

Mitigating compounding hazard impacts on public health through a community co-created toolkit on food-energy-water (FEW) insecurity

Disaster
Prevention and
Management: An
International
Journal

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Received 28 June 2024

Revised 18 March 2025

Accepted 6 June 2025

Abstract

Purpose – Climatic- and non-climatic hazards pose increasingly complex risks with and across food, energy and water (FEW) systems. These risks create significant public health challenges, given the centrality of FEW in everyday life. One, evolving hazard-risk context includes the prevalence of “compounding” hazards, such as concurrent hurricanes, heatwaves and droughts. Puerto Rico already experiences concurrent hazards that warrant greater preparedness to guard against health risks.

Design/methodology/approach – To respond to this need and to build on previous community-based participatory research (CBPR), we partnered with community leaders in the remote community of Corcovada, Puerto Rico to co-develop, pilot and validate a problem-focused and solutions-orientated survey toolkit for community use. This toolkit is co-designed to help community leaders and public health officials assess FEW insecurity at the household level, capturing experiences and possible health risks before, during and after one or several compounding hazards.

Corrigendum: It has come to the attention of the publisher that the article: Painter, M.A., Roque, A.D., Quintana, E., Shah, S.H., Cuevas, F. and Tormos-Aponte, F. (2025), “Mitigating compounding hazard impacts on public health through a community co-created toolkit on food-energy-water (FEW) insecurity”, *Disaster Prevention and Management: An International Journal*, Vol. ahead-of-print No. ahead-of-print. <https://doi.org/10.1108/DPM-06-2024-0163> incorrectly published the affiliation of Anais Delilah Roque as “School of the Environment, Duke University Nicholas, Durham, North Carolina, USA.” This has been corrected to “Nicholas School of the Environment, Duke University, Durham, North Carolina, USA.” The sentence “Target Journal: Disaster Prevention and Management Journal – Special Issue ‘Using Critical Perspectives to Explore Disasters Through Shifting Climates’” has been removed. These two errors were introduced during the production process. The reference “Ablah, E., Tinius, A.M., Konda, K., Eckert, C.M. and Gebbie, K.M. (2012), ‘Community disaster preparedness and response: the role of training, exercise, and coordination in the Midwest,’ *Journal of Public Health Management and Practice*, Vol. 18 No. 5, pp. 433-440” was incorrectly entered and has been updated to “Ablah, E., Weist, E.M., McElligott, J.E., Biesiadecki, L.A., Gotsch, A.R., Keck, C.W. and Gebbie, K.M. (2013), “Public health preparedness and response competency model methodology”, *American Journal of Disaster Medicine*, Vol. 8 No. 1, pp. 49-56, <https://doi.org/10.5055/ajdm.2013.0110>.” The publisher asks that the above are confirmed at article proofing stage.



Disaster Prevention and Management:
An International Journal
© Emerald Publishing Limited
e-ISSN: 1758-6100
p-ISSN: 0965-3562
DOI 10.1108/DPM-06-2024-0163

Findings – We discuss the toolkit’s public health implications and its potential to advance environmental justice and health. Community leaders can leverage local expertise and use this toolkit, or ones developed with a similar methodology, to gather and disseminate hazard information. In doing so, this exercise supports environmental justice principles of informed consent to research and education on social and environmental issues.

Originality/value – With this tool, community leaders and public health officials can mitigate negative public health impacts by identifying at-risk populations, monitoring community health outcomes and using it as a tool to make mitigation, preparedness and response plans.

Keywords Food-Energy-Water (FEW) insecurity, Public health, Community health, Compounding hazards, Community-based participatory research (CBPR), Survey design

Paper type Research paper

1. Introduction

Recent research on the human dimensions of climate change emphasizes the inadequacy of examining single climatic stressors, instead stressing the need to assess the compounding climatic- and non-climatic risks that communities experience (Intergovernmental Panel on Climate Change [IPCC], 2021; Thomas *et al.*, 2020; Zscheischler *et al.*, 2018; Zscheischler *et al.*, 2020). Compounding hazards are often understood as extreme climate, weather-related or other events that combine to increase environmental and social risk (Zscheischler *et al.*, 2020). Puerto Rico recently experienced several major hazard events, including Hurricane María in 2017, the 2020 earthquakes, the COVID-19 pandemic and most recently, Hurricane Fiona in 2022 – all within a span of five years. Therefore, disaster risk reduction and response must be attentive to the elevated and increasingly complex risks that emerge from diverse compounding hazards, which affect public health and critical resources.

One significant way in which single and compounding climatic hazards interact with social and built environments to aggravate public health risks is through their impacts on food, energy and water (FEW) systems (Dargin *et al.*, 2020; Wells *et al.*, 2022). Insecurity within each one of these systems potentially produces negative outcomes in public health. Household food insecurity is associated with iron deficiencies, malnutrition and adverse mental health outcomes (Ashby *et al.*, 2016; Eicher-Miller *et al.*, 2009). Household water insecurity is associated with emotional distress (e.g. Brewis *et al.*, 2021; Sultana, 2011; Wutich and Ragsdale, 2008; Wutich *et al.*, 2020), illnesses and infections (Rosinger, 2018; Rosinger and Young, 2020; Stoler *et al.*, 2021). Energy insecurity deepens food and water stress while further contributing to a range of adverse health outcomes (e.g. sleep loss, respiratory illness and mental health issues) (Plappally and Lienhard, 2012; Hernández, 2013). Further, disruption in one of these FEW domains poses challenges to other domains, given their inherent interconnectedness. For instance, water is necessary for food preparation; food production and agriculture affect water quality; energy is used in food preparation and agriculture and water and energy are interlinked through industry, agriculture and electricity production (e.g. Molajou *et al.*, 2021). However, this interconnectedness of FEW systems is not studied as prevalently through survey research. Researchers have often developed single security (food, energy or water) assessment tools, such as surveys, to evaluate household experiences with resource insecurity. This is problematic because it risks underestimating the production of FEW insecurities.

In its most basic form, a survey is the “systematic data collection about a sample drawn from a specified larger population” (Schwarz *et al.*, 1998, p. 143). Modern roots in survey research stem from the early to mid-twentieth century, with sampling statistics developing in the United States in this period, followed by the expansion of survey deployment with the advent of new technological communications (Groves, 2011). Contemporary survey research takes many forms in both public and private enterprise and has become a staple in academic research across disciplines.

Used within the disaster context, survey research has helped to identify important components of knowledge, including in the pursuit of disaster preparedness and mitigation. Survey research can help to plan for different strategies in a disaster context (Henderson *et al.*, 2009), track morbidity (Schnall *et al.*, 2011) or gather information about effective training and response

strategies (Ablah *et al.*, 2013). When conducting disaster research, it is paramount to develop a rigorous survey design and implementation (Henderson *et al.*, 2009; Shoaf and Peek-Asa, 2000). Additionally, incorporating co-creating in projects, such as piloting surveys in communities, alongside culturally responsive survey methods and community involvement, helps to document community health needs and priorities (Kelley *et al.*, 2019). Community–science partnerships also help identify areas of what Frickel *et al.* (2009) refer to as “undone science,” whereby community groups identify crucial research questions that academics have left *undone*. Such collaborations have enhanced community political impact on environmental justice issues, more broadly (Allen, 2003), while also promoting a sense of community and support.

Using surveys to assess public health – both physical and mental – in the context of natural hazards is established as a useful tool (Bayleyegan *et al.*, 2015; Henderson *et al.*, 2009; Platt *et al.*, 2016; Shoaf and Peek-Asa, 2000; Spence and Lachlan, 2010). Additionally, surveys were found to be useful for understanding food (Kosa *et al.*, 2012; Rodríguez-Cruz *et al.*, 2022), energy (Dominianni *et al.*, 2018; Kishore *et al.*, 2018) and water (Young *et al.*, 2019) insecurity in the context of varied natural hazards.

This paper reports on the development of a household survey instrument in Corcovada, Puerto Rico designed to mitigate community-scale public health risks linked to FEW insecurities during multiple stages of compounding hazards. We respond to several important gaps in survey instrument design. First, our survey development process involved co-developing, testing and validating a context-specific, community-relevant public health assessment (or “toolkit”) to mitigate public health risks under compounding – not only single – hazard contexts. Second, we contribute this toolkit to assess *interlinked* FEW risks, which are often studied as independent insecurities despite widespread recognition of their interdependencies. Third, we contribute to a dearth of literature that seeks to understand FEW risks within disaster contexts.

The validation process included developing a survey instrument through a series of feedback processes, including consulting academic experts in FEW security, and in partnership with community experts in Corcovada, Puerto Rico. We then validated the survey through face-to-face, household interviews, in the community. This allowed the research team to identify unclear language and receptivity from participants with the survey objectives, ensuring robustness, accuracy and relevance. Earlier workshops developed key themes for which informed the initial survey. A later event, post-survey validation, provided the opportunity for sustained and collective co-creation of the survey. The incorporation of active community participation in these processes fostered further participation, provoked by knowledge sharing and the exchange of ideas in a safe space that was comfortable for all. Having a focus of people as experts of their lived experiences and realities created a sense of belonging in the survey development process, which allowed a flexible, open and participatory scope at all times, including in spaces for debate and dissent.

In the development of a survey instrument with the intention of community leaders and public health officials as the end-user, we find that community experts and academic experts had varied – and sometimes conflicting – feedback on survey question type and confidentiality. This reflects the intention of survey use in academic spaces versus for community use. Additionally, households that were part of the validation process provided insight into questions and wording that were otherwise not considered by the research team and experts. By focusing on community priorities, this toolkit can help to strengthen community relationships and supports self-management to meet public health needs and support local knowledge-holders as key players in disaster management. This process clarified the need to understand end-user goals, as well as the purpose of instruments in settings outside of academic pursuits.

2. FEW security and public health assessments

FEW security is central in both public health and disaster-related studies (Roque *et al.*, 2022). Understanding the emergence of FEW insecurities presents opportunities to understand the linkages between disaster impacts and public health. For example, post-disaster power outages

can impede water availability and quality, in turn limiting healthy food choices (Lopez-Cardalda *et al.*, 2018). Such interdependencies underscore the need for “nexus” thinking (Daher *et al.*, 2021), which can heighten integrative attention toward preparing, adapting and mitigating FEW insecurities (Schmidt *et al.*, 2022).

Several assessment tools exist to evaluate household experiences with individual dimensions of food, energy or water insecurity. For example, the U.S. Department of Agriculture (2012) Household Food Security Scale Module is a validated survey that monitors food insecurity experiences in the United States, while the Household Water Insecurity Experience Scale (Young *et al.*, 2019) assesses water insecurity in many diverse low- and middle-income countries (LMICs). Others developed household energy insecurity scales (e.g. Cook *et al.*, 2008; Boateng *et al.*, 2020). However, these instruments advance our understanding of FEW insecurities largely independently (but, cf. Brewis *et al.*, 2020). They are not primarily designed to provide robust insights into *interactive* FEW insecurities in a single assessment tool. That is, existing standardized instruments do not conceptualize and measure FEW insecurities as non-independent. This limits our collective understanding of the combined impacts of these insecurities on public health, which is critical during post-disaster periods where health risks are heightened.

Existing public health assessment tools – such as the Community Assessment for Public Health Emergency Response (Schnall *et al.*, 2017), the Environmental Health Shelter Assessment Tool (McDavid and Cruz, 2019) and the Disaster-Related Mortality Surveillance Form (Noe, 2018) – are useful in assessing health challenges after a disaster (e.g. food and water-borne disease, physical injury, psychological impacts, morbidity and mortality). While these instruments contribute to understanding community health resilience, such instruments are intended to be deployed by public health officials, emergency managers or academics.

Community leaders and other local stakeholders often bear central responsibilities for disaster management (Lillibridge *et al.*, 1993). In Puerto Rico specifically, community leaders often look after vulnerable populations, such as people with hearing difficulty, women, or older adults, who lack resources and support (see Ortiz Torres *et al.*, 2024). Ortiz Torres *et al.* (2024, p. 18) a community project coordinator, clarifies the immense, everyday importance of these local leaders for their communities:

Los líderes y lideresas comunitarias de Puerto Rico son esa materia prima que genera obras de incalculable valor. Sus orígenes y desarrollo se dan en contextos y en tiempos distintos, motivados por múltiples razones. Algunos se forman siguiendo los ejemplos de su niñez. Otros porque ante la espera o el olvido, decidieron crear soluciones. Unos cuantos porque sintieron el llamado de servir a los demás.

Puerto Rico’s community leaders are the raw material that generates works of incalculable value. Their origins and development take place in different contexts and at different times, motivated by multiple reasons. Some are formed following examples from their childhood. Others, faced with waiting or destruction, defied to create solutions. A few felt the call to serve others. Xavier D. Ortiz Torres (Ortiz Torres *et al.*, 2024, p. 18)

During and after disasters, communities often rely on their social networks and community organizing to meet their food, water, energy and health needs (Roque *et al.*, 2021; Vega, 2019; Mulligan and Garriga-Lopez, 2021). As one of many examples during Hurricane María, Ortiz Torres *et al.* (2024, p. 45) highlight how one community leader helped diabetic patients obtain insulin for those who did not have a refrigerator nor ice to keep their medication at a cool temperature. Useable and comprehensive assessments could help advance community health resilience for community leaders to know the needs of households and individuals in the community.

3. Research area context

Corcovada is a barrio in the western municipality of Añasco, Puerto Rico, located in a remote, mountainous area. Organized over fifty years ago, this community of approximately 600 residents is mostly elderly, due to significant out-migration from the community, and Puerto

Rico at-large. In the 1960s, Corcovada’s leaders constructed a drinking water aqueduct based on their exclusion from the centralized “Puerto Rico Aqueduct and Sewer Authority” (PRASA) network (Asencio *et al.*, 2018; Roque *et al.*, 2022). Today, through a long history of community organizing, Corcovada has two non-PRASA infrastructure systems and freely available tap water for close by communities to use (see Roque *et al.*, 2022).

Like other remote communities in Puerto Rico, from 2017 to 2021, Corcovada recently experienced landslides, earthquakes, hurricanes, flooding and the COVID-19 pandemic (Roque *et al.*, 2022). These compounding climatic and non-climatic hazards, in tandem with vulnerable critical infrastructure, led to water shortages, energy outages, blocked transportation routes and challenges in obtaining public health resources (see Roque *et al.*, 2020, 2022). Our survey was developed with the aim of supporting community leaders to identify the on-going challenges and opportunities to maintaining and enhancing FEW security.

4. Community engagement (phase 1)

Our process leveraged two “phases” of research (see Figure 1). In Phase 1 of our research, we used a community-based participatory research (CBPR) approach with sixteen community leaders to answer a set of research questions. We sought to understand what role social capital plays in community health resilience, how co-occurring hazards affect this relationship and what community leaders perceived as challenges to their FEW security within these contexts (Roque *et al.*, 2022). Through CBPR, our aim was to “increase knowledge and understanding of a given phenomenon and integrate the knowledge gained with interventions and policy and social change to improve the health and quality of life of community members” (Israel *et al.*, 2005, p. 5).

Workshops were held with community leaders and members over the course of two days (February 13 and 20, 2022), with several interactive in-person activities. Participants were selected from a diverse set of socio-economic backgrounds, including holding formal or informal leadership roles in Corcovada. Activities included both small- and large-group discussions, and a participatory mapping exercise where critical FEW and social infrastructure was mapped. Through these activities, participants were able to reflect on critical events and

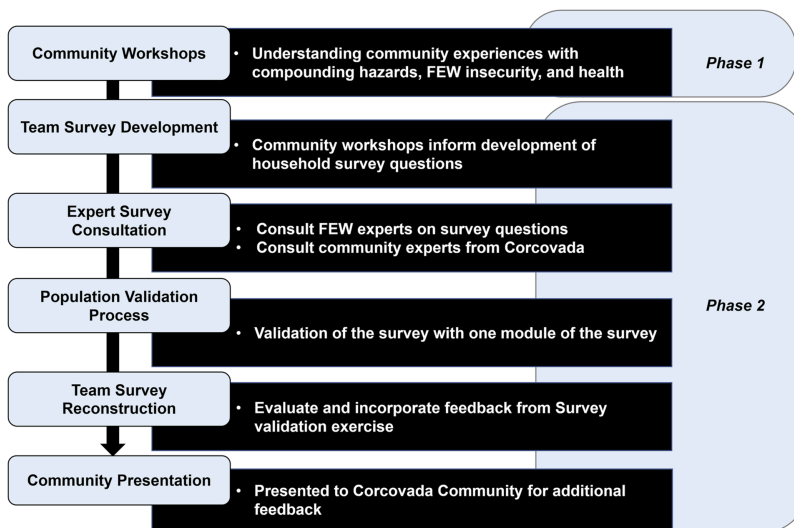


Figure 1. Survey development process. Source: Author’s own work

risks in Puerto Rico from the last decade, discuss existing community public health risks and needs and identify changes and transformations that could be made for the future (see [Roque et al., 2022](#)).

These workshops concluded with four research findings related to social capital, public health and FEW security in Corcovada ([Roque et al., 2022](#)). These included: (1) social capital is strongly linked to how health resilience is perceived; (2) social capital enables residents to support multiple entities – such as local organizations – and each other in the wake of disasters; (3) the COVID-19 pandemic challenged community self-organization through physical isolation, making effective communal-scale organization more difficult and (4) on-going challenges related to outmigration and local knowledge erosion affect current and long-term prospects for effective community organizing under compounding hazards ([Roque et al., 2022](#)). This included challenges to autogestion, or community self-management rooted in knowing community needs and managing them to achieve collective community goals.

The findings from the Phase 1 workshops provided a comprehensive set of considerations for better understanding the community. Through identifying specific community-level risks, this Phase set the stage for development of the co-created survey on public health and FEW security (Phase 2).

5. Co-creation survey development (phase 2)

To develop and validate the community survey, we established a process for incorporating community experiences and expert knowledge into the survey design. Taking its roots in CBPR ([Kelley et al., 2019](#)), the survey development process incorporated findings from previous community engagement efforts (Phase 1) and utilized the expertise of community leaders, with systematic input from community members through a survey validation process. We then held another outreach effort which included a community presentation of the survey, where we asked for some additional feedback on the survey construction. Ultimately, our survey development team sought to create an action-oriented assessment instrument that is both accessible and useful for community leaders and public health officials. The survey needed to make data collection and analysis accessible and non-burdensome for leaders and officials, who might not have experience with this type of data gathering and analysis.

Survey development began with an inductive approach, informed by workshop data from our CBPR for Phase 1 in Corcovada. Here, community leaders provided questions and areas of interest when considering challenges to FEW (in)security as well as emergency response. Following this, the research team met regularly to develop questions pertaining to FEW security, social capital and public health. We developed the survey to have questions in different cycles of a disaster: before, during and after.

For the initial survey, we gathered information from the previous workshops and literature, as well as deriving many of the questions from our own expertise in water, energy, public health and hazard and disasters research. We initially used very specific, close-ended questions as a mode of simplification for community end-users. We also accounted for timing of survey deployment by creating versions for before, during and after a hazard or disaster. Additionally, we incorporated questions of health and social connections to account for both public health concerns and households or individuals that might need extra support through community connection.

Following the initial survey development, we consulted with experts to validate survey questions for bias, accuracy and clarity. First, we reached out to academics with research experience in FEW, including those who developed household surveys on these specific topics. We then asked community experts from Corcovada who had firsthand experience addressing FEW insecurities and health crises following natural hazards and disasters their local expertise in this area. Both groups of experts worked closely with the survey development team throughout the community-based participatory research process. We reached out to experts via email with a set of questions to provide feedback and met with each expert either virtually or in person to discuss improvements to the survey.

After incorporating feedback from both academic and community experts, we then surveyed households using one module of the survey. We then streamlined modules such that some problems found in one could be identified and adjusted in another module. Lastly, using only one module saved time and helped to avoid participation fatigue from the target population.

We used a purposive sampling approach to the survey validation process with the intention of reaching varying demographic identities across age, gender and household composition. We were able to interview 13 households until we received no new feedback, reaching data saturation for this single module. In 25–45 min interviews, we asked participants about the relevance of key terms and comprehension. Additionally, participants provided feedback on the clarity of questions, if questions reflected their lived situation, if any questions on critical resources or infrastructure was missing and if they were comfortable with community leaders asking these questions.

With feedback from community members, we then incorporated feedback from participants of the survey validation process. In incorporating feedback from both experts and the community, the survey development team democratically decided on changes to any outstanding questions. We also incorporated feedback to both the English and Spanish versions of the surveys. Lastly, we held an in-person community event after the survey development, where the team introduced the survey to the community. We received additional feedback from this event and that was later incorporated into the survey.

6. Observations on survey development

6.1 Team survey development outcomes

The FEW security questions sought to address the availability, reliability, accessibility and quality of FEW, but were very different depending on the survey's timing (before, during and after) in the initial survey creation. The public health questions focused on community health which included questions on identifying special health care needs in the household (e.g. equipment, family members with special needs), environmental health (e.g. water quality), mental health (e.g. emotional well-being and a fulfilling life) and emergency health preparedness amongst others. Additionally, we noticed that most of our questions were closed ended and health questions were very specific (e.g. *are any family members bedridden?*). Considering the action-oriented focus of the survey, we agreed – at first – this would allow for easy collection and data analysis. We expanded health questions to have explicit connections to energy, food and water (e.g. electricity dependence for health equipment, dietary restrictions due to health and water source for drinking and sanitation). For expert consultation, the research team shared the survey via email and allowed two weeks for feedback through track-changes or notes. This email included a set of questions to elaborate their feedback. Following this, the research team met with them virtually or in-person to have a detailed discussion on their feedback. This included wording, clarity, question order, question sensitivity and a space for other comments.

6.2 Expert feedback outcomes

The academic and community experts recommended several ways to improve the clarity and consistency of the survey. First, they recommended that questions in the three modules (before, during and after) have a consistent flow so that community leaders and public health officials could compare variation across modules. To fix this, we developed consistent questions and question-wording to create a better flow throughout the instrument, and fixed grammar and numbering across the survey. After incorporating both academic and community expert feedback, each module in the survey was 40 questions with questions across modules.

We find that academic and community experts vary in their feedback, sometimes contradicting one another. For example, academics were more concerned with the confidentiality aspect of the survey (e.g. who is going to have access to the information) while community leaders appreciated that we did not ask about income, which is usually left

until the end of surveys due to question sensitivity. Further, community leaders did not mind the demographic questions at the beginning of the survey, which academics usually place at the end for fear of participants withdrawing from the survey due to the sensitivity of these questions. This was also reflected in the findings of the survey validation process, as no interviewees expressed any concerns about the demographic questions. Overall, community experts were not concerned about confidentiality or data access thus challenging academics' hesitation. Community experts also preferred open-ended questions that would allow respondents to expand on specific topics. Overall, academics focused on the nuance that the survey needed to capture to inform theory. In contrast, the community leaders focused on how the survey would be useful for assessing and meeting community needs, showcasing the necessity of consulting communities to gain their perspective.

6.3 Target population survey validation outcomes

We conducted a survey test with 13 households who were receptive to this type of survey of the community. However, there were concerns about question structure and unrecognizable words. One participant did not fully understand some words used in the survey, such as what was meant by a motor vehicle (*vehículo motorizado*) and suggested some clearer ways to word questions. Others found gaps in questions, such as not having an option for if there were no health concerns in a household or if a household does not have any immediate neighbors. This feedback was specific and provided insight on how to improve certain questions not considered by the research team, community experts, or academic experts.

6.4 Public health impacts

This survey development highlights the importance of co-creating public health surveys and assessments with diverse stakeholders. Co-creation of these instruments deepens the knowledge that can be gained and generated from surveying communities in the context of disasters, diversifies knowledge generation and informs survey design and deployment in ways that hold the potential to inform both public health practice and theory. Bringing together academic and community experts, allowed the survey to not diverge from community priorities and confirmed its usability for community leaders. Assessment tools, such as surveys, can be crucial for understanding the diverse health needs of the community, collecting data on food, water, energy security, chronic conditions, disabilities and mental health indicators. This survey can help anticipate and address these needs, ultimately mitigating the effects of hazards and facilitate coordinated responses among individuals, households, community leaders and aid organizations, such as local or state health departments, government agencies and non-governmental organizations.

The co-development of this survey has several significant public health implications for underserved communities that rely on self-management for emergency preparedness and disaster response. First, co-creating public health assessment tools can support communities and local health officials build local knowledge of community needs in all parts of the disaster cycle, centering community priorities over solely academic theoretical pursuits. Second, the use of surveys can help strengthen community relationships and social capital through empowering community leaders and public health officials with tools to meet community needs. Third, in diverse hazard and disaster contexts, public health is impacted by mitigation, preparedness, response and recovery. However, these efforts often place communities as recipients of aid or victims rather than key knowledge-holders of disaster management. Overall, the co-development of this survey provides a comprehensive understanding of community needs and assets to address the complexities of disasters.

6.5 Next steps: post-validation

The specific outcome of this work was to develop and validate the survey for dissemination by community leaders and local public health officials to assess community needs in all phases of

the disaster cycle. However, this is only the first step into the possible application and use of this survey. Our survey development team is currently planning next steps to share and help disseminate this survey across various communities in Puerto Rico, and other communities in need of food, energy, water and public health assessments. We see the potential for future work where community leaders, either with or without researcher collaboration, work to gather various information that can assist before, during, or after a hazard. These next steps can also act as further validation of the instrument.

7. Conclusion

We sought to develop an action-oriented survey with input from community experts and residents as an essential part of this process. Since community leaders may not have survey deployment or analysis training or have challenges with technology, we focus on developing a survey that could be both easy to administer as well as easy for data analysis. This is expected to facilitate data analysis and dissemination of results to different forums (e.g. local organizations, emergency preparedness plans). Overall, the co-creation of this survey can inform those with resources, such as local governments, federal agencies, emergency managers, non-profits, or other organizations, how best to aid before, during and after a disaster event. Such an approach is intended to contribute to community-based and community-driven public health initiatives and support.

There are many challenges with conducting surveys in the context of disasters, including language barriers, sampling representativeness and ethical considerations (Shoaf and Peek-Asa, 2000). However, concerns can be mitigated with a focus on collaboration between researchers, disaster responders and public health officials (*ibid*). Community leaders and public health officials are the end user, and this survey provides support that can lead to action. With this tool, these end users can mitigate negative public health impacts by identifying at-risk populations, monitoring community health outcomes and using it as a tool to make mitigation, preparedness and response plans.

Collaboration enabled us – together with our partners in Corcovada – to co-create a public health assessment tool that communities can use to address FEW insecurities and health issues before, during and after disasters. While local leaders understand how these insecurities manifest in their communities before and after crises, this survey will allow them to easily quantify how many households are experiencing FEW insecurities (i.e. accessibility, reliability, quality, availability) and to identify those in need of assistance in ways that better target aid efforts. This survey will also allow for users to collect data and draw conclusions for action efficiently, as this survey considers the interacting and reinforcing impact of FEW insecurities and related public health risks.

Collaborating with community experts and residents provided culturally relevant insights relating to their experiences with these insecurities. This survey development process, along with Phase 1 and other projects with the Corcovada community continue to support a sense of community among participants and community members. Community cohesion is enhanced through problem-solving as collective growth, which could potentially lead to other forms of self-management and mutual support, especially when faced with hazard, disaster and public health impacts.

Our survey innovates by including questions related to chronic conditions, disability and mental health/mental distress which is a significant step toward addressing the unique vulnerabilities of individuals in disaster-prone areas like Puerto Rico. By identifying these specific household health vulnerabilities, community leaders and decision-makers can gain valuable insights to inform their disaster planning and response strategies. This approach is especially important in Puerto Rico, considering its aging population (median age is 44.2 vs 38.8 in the United States) and the increasing prevalence of self-reported poor physical and mental health status, and depression diagnoses following Hurricane María in 2017 (Chandra *et al.*, 2021). Our co-created survey assists community leaders at the intersection of compounding hazards and public health by providing tools to know and understand community gaps and needs.

Acknowledgement

We extend our gratitude to the community leaders and residents of Corcovada, Puerto Rico, for their time and invaluable contributions to this collaboration. We would especially like to thank our Project Manager, Javier Nieves Torres (Duke University), for his support in this work. We also would like to thank Ryelie Barnes for her support with our project toolkit and website.

Funding: This research was funded by the Public Health Disaster Research Award Program at the Natural Hazards Center at the University of Colorado Boulder. This award program is supported by the Centers for Disease Control and Prevention (CDC) through supplemental funding to the National Science Foundation (NSF Award #1635593). Any opinions, findings, conclusions, or recommendations expressed from this research are those of the author(s) and do not necessarily reflect the views of the CDC, NSF or Natural Hazards Center.

Work reproduction acknowledgement: This paper derives from Roque, A. D., Quintana Torres, E., Shah, S. H., Painter, M. P., Cuevas, F. and Tormos-Aponte, F. (2023). *Assessing Intra-Community Public Health Impacts from Compounding Food, Energy, and Water Insecurities* (Natural Hazards Center Public Health Disaster Research Report Series, Report 37). Natural Hazards Center, University of Colorado Boulder. <https://hazards.colorado.edu/public-health-disaster-research/assessing-intra-community-public-health-impacts-from-compounding-food-energy-and-water-insecurities>. Parts of this manuscript were reproduced with permission from the Natural Hazards Center, Emerald Publishing, the editors of this special issue, and the co-authors of this report.

Institutional review board: Both phase 1 (workshops) and phase 2 (survey development) were approved under the existing IRB protocol for “Environmental Inequity and Disasters Research” (Study 22060200) at the University of Pittsburgh.

Conflict of interest: None.

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