access to resources, and inadequate local investment, lends support to this hypothesis. These responses suggest that organizations involved in disaster preparedness and response might partner with economic and political leaders to reduce social vulnerability. Responses also highlight a need for further study of the relationship between root causes of vulnerability to environmental shocks or shifts and downstream vulnerability indicators.

Root causes associated with centralization and sectoral divisions also have implications for risk communication, and, in particular, alternatives to traditional top-down and one-way risk communication from federal institutions outward. Respondents expressed a desire for better communication with at-risk communities and shared that community members' perceptions of institutions' forecasting abilities were critical to responsiveness to flood warnings and the

effectiveness of preparation and response actions. Here, our results also showed a notable divergence between stakeholders based on working location. Compared to respondents working in Lima, respondents not working in Lima noted weaker communication among organizations, especially communication involving national-level organizations. This suggests a need to improve risk communication strategies among organizations and between organizations and communities in ways that encourage two-way communication, more frequent collaborations, and increase community trust in forecasting abilities.

Improved communication may further enable deeper understandings of community contexts and enhance communities' disaster responses. Respondents working for organizations outside of Lima were both less optimistic about community responsiveness to flood warnings and less likely to agree that increasing warning time would improve disaster preparation. Participants also noted possible divergence between community risk perception and community responsiveness to flood warnings. Deeper communication with communities, especially two-way communication that considers local contexts and interests, may close this gap and increase community responsiveness.

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PHOTO CREDITS

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ADDITIONAL INFORMATION

If you have questions or comments, including requests for descriptive statistics, further analyses, or raw data, please contact Katherine Curtis at kcurtis@ssc.wisc.edu.

Funding for this research was provided by a UW2020 grant supported by the Wisconsin Alumni Research Foundation.