

Are Public Housing Authorities Preparing for Disasters? A Mixed Methods Study on Public  
Housing Authority Disaster Risk Management Strategies

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**Abstract**

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Disasters damage and destroy housing, exacerbating adverse impacts on low-income renters living in federally-subsidized housing units managed by Public Housing Authorities (PHAs) across the United States (U.S.). To date, there is limited research on what approaches to preparedness, response, and recovery, or disaster risk management strategies, are being implemented by PHAs. This dissertation research utilizes qualitative and survey research methods across three studies to explore if, how, and why U.S. PHAs are implementing disaster risk management (DRM) strategies. In the first study, we conducted a content analysis of state-level disaster plans to better understand the roles and responsibilities delegated to PHAs. We found that state-level disaster plans rarely outline roles and responsibilities of PHAs, suggesting an urgent need for integration of PHAs into planning and opportunity to develop Disaster

Housing Plans that include PHAs and other low-income housing providers. In the second study, we conducted semi-structured interviews with key informants, guided by the Consolidated Framework for Implementation Research (CFIR), an implementation science framework, to identify the barriers, facilitators, and opportunities to implement DRM strategies at PHAs. Results showed that financial and administrative hindrances, lack of policy, and lack of disaster training among PHA staff are notable barriers to engaging in DRM at PHAs, while past disaster experience, interagency partnerships, and designated DRM roles at PHAs support successful implementation of DRM strategies at PHAs. In the third study, a national-level survey was administered to PHAs to assess their implementation of DRM strategies. Survey results, along with secondary data on community- and organizational-level characteristics, were analyzed using descriptive statistics. Findings suggest that PHA Moving To Work status, PHA size, urban classification, state-level political affiliation, and perceived hazard risk influence PHA DRM implementation. Together, these studies demonstrate the need for PHA inclusion in state-level disaster planning, uncover barriers and facilitators to PHA DRM implementation, and provide a novel overview of DRM strategies that PHAs are currently implementing. Findings identify numerous opportunities for improving implementation of DRM strategies at PHAs, and can inform decisions to promote equity-focused federal disaster and housing policy to better protect residents living in federally-subsidized housing units.

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## LIST OF ACRONYMS

AFN	Access and Functional Needs
AMI	Area Median Income
CFIR	Consolidated Framework for Implementation Research
DRM	Disaster Risk Management
EOP	Emergency Operations Plan
ESF	Emergency Support Function
FEMA	Federal Emergency Management Bureau
HUD	U.S. Department of Housing and Urban Development
KI	Key Informant
LIHTC	Low Income Housing Tax Credit
MTW	Moving To Work
NLIHC	National Low Income Housing Coalition
PHA	Public Housing Authority
RAD	Rental Assistance Demonstration

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## **DEDICATION**

To my mountain and writing partner, Aloo.

## Chapter 1. INTRODUCTION

### 1.1 DISASTERS AND AFFORDABLE HOUSING

The U.S. is currently experiencing a shortage of 7 million affordable and available homes for low-income renters (Bovell-Ammon et al., 2020), which is partially due to a shrinkage of affordable housing in the private housing market, an increase in severely rent-burdened households, and a chronic underfunding of federal affordable housing programs (Desmond & Shollenberger, 2015; Frederick J. Eggers, 2010; Newman & Holupka, 2018). As of 2015, only one-quarter of 20 million eligible U.S. households received housing assistance through federal spending programs (Congressional Budget Office, 2015), highlighting the severity of the affordable housing crisis.

At the same time, climate change is contributing to a rapid increase in disaster frequency and intensity (NOAA, 2021). From 2019-2023 alone, there were 102 total weather and climate disaster events, totaling to costs of \$617 billion (USD) and approximately 1,996 recorded deaths (NOAA, 2024). These totals do not include the many adverse impacts from other disasters, such as COVID-19, or the long-term health and mortality impacts from disasters. Disasters damage and destroy residential housing, lead to detrimental impacts on public health, and disproportionately affect marginalized groups (J. Y. Lee & Van Zandt, 2019; Peacock et al., 2014). The impact of disasters affects communities unequally, which is largely due to poor urban planning, socioeconomic disparities, inequitable policies, and structural racism (Chmutina & von Meding, 2019; Cutter et al., 2003).

These societal structures work in tandem to exacerbate the adverse impacts of disasters among low-income renters, who are disproportionately impacted compared to homeowners (Chmutina & von Meding, 2019; Cutter et al., 2003). On an everyday basis, roughly 7.6 million

extremely low-income renter households, defined as 30% of the Area Median Income (AMI) or below the poverty line (*HUD's Public Housing Program, 2017*), are severely housing cost-burdened and spend more than half of their incomes on rent and utilities (Aurand et al., 2024), which subsequently increases risk of eviction and homelessness, and negatively impacts physical and mental health (Desmond & Kimbro, 2015; Tsai, 2015). Following disasters, the risk of housing displacement increases among renters in federally-subsidized housing (American Planning Association, 2014) because these units are often not prioritized for repair, and sometimes are instead torn down after a disaster by local governments (Hamideh & Rongerude, 2018; Khajehei, 2019). Roughly 10% of U.S. rental units are federally-subsidized and provisioned for low-income renters, highlighting the critical need to protect this resource as the adverse impacts of climate change accelerate (Aurand et al., 2021).

## 1.2 PUBLIC HOUSING AUTHORITIES

Public housing authorities (PHAs), who are quasi-governmental agencies that receive funding from the U.S. Office of Housing and Urban Development (HUD), are responsible for managing and operating federal housing programs, including administering the application process, providing written notification of acceptance or rejection, managing waiting lists, and ensuring that housing units meet health criteria (Kleit & Page, 2015). PHAs vary widely in the number of units they administer and their jurisdiction sizes. There are roughly 3,820 PHAs in the U.S. and U.S. territories, and the majority of these are small (69.3% of PHAs are responsible for overseeing fewer than 250 units total) and medium-sized (21.3% of PHAs are responsible for overseeing 250-1,249 units total), but large PHAs are responsible for the majority of federal housing assistance (6.4% of PHAs are responsible for overseeing 1,250-10,000+ units total)

(Congressional Budget Office, 2015; HUD, 2022c). From 1976 to 2004, congressionally authorization for housing assistance decreased by 48%, from \$56.4 billion to \$29.2 billion (in 2004 dollars) (Dolbeare et al., 2004). PHAs, who often juggle multiple funding mechanisms to provide housing to their clients, face serious challenges in creating effective organizational strategies given federal limitations and the increasingly neoliberal approach to housing policy, pushing them to use both public and private sources of funding to carry out organizational goals, such as supporting the growth of affordable housing units (Kleit & Page, 2015). PHAs often lack resources to meet renter needs, frequently resulting in long waiting times, high tenant occupancy rates for housing units, and rationing of available units (Geyer & Sieg, 2013). As housing need among renters grows and federal funding limitations continue to exist (Fischer & Sard, 2017), PHAs will continue to struggle with meeting affordable housing needs of current and prospective residents.

In the past 25 years, federal initiatives have greatly expanded the scope of local PHA action, which has both created conflicting goals for PHAs and promised them more flexibility for adopting new strategies at the local level (Kleit & Page, 2008). For example, the Moving to Work (MTW) program is a HUD-led demonstration program that provides some PHAs with opportunities to design and test innovative, locally-guided strategies to use federal funding more efficiently, increase housing choices for low-income families, and provide exemptions from existing rules around using funding (HUD, 2022b). Programs such as MTW have potential to influence PHA planning decisions (Walter et al., 2020). PHAs, who vary greatly in their abilities to leverage private investment (Kleit & Page, 2015), have turned to market-based approaches and business techniques to provide affordable rental housing, or enlisted the services of nonprofits and faith-based organizations (Nguyen et al., 2012). Indeed, a case study investigation

of 13 PHAs across Washington and Oregon, which included a content analysis of PHA documents and semi-structured interviews with PHA staff, outlined activities that PHAs carried out to balance public mission with private-market means and demonstrated creative approaches PHAs are taking in preserving affordable housing through the implementation of a wide variety of policy strategies (Kleit & Page, 2015).

### 1.3 DISASTER RISK MANAGEMENT PLANNING

Partner engagement in mitigation, preparedness, response, and recovery planning (FEMA, n.d.),<sup>1</sup> also known as disaster risk management (DRM), has been shown to improve identification and prioritization of community needs and resources, as well as aid partners in aligning around shared goals, enhancing both plan effectiveness and overall quality (Berke et al., 2014; Institute of Medicine, 2015; Olshansky et al., 2012). In addition, organizational-level disaster planning among state and local government agencies has been shown to mitigate the effects of short- and long-term housing displacement and its associated health impacts, specifically among low-income populations (Peacock et al., 2014; Smith et al., 2013).

However, it is largely unknown if and how organizations serving low-income renters, such as PHAs, are engaging in DRM implementation in the U.S. At the same time, there are few requirements of PHAs to implement organizational DRM strategies. Although PHAs are required by HUD to develop five-year plans describing their organizational missions and goals, disaster preparedness, response, or recovery are not included as one of the 19 required PHA plan components (Gramlich, 2021). While HUD does have a guidance document for PHAs around

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<sup>1</sup> Throughout this dissertation, the term disaster risk management (DRM) is used to refer to the preparedness, response, and recovery phases, in alignment with HUD's PHA disaster readiness, response, and recovery guidebook (HUD, 2022d).

disaster readiness, response, and recovery (HUD, 2022d), the implementation of this guide by PHAs has yet to be investigated. Additionally, the Federal Emergency Management Agency (FEMA) does not have any mandates in place for PHA disaster preparedness. Collaborative disaster planning among local governments and PHAs can serve a dual purpose: enhancing jurisdictional preparedness to account for the needs of low-income renters, as well as bolstering organizational readiness at the PHA level, given the absence of formal planning requirements. To date, it remains unknown if collaboration with PHAs in DRM planning is occurring at the state-level.

#### 1.4 STUDY AIMS

Despite the evidence that collaborative and organizational disaster planning can serve as an effective strategy for mitigating the adverse impacts of disasters, specifically among low-income populations (Peacock et al., 2014; Smith et al., 2013), *there has been little research to assess Public Housing Authority engagement in disaster risk management*. In response, this national-level study explores if, how, and why PHAs across the U.S. are implementing disaster risk management strategies. Specifically, we aim to:

**Aim 1: Identify the roles and responsibilities assigned to PHAs within state-level disaster plans.** We systematically collected and assessed the content of state-level disaster plans and summarized each plan’s description of the roles and responsibilities of PHAs.

**Aim 2: Describe the preparedness, response, and recovery strategies undertaken by PHAs before, during, and after disasters, as well as barriers, facilitators, and opportunities for**

**their implementation.** We used semi-structured key informant interviews with federal housing officials, PHA leaders, and affordable housing non-profit staff to identify DRM strategies PHAs are currently undertaking. Interviews explored how external (e.g., financial resources) and internal (e.g., leadership) factors influence implementation of PHA DRM strategies.

**Aim 3: Assess the association of community- and organization-level characteristics, political characteristics, and perceived hazard risk, with implementation of disaster preparedness, response, and recovery strategies at PHAs.** We administered a national survey, informed by past literature and Aim 1 and 2 findings, to PHAs to assess their implementation of DRM strategies. Secondary data on PHA characteristics were utilized to understand their association with DRM strategies.

## 1.5 OUTPUTS, OUTCOMES, AND IMPACT

To date, no research has specifically examined how PHAs are planning for disasters, and no studies have provided insight into the barriers, facilitators, and opportunities behind implementation of PHA disaster risk management strategies. This innovative, mixed-methods research enhances knowledge about the current state of implementation of such strategies and can guide decisions to promote future, equity-focused federal disaster and housing policy, to minimize displacement after a disaster and ultimately improve the health and well-being of current and future federally-subsidized housing residents.

## Chapter 2. ASSESSING THE ROLES AND RESPONSIBILITIES OF PUBLIC HOUSING AUTHORITIES IN STATE-LEVEL DISASTER PLANS

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## 2.1 ABSTRACT

Low-income renters living in federally-subsidized housing are especially vulnerable to disasters due to their socioeconomic status and because they often live in older housing located in high hazard risk areas. Public Housing Authorities (PHAs) are responsible for maintaining these units and their residents on an everyday basis and during disasters, yet their roles in state-level disaster plans have not been systematically documented. This study aims to identify if and how state-level disaster plans integrate PHA roles into disaster planning. Eighty-five documents including state Emergency Operation Plans, Recovery Plans, Emergency Support Functions, and Disaster Housing Plans were collected from state websites. The plans were qualitatively analyzed to identify PHA roles in disaster planning. A total of 44 states were represented among collected plans. Our findings reveal an overall lack of defined roles assigned to PHAs in state-level disaster plans. Of the collected plans, seven percent assigned roles to PHAs focused on post-disaster activities and strategies, partnerships, and coordination. However, 15 percent of plans assigned roles to agencies other than PHAs related to preparedness, response, and recovery for low-income housing in collaboration with PHAs. This suggests that PHAs are still being considered in disaster planning. State disaster plans poorly define the roles of PHAs, suggesting a lack of coordinated preparedness strategies to protect renters in federally-subsidized housing. There is an urgent need for PHAs to be incorporated into state-level disaster planning and assigned formal roles in disaster plans to better protect their low-income residents from disasters.

## 2.2 INTRODUCTION

As anthropogenic climate change rapidly increases the intensity and frequency of disasters across the United States (U.S.) (NOAA, 2021), low-income renters in the private

housing market as well as those in federally assisted housing (through U.S. Department of Housing and Urban Development (HUD)), live in areas that are disproportionately prone to hazards and are at greater risk of housing loss and displacement (Buchanan et al., 2020; Chakraborty et al., 2021; Lee & Van Zandt, 2019; The Public and Affordable Housing Research Corporation & The National Low Income Housing Coalition, 2021). A 2021 National Low Income Housing Coalition (NLIHC) report found that roughly one-third of HUD-assisted housing is located in “very high or relatively high risk” areas that are prone to negative effects from environmental hazards, along with 40% of HUD’s public housing units located in “high risk areas” (The Public and Affordable Housing Research Corporation & The National Low Income Housing Coalition, 2021). Additionally, non-white households living in HUD-assisted housing were more likely to live in areas with greater hazard risk than white HUD-assisted households (The Public and Affordable Housing Research Corporation & The National Low Income Housing Coalition, 2021). As of 2022, there are roughly 49.5 million rental housing units in the U.S. (HUD, 2022e), of which 1.1 million are public housing units. A report from New York University’s Furman Center states that 5% of these public housing units were located in 100-year floodplains and 9% were located in both 100- and 500-year floodplains (Rosoff & Yager, 2017). Meanwhile, of about 4.1 million privately-owned HUD-assisted rental units, 4% were located in 100-year floodplains and 8% were located in both 100- and 500-year floodplains (Rosoff & Yager, 2017). The number of HUD-assisted housing units exposed to extreme coastal water levels is predicted to roughly triple by 2050 (Buchanan et al., 2020). Thus, a cycle of environmental injustice produces and reproduces disaster vulnerability: families reliant on public housing due to their income, disability status, and/or age (HUD’s Public Housing Program,

2017) may have no choice but to reside in flood-prone areas due to lower housing costs, thus facing increasing risk of exposure to disasters (Levine et al., 2007).

In the U.S., low-income households, many of which are elderly or disabled, are eligible for HUD-subsidized housing units (HUD's Public Housing Program, 2017), which are managed by roughly 4,000 Public Housing Authorities (PHAs), for which HUD provides oversight. The majority of PHAs are small (69.3% of PHAs are responsible for overseeing fewer than 250 units total) and medium-sized (21.3% of PHAs are responsible for overseeing 250-1,249 units total), but large PHAs are responsible for the majority of federal housing assistance (6.4% of PHAs are responsible for overseeing 1,250-10,000+ units total) (Congressional Budget Office, 2015; HUD, 2022c). While local PHAs are responsible for managing and operating federal housing programs, including administering the application process, providing written notification of acceptance or rejection, managing waiting lists, and ensuring that housing units meet health criteria, their structure, roles, funding mechanisms, and individual responses to implementing housing strategies across jurisdictions, counties, and states are highly variable (Kleit & Page, 2015). PHAs have insufficient federal resources to meet renter needs, often resulting in long waiting times, high tenant occupancy rates for housing units, and rationing of available units (Geyer & Sieg, 2013). At the same time, the ongoing affordable housing crisis has increased demand for PHA services (Levine et al., 2007). As of 2015, only one-quarter of 20 million eligible households received housing assistance through federal spending programs (Congressional Budget Office, 2015). The increasing number of low-income households who are rent-burdened and are competing for federal housing subsidies leaves little room for choice in safe and affordable housing, and traps low-income renters in overcrowded and overpriced housing (Kamel, 2012).

As disasters decrease supply and amplify demands for affordable housing (Davlasheridze & Miao, 2021), the climate crisis will only exacerbate this imbalance. Given the potential impact on their existing and future operations, PHAs are expected to have vested interests in reducing the impact of disasters on their assets and other affordable housing units within their jurisdictions. While HUD has developed tools to engage PHAs in disaster risk management (HUD, 2016, 2022d), such as 2016 and 2022 guidance documents for PHA disaster readiness, response, and recovery, their role in state and local disaster planning has not been explicitly defined or assigned by HUD or other federal agencies. PHAs are often underfunded while typically serving some of the poorest renters with the most limited resources, differentiating them from other housing agencies (Kleit & Page, 2015), such as state housing finance agencies, that primarily finance affordable housing but do not specialize in providing deep subsidies for the poorest renters as PHAs do. At the same time, the units PHAs manage are often difficult to replace post-disaster due to a disinterest from local communities to fund or build public housing and a lack of federal funding to fix such units (Adams, 2013; Green & Olshansky, 2012). Prior events have further demonstrated the detrimental impacts of disasters on public housing residents, underscoring the need for PHAs to be included in the planning process to protect their low-income residents. For example, in a study examining hurricane impacts on high-rise and high-density public housing, Hernandez et al conducted focus groups with public housing residents who had experienced Hurricane Sandy in New York City (Hernández et al., 2018). The authors found that Sandy left most residents without water, energy, and transportation for several weeks following the storm and that impacts were especially pronounced for socially, physically, economically, and medically vulnerable groups, indicating a strong need for improved disaster preparedness (Hernández et al., 2018). As there are no universally assigned responsibilities for

PHAs to adhere to with respect to disasters, PHA collaboration with state and local agencies within their jurisdictions can help to define their disaster risk management roles through disaster planning processes.

Planning is an essential component of disaster risk management and should be executed at multiple governmental and organizational levels for efficiency and equity when managing risk (FEMA, 2016b). State agencies develop a number of emergency plans, including emergency operation plans (EOPs), continuity of operations plans, hazard mitigation plans, and disaster recovery plans, and are advised to update them regularly (FEMA, 2016c, 2021). An EOP is an all-hazards document that outlines the roles of different agencies during a disaster. Local EOPs must be aligned with state-level EOPs (U.S. Department of Health and Human Services, n.d.). Statewide recovery plans outline the actions that must be taken by state-level agencies to efficiently execute disaster recovery processes, including restoring, redeveloping, and revitalizing state assets (FEMA, 2016c). Together, EOPs and recovery plans form a baseline strategy for states to plan for three of four phases of the disaster risk management process: preparedness, response, and recovery (FEMA, n.d.). The fourth phase, mitigation, is often addressed in a separate state-level hazard mitigation plan, which were not included in this study due to the focus on housing preparedness, response, and recovery.

Having diverse partners to engage in disaster planning helps to identify and prioritize community needs and resources, as well as aids partners in aligning around shared goals, and therefore implement more effective plans (Berke et al., 2014; Institute of Medicine, 2015). Additionally, involving partners across disciplines and organizations can facilitate a culture of knowledge sharing, incorporate differing values into disaster planning decisions (Pathak Aishwarya et al., 2020), and establish trust between partners for decision making (Desportes et

al., 2016). In disaster risk management planning, partners may include federal government, public agencies, private organizations, academia, non-profits, and community residents, including those most at risk (Desportes et al., 2016; Kapucu & Garayev, 2011). Disasters create environments where interagency cooperation across multiple hierarchical structures is further complicated (Kapucu & Garayev, 2011), highlighting the importance of collaborative planning practices before disasters occur. A recent study deployed a social network analysis to examine how multi-sector partners integrate on housing resilience planning in the Greater Miami area, finding that most housing resilience planning documents only involve a few partners rather than the many players that should be incorporated into planning decisions (Ren et al., 2023). This suggests an overall need for more intersectoral collaboration to enhance housing resilience planning (Ren et al., 2023), beginning with an understanding of how different partners, such as PHAs, are considered in planning processes.

Despite this need, to our knowledge, there has yet to be empirical research to document the roles and responsibilities of PHAs in state-level disaster planning. In this study, we aim to understand the disaster risk management roles and responsibilities assigned to PHAs through a content analysis of state-level disaster plans, including EOPs, recovery plans, and specific disaster housing or housing recovery plans. Understanding PHA involvement in state-level disaster planning is necessary for improving future disaster policy that prioritizes the well-being of low-income renters before, during, and after disasters, as well as evaluating specific actions that other partners are currently taking or can take in the future to improve PHA disaster risk management strategies.

## 2.3 METHODS

### 2.3.1 DATA COLLECTION

State EOPs and disaster recovery plans compiled by state emergency management agencies were gathered from state-level emergency management websites during the summer of 2022 for 50 U.S. states. Agency-specific plans that are not part of an overall statewide strategy were excluded from the search. In addition, Emergency Support Functions (ESF) #6 Mass Care, Emergency Assistance, Housing and Human Services and ESF #14 Long-term Recovery were collected from state emergency management websites, if available and not initially included in the state's overall EOP. If a state plan specific to Disaster Housing was included on the state's website, it was included during data collection. These plans and their definitions are provided in **Table 2.1**. Two initial keyword searches for “[state name] emergency operations plan” and “[state name] disaster recovery plan” were done per state on Google, and plans were subsequently downloaded from websites, if available and published from 2017-2022. If a plan was either not available on a website or was available but published before 2017, state emergency management agencies were contacted by email first (if available on their website) and then by phone (if available on their website) to identify the plan or confirm that the plan was the most recent EOP or recovery plan and request that the document to be shared. If there was no response after two contact attempts, it was assumed that the plans were either not available or the pre-2017 version available online was the most current. Eighty-five documents were collected in total.

**Table 2.1:** Types of plans that were collected, their definitions, and the number of collected plans.

<b>Plan Type</b>	<b>Definition</b>	<b>Number of Collected Plans</b>
Emergency Operations Plan (EOP)	State-level EOPs detail what different agencies will do during a disaster. This plan should incorporate all hazards and must line up with local EOPs for information sharing and resource requests (U.S. Department of Health and Human Services, n.d.). The EOP may include hazard-specific annexes, as well as Emergency Support Function (ESF) sections. Some of the EOPs collected did include ESF #6 and #14, described below; however, these were separated for analysis. EOPs are sometimes referred to as Emergency Management Plans (EMPs) or Comprehensive Emergency Management plans (CEMPs)	43
Recovery Plan or Emergency Support Function (ESF) #14: Long-term Community Recovery*	State-level recovery plans explain the necessary actions taken by state-level agencies to efficiently execute disaster recovery processes. These processes focus on restoring, redeveloping, and revitalizing state assets (FEMA, 2016c)  ESF #14 provides state-level procedures for managing coordination between tribal, regional, and local governments, as well as nongovernmental organizations (NGOs) and the private sector. The goal of these procedures is to improve both short- and long-term recovery after disasters. ESF #14 also aids in the recovery phase through the identification of available recovery funding sources, as well as listing sources of technical assistance for community recovery and planning support (FEMA, 2008)	18 Recovery Plans 5 ESF #14
Emergency Support Function (ESF) #6: Mass Care, Emergency Assistance, Temporary Housing, and Human Services Annex	ESF #6 outlines disaster-related roles and responsibilities at the local, state, and tribal levels for: mass care, emergency assistance, temporary housing, and human services organizations (FEMA, 2016a)	14
Disaster Housing Plan	A state-level disaster housing plan outlines roles and responsibilities delegated to state agencies during the housing recovery process and facilitates coordinated state and federal level support to local communities who require disaster housing assistance (FEMA, 2020)	5
Total collected plans:		85

\*As some states use ESF #14 as their primary recovery plan, our study combined both plan types into one category for analysis. While 85 plans were collected in total, some EOPs included multiple components that independently qualified as plans based on our inclusion criteria (e.g., an EOP that also included ESF #6 and #14 would count as three separate plans). Thus, the total count of plans analyzed (119) exceeded the number of plans collected (85). Additional details on the collected plans are provided in the “Results” section of the paper.

### 2.3.2 DATA ANALYSIS

A qualitative content analysis approach was used to analyze the plans, which entails the systematic classification process of coding to summarize the content of text data (Hsieh & Shannon, 2005). Specifically, a deductive or “directed” approach was utilized, which uses existing theory or previous research to guide the initial coding scheme or relationship between codes. This approach is used often in qualitative work and is beneficial for expanding upon an existing theory, or where some knowledge around a research question already exists (Hsieh & Shannon, 2005). Prior work has used similar methods to assess the content of state and local disaster recovery plans (Archer et al., 2022; Kennedy et al., 2021), as well as heat adaptation planning (Randazza et al., 2023).

Coding questions and a preliminary set of codes were deductively developed using the pre- and post-disaster activities provided in the 2016 HUD PHA Disaster Readiness and Preparation Guide (HUD, 2016). The guide includes a pre-disaster preparedness section (i.e., risk assessment, coordination, guidance development, partnerships, staffing, training) and a post-disaster recovery section (i.e., activation and development, assessments, recovery support, technical assistance, communication, transition to normalization). One investigator (AK) then inductively developed additional codes based on familiarization with a sample of the plans and consultation with the research team and subject matter experts at NLIHC. Consultation with all the authors at the start of the coding process ensured an iterative process around codebook development. The codes were then applied to all 85 plans in their entirety by one investigator (AK) to the plan components outlined in **Table 2.2**. Coding was done in NVivo (released in 2022) (NVivo, 2020). Code definitions are provided in **Table 2.3**. Weeks after the first round of coding, the investigator (AK) randomly re-coded 10% (n=9) of the total plans to assess reliability

of the codebook and code application process. Discrepancies in applied codes between the first and second rounds were minimal, and adjudication of any differences in coding was done independently by the investigator (AK) by recoding any discrepancies. The proportion of plan types that contained text that aligned with each of the codes was captured in Microsoft Excel and summarized using descriptive statistics.

**Table 2.2:** Plan components reviewed, if present, and their definitions

<b>Plan component</b>	<b>Definition</b>
Introduction	This includes the mission, vision, purpose, or an equivalent.
Table of Contents	To determine if sections/subsections of plan mention ‘housing recovery,’ ‘housing authority,’ or ‘low-income housing’ in the title.
Housing-specific section(s)	This was determined from the table of contents or by a review of the plan, if applicable.
ESF #6 and ESF #14	To determine if ‘housing authorities’ are incorporated into the section, if applicable. A note that these plans may have been downloaded as separate documents, if not included in the overall EOP.
Paragraphs containing the keyword “hous”	Following a keyword search, the entire paragraph where the word was present was reviewed, to determine if the provided information aligned with the topic of low-income housing. Any relevant paragraphs were included in the analysis.

**Table 2.3:** Code names in the analysis and their definitions

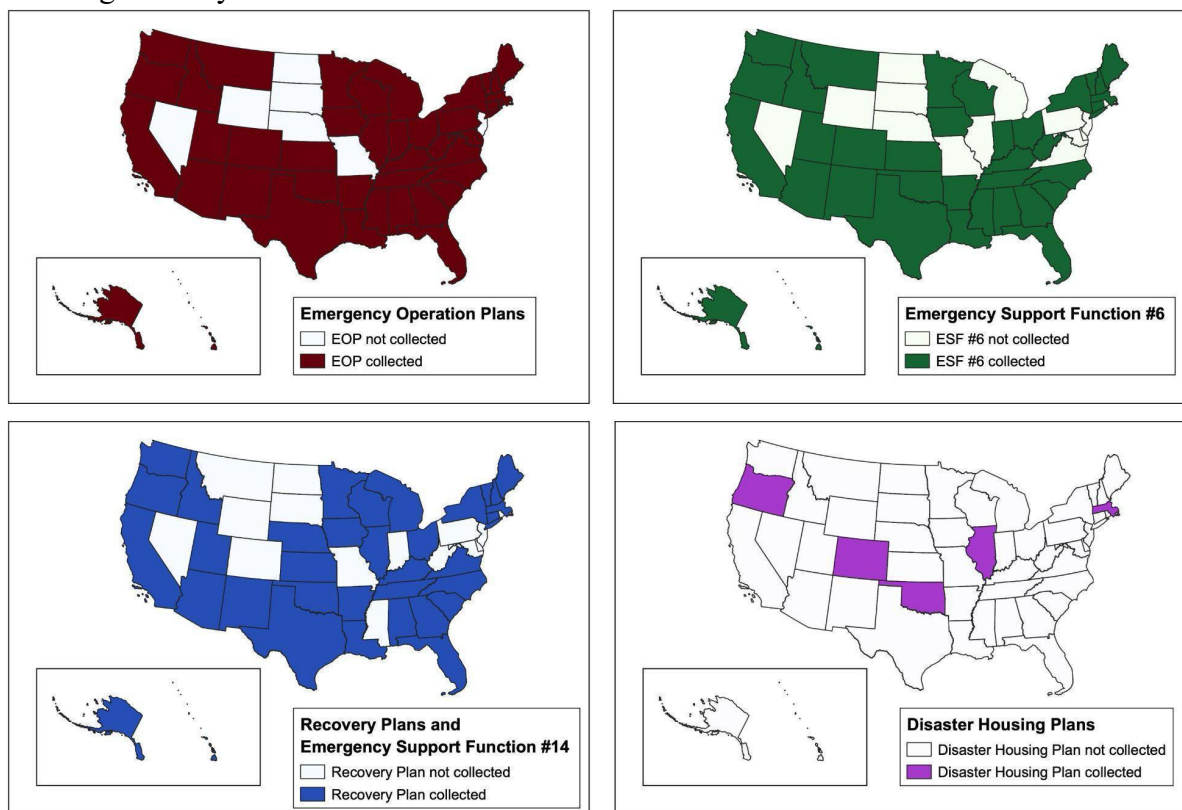
<b>Code Name</b>	<b>Code Definition</b>
PHA pre-disaster activities and strategies	This code describes activities or strategies specifically assigned to PHAs that occur during the planning process prior to a disaster event. It can include activities or strategies implemented during the pre-disaster planning process that support post-disaster recovery.
PHA pre-disaster partnerships and coordination	This code describes coordination activities or strategies specifically assigned to PHAs that occur during the planning process prior to a disaster event, with the primary goal of developing or utilizing partnerships or networks. It can include activities or strategies implemented during the pre-disaster planning process that support post-disaster coordination.
PHA post-disaster activities and strategies	This code describes activities or strategies specifically assigned to PHAs that occur during the recovery process following a disaster event. It can include activities or strategies implemented during the post-disaster recovery process that support post-disaster recovery.

PHA post-disaster partnerships and coordination	This code describes coordination activities or strategies specifically assigned to PHAs that occur during the recovery process following a disaster event, with the primary goal of developing or utilizing partnerships or networks. It can include activities or strategies implemented during the post-disaster recovery process that support post-disaster coordination.
Other agency roles and responsibilities	This code describes roles or responsibilities specifically assigned to agencies other than PHAs related to disaster risk management for public/low-income/affordable/assisted rental housing. It can include pre- and post-disaster activities that aim to aid low-income renters before, during, or after disasters, but does not include roles or responsibilities related to homeowners. The sub-code below (PHA collaboration) was included within this count.
Other agency roles and responsibilities: PHA collaboration	This code describes roles or responsibilities specifically assigned to agencies other than PHAs, but done in collaboration with PHAs, related to disaster risk management for public/low-income/affordable/assisted rental housing. It can include pre- and post-disaster activities that aim to aid low-income renters before, during, or after disasters but does not include roles or responsibilities related to homeowners.
Access and functional needs (AFN) populations	This code describes individuals living with disabilities, low-income individuals, unhoused/homeless individuals, individuals with limited English proficiency, or individuals who are a racial minority (non-White). It includes any reference to vulnerable, at-risk, or AFN populations.

## 2.4 RESULTS

A total of 44 states were represented in the 85 plans collected. State EOPs analyzed were formatted variably, including as comprehensive plans with ESFs and/or a recovery plan, while others referenced a standalone recovery plan and/or ESFs. A total of 43 state EOPs, 18 recovery plans, 14 ESF #6, five ESF #14, and five plans specific to disaster housing were collected. An additional 12 ESF #14 and 22 ESF #6 plans were identified following review of these plans (i.e., because they were annexed to the primary EOP collected). While 85 plans were collected in total, some EOPs included multiple plans within them (ESF #6 or #14), and thus the total count of plans analyzed was 119. As some states use ESF #14 as their primary recovery plan, our study combined recovery plans and ESF #14 into one category for the analysis. The geographical distribution of the final count of plans is visualized in **Figure 2.1**. A more detailed list of collected plans is provided in **Appendix A**.

**Figure 2.1:** Geographical distribution of collected Emergency Operation Plans, Emergency Support Function #6, Recovery Plans and Emergency Support Function #14, and Disaster Housing Plans by U.S. states.



Roles and responsibilities were seldom assigned to PHAs in the collected plans. **Table 2.4** provides a summary of the percentage of each code by type of plan (EOP, ESF#6, Recovery Plan/ESF #14, and Disaster Housing Plan). Most information specific to PHA roles and responsibilities was identified in recovery plans (including ESF #14) or Disaster Housing Plans. Although EOPs were the most common type of plan collected, there was no information containing PHA roles or responsibilities found in any of the EOPs. Recovery plans were also the most common type of disaster plan collected to mention other agency’s roles with respect to PHA collaboration. Lastly, all plans mentioned access and functional needs (AFN) populations, which often includes populations who are living in HUD-subsidized housing, but these mentions were especially prevalent in EOPs and Disaster Housing Plans.

**Table 2.4:** The percentages of each code occurrence in each type of plan (EOP, ESF#6, Recovery Plan and ESF #14, and Disaster Housing Plan)

	All types of plans	Emergency Operations Plan	Recovery Plan and ESF #14	ESF #6	Disaster Housing Plan
N	119*	43	35	36	5
	% (n)	% (n)	% (n)	% (n)	% (n)
PHA pre-disaster activities and strategies	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
PHA pre-disaster partnerships and coordination	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
PHA post-disaster activities and strategies	4.2% (5)	0 (0)	8.6% (3)	2.8% (1)	20% (1)
PHA post-disaster partnerships and coordination	2.5% (3)	0 (0)	0 (0)	0 (0)	60% (3)
Other agency roles and responsibilities	29.4% (35)	11.6% (5)	48.6% (17)	27.8% (10)	60% (3)
Other agency roles and responsibilities: PHA collaboration	15.1% (18)	2.3% (1)	28.6% (10)	11.1% (4)	60% (3)
AFN populations	79.8% (95)	90.7% (39)	57.1% (20)	86.1% (31)	100% (5)

\*While 85 plans were collected in total, some EOPs included ESF #6 or #14 and thus the total count in Table 4 is higher than the original number of collected plans.

Overall, plans had very limited descriptions of roles and responsibilities assigned to PHAs. Results provided in **Table 2.4** are described below in detail. There was no mention of PHA pre-disaster activities and strategies or PHA pre-disaster partnerships and coordination within the collected plans.

## 2.4.1 PHA post-disaster activities and strategies

Only five plans (4.2%) assigned roles or responsibilities to PHAs that explicitly mentioned post-disaster activities and strategies. These roles or responsibilities that pertained to PHA post-disaster activities and strategies encompassed two overall themes or types. The first type of such responsibilities was locating housing resources for affected residents, exemplified in Kentucky's ESF #6 "to coordinate housing and rental assets requested by the Commonwealth Emergency Operations Center to support the housing of evacuees within the Commonwealth" [and] "Develop assessment matrix to determine type of facility required by evacuee (Kentucky Emergency Management, 2014)." Another example of such activities is conducting case management for the residents, including tracking their needs, as demonstrated in Colorado's Housing Recovery Annex, "Typically, a county, municipality, special district, housing authority, or tribal government is responsible for assessing and tracking the needs of residents, the progress of services, locations, and situation of impacted residents (Colorado Division of Homeland Security and Emergency Management, 2021)." The second type of identified PHA role is giving priority to eligible, displaced residents. For example Minnesota's plan states "People displaced by a disaster may find temporary or permanent housing in vacant properties owned by PHAs... PHAs must be willing to give priority to disaster victims (Minnesota Department of Public Safety, 2018)," which could be through prioritized housing vouchers. In another example, North Carolina's Recovery Plan states, "PHAs are funded by HUD but have broad local discretion to put in place preferences for disaster survivors to receive Housing Choice Vouchers / Section 8 and Public Housing (North Carolina Emergency Management, 2020)." Another option for prioritization mentioned was moving disaster survivors to the front of waiting lists, as

exemplified in Ohio’s ESF #14: “HUD housing providers have the ability to provide priority housing placement to allow disaster survivors to move up on the waiting list if displaced due to a presidentially declared disaster (Ohio Emergency Management Agency, 2018).”

#### 2.4.2 PHA post-disaster partnerships and coordination

Only three plans (2.5%) assigned roles or responsibilities to PHAs that explicitly mentioned post-disaster partnerships and coordination. The roles or responsibilities focused solely on PHA identification of rental housing and housing resources for residents affected by a disaster. These were delegated within Colorado’s Housing Recovery Annex, “...disaster case managers rely on housing agencies and other partners to help locate housing resources for clients (Colorado Division of Homeland Security and Emergency Management, 2021),” Oklahoma’s Disaster Housing Strategy plan, “Permanent housing options will be accomplished in partnership with local housing authorities and other... agencies (Oklahoma Department of Emergency Management, n.d.),” and Illinois’ Disaster Housing Annex, “Disaster housing options and strategies will be coordinated with the local community to include, but not limited to: Public housing authorities...(Illinois Emergency Management Agency, 2021).”

#### 2.4.3 Other agency roles and responsibilities

Thirty-five plans (29.4%) assigned roles or responsibilities to agencies other than PHAs that involved disaster risk management for low-income rental housing. These “other” agencies included state-level Departments of Housing and/or Community Development/Services and Housing Coalitions, state-level Departments of Commerce, state-level Housing Finance Agencies, state-level Housing Development Authorities, state-level Offices of Emergency

Services, state-level Housing Corporations, state-level Disaster Housing Task Forces composed of multiple agencies, state-level Departments of Health and Human Services, and HUD (including regional HUD offices). Roles and responsibilities for non-PHA agencies included: providing temporary post-disaster housing (California Governor’s Office of Emergency Services, 2017; Massachusetts Emergency Management Agency, 2015), providing monetary assistance in the form of grants (Arizona Department of Emergency and Military Affairs, 2019), reconstruction or rehabilitation of housing (Department of Military Affairs Division of Emergency Management, 2021; Governor’s Office of Homeland Security and Emergency Preparedness, 2019; Massachusetts Emergency Management Agency, 2018; Oregon Office of Emergency Management, 2018), providing technical assistance to renters (Oregon Office of Emergency Management, 2018), amending existing policies (California Governor’s Office of Emergency Services, 2017; Oregon Housing and Community Services Department, 2021), aiding in coordination (Massachusetts Emergency Management Agency, 2015), and preparedness (Oregon Office of Emergency Management, 2018).

#### 2.4.4 Other agency roles and responsibilities: PHA collaboration

Eighteen plans (15.1%) assigned roles or responsibilities to agencies other than PHAs that involved disaster risk management for low-income rental housing in collaboration with PHAs. Some of these roles and responsibilities included maintaining liaisons with PHAs (California Governor’s Office of Emergency Services, 2017; North Carolina Emergency Management, 2020; State of Florida Division of Emergency Management, 2008), accessing and disbursing federal resources with PHAs (Arizona Department of Emergency and Military Affairs, 2019), assessing damage at PHA properties (Massachusetts Emergency Management

Agency, 2015), working with PHAs to get housing availability/condition or coordinating plans to house displaced people (Colorado Division of Homeland Security and Emergency Management, 2021; Ohio emergency management agency, 2020; Vermont Emergency Management, 2019), providing short-term rental assistance through contracts with PHAs (Colorado Division of Homeland Security and Emergency Management, 2021), seeking input from PHAs for disaster housing recovery operations (North Carolina Emergency Management, 2020), having PHAs serve on or work with disaster housing task forces (Kentucky Emergency Management, 2014; Vermont Emergency Management, 2019), convene housing partners such as PHAs during the preparedness planning phase (Nebraska Emergency Management Agency, 2020), amending administrative plans with PHAs to prioritize vouchers for survivors (Oregon Housing and Community Services Department, 2021), and providing financial and/or technical disaster assistance to PHAs concerning programs or resources available to them (Colorado Division of Homeland Security and Emergency Management, 2021; Massachusetts Emergency Management Agency, 2018; Montana Disaster & Emergency Services, 2022).

#### 2.4.5 Access and functional needs populations

Ninety-five plans (79.8%) explicitly included language around access and functional needs (AFN) populations. For example, Alabama’s EOP mentioned collaboration to improve shelters, “The Governor’s Office on Disability will be consulted on accessibility requirements for all shelter types (Alabama Emergency Management Agency Response Division, 2022).” Georgia’s EOP also includes language around planning with AFN individuals in mind, “Localities have a plan as part of an emergency management program which reflects current doctrine and protocol, including provisions for the needs and requirements of the population,

such as children, individuals with AFNs, service animals, and household pets (Georgia Emergency Management and Homeland Security Agency, 2019).”

## 2.5 DISCUSSION

As climate change rapidly progresses and the U.S. continues to experience a shortage of 7 million affordable homes for housing low-income renters (Bovell-Ammon et al., 2020), engaging PHAs in disaster planning decisions and implementing equity-centered policy is essential to protect low-income residents. The state-level disaster plans collected in this study reveal an overall lack of PHA engagement, with the few assigned roles and responsibilities solely focusing on post-disaster activities, partnerships, and coordination. These roles mainly revolved around providing housing recovery resources to residents and amending housing waitlists to prioritize residents affected by disasters.

Although state and local agencies are recommended to work with local PHAs for conducting post-disaster activities, such as initial damage assessments and reporting to local authorities for monetary assistance (HUD, 2022d), the majority of state-level disaster plans did not mention PHAs in any capacity. At the same time, 15% of all plans reviewed had roles or responsibilities assigned to other state-level agencies that involved collaborating with PHAs on disaster risk management, suggesting that PHAs are still being considered in the disaster planning process in some way. These roles were, however, highly variable, including everything from providing financial and/or technical disaster assistance to PHAs to assessing damage at PHA properties.

In 2016, HUD created a very basic first version of a “PHA Disaster Readiness and Preparation Guide” which succinctly outlined a number of recommended practice-based

approaches informed by PHAs, based on their personal experiences (HUD, 2016). In 2022, HUD revamped this guide to include much more detail, including new sections on funding and financial management, communications, and displacement housing options (HUD, 2022d). The 2022 HUD guidebook is also further divided into readiness, response, and recovery chapters and includes counsel on PHA disaster roles and responsibilities. Given the availability of these HUD resources, the lack of roles assigned to PHAs in state plans, and the variable responsibilities involving PHA collaboration assigned to other agencies, we recommend that future state disaster plans and policies incorporate standardized PHA roles and responsibilities based on HUD's guidelines. Additionally, as PHAs may also have localized hazards and residential needs that may not be fully addressed in HUD's general guidelines, state emergency management agency websites are a valuable resource for PHAs to consult when creating or updating their disaster plans. Future research is necessary to identify what resources states and PHAs utilize to inform and implement disaster planning strategies, including the HUD guidance document, which can be investigated through qualitative interviews with state-level partners, PHA leaders, and other housing experts.

Within the five specific Disaster Housing Plans (present in Colorado, Illinois, Massachusetts, Oklahoma, and Oregon) reviewed, one contained information about PHA post-disaster activities and strategies, three contained information about PHA post-disaster partnerships and coordination, three contained other agency roles that involved collaboration with PHAs, and all of them incorporated information about AFN populations. These findings suggest that the development of Disaster Housing Plans at the local- or state-levels may impact engagement of PHAs in interagency disaster planning. While no guidelines exist specifically for creating PHA Disaster Housing Plans, the Federal Emergency Management Agency (FEMA)

maintains a comprehensive document outlining planning considerations for disaster housing (FEMA, 2020), which provides guidance to partners for developing their own disaster housing plans for their communities. Based on our findings, we recommend that Disaster Housing Plans or other types of plans specific to housing recovery should be considered by state agencies to plan for disaster-specific housing needs with housing providers, including PHAs. FEMA's guidance may provide initial direction to springboard planning, but evaluations of specific recommended strategies and impact of the development of Disaster Housing Plans overall are necessary to support recommendations for standardized roles and responsibilities of PHAs in state disaster plans.

It has been well established that cross-sectional collaboration can aid in identifying and prioritizing the resource needs of low-income residents and facilitate knowledge sharing (Pathak Aishwarya et al., 2020), ultimately resulting in implementation of more effective disaster plans (Berke et al., 2014; National Academies of Sciences & Medicine, 2020). However, our results indicate that PHAs – a key cross-sectoral partner due to their role in managing low-income housing – have not yet been engaged in disaster risk management planning in practice. Additional research is necessary to better understand the drivers behind this substantial evidence-to-practice gap. For example, semi-structured key informant interviews with PHA leaders, federal and state partners, and nonprofits focused on affordable housing would provide an opportunity to assess the challenges and opportunities PHAs experience when implementing disaster risk management strategies. While our methods did not lend themselves for formal comparisons across states, anecdotally, U.S. states that have experienced large disasters in recent years (e.g., Louisiana, New York) were not observed to have more assigned PHA roles within their plans and had no specific Disaster Housing Plans in place. While past disaster experience

has been associated with higher levels of preparedness (Malmin, 2021), additional research is necessary to explore how prior disaster experience influences planning and preparedness related to low-income housing.

### 2.5.1 LIMITATIONS

While this study provides a first of its kind assessment of the roles and responsibilities of PHAs in U.S. state-level disaster plans, its cross-sectional nature does not permit the capture of changes in plans over time. Future research on this topic can replicate this analysis to build out a longitudinal understanding of how plans evolve over time. Secondly, only one researcher coded the plans. A common strategy for verifying reliability and validity of a coding scheme is to have two or more coders apply codes to the same set of qualitative data (e.g., transcripts, plans). Another option for verifying intercoder reliability for a *single coder* is to recode a certain percentage of plans to address discrepancies and ensure the validity of codes. Although the coder in this study recoded 10% of the total number of plans, future studies could be strengthened by having two or more coders analyzing the same set of plans.

This study did not include state-level mitigation plans, as it was explicitly focused on preparedness, response, and recovery. Future studies could assess the content of mitigation plans to identify PHA engagement and roles in mitigation planning. Due to the convenience sampling approach used, it was not possible to make formal comparisons of plans or plan elements across states. Future research could assess differences across plans through intentional sampling that facilitates state-level comparisons. In addition, the content analysis of plans used in this aim may not capture unpublished plans from which state government agencies may be basing disaster decisions or informal but critical relationships that housing providers may have with emergency

management partners, and may thus miss specific strategies, roles, or responsibilities delegated to PHAs. Future qualitative and/or survey research that gathers insight from partners who have a role in PHA disaster risk management can help to fill this gap. Furthermore, local jurisdictional plans were not included in the analysis. Local jurisdictions, who are ultimately responsible for meeting their community's needs following a disaster (Greer & Binder, 2017), may have different levels of engagement with PHAs in disaster planning. Future work on this topic should investigate disaster plans developed at the local or regional level to understand their engagement with, and the roles and responsibilities assigned to, PHAs serving clients within their jurisdiction. A final limitation of this work is the limited generalizability of the results to other countries, which have various affordable housing models and disaster risk management infrastructure and may not experience the same lack of affordable housing organization involvement in collaborative disaster planning. As the need for adequate disaster planning and a lack of affordable housing are pertinent issues across the world, especially given the expected acceleration of housing displacement due to climate change in the coming years (Palinkas, 2020), comparative research is necessary to identify commonalities or differences related to integration of actors that support affordable housing in disaster planning, and potential opportunities for cross-country learning.

## 2.6 CONCLUSION

State-level disaster plans rarely outline roles and responsibilities of PHAs even though residents living in HUD-subsidized housing are among the most susceptible to the detrimental effects of disasters in the U.S. In order to protect their low-income residents before, during, and after disasters, these findings suggest an urgent need for meaningful integration of PHAs into

state-level disaster risk management planning and assignment of formal roles and responsibilities to PHAs in disaster plans. In addition, states may consider incorporating a specific Disaster Housing Plan or Housing Recovery Plan into their collection of disaster plans, as these plans provide an opportunity to delegate tasks to housing agencies such as PHAs. Together, these actions can drive more equitable policy decisions and help to prevent adverse health impacts and low-income renter displacement in HUD-subsidized housing.

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## Chapter 3. OPPORTUNITIES FOR IMPLEMENTATION OF DISASTER RISK MANAGEMENT STRATEGIES AMONG PUBLIC HOUSING AUTHORITIES

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### 3.1 ABSTRACT

Renters living in subsidized housing units managed by Public Housing Authorities (PHAs) are highly vulnerable to disasters. This study aims to describe barriers, facilitators, and opportunities for implementation of disaster risk management (DRM) strategies at PHAs. Fifteen semi-structured key informant (KI) interviews with federal and state housing officials, PHA leaders, and housing non-profit staff were conducted and thematically analyzed. Interviewees mentioned financial and administrative hindrances, lack of policy, and lack of disaster training among PHA staff as notable barriers to engaging in DRM. Past disaster experience, interagency partnerships, and designated DRM roles at PHAs were introduced as facilitators for implementing DRM strategies.

### 3.2 INTRODUCTION

Disasters damage and destroy large amounts of housing, displacing populations (Myers et al., 2008) and leaving those that stay exposed to environmental hazards (Burby et al., 2003; Lichtveld et al., 2020). Poor urban planning, socioeconomic disparities, inequitable housing policies, and structural racism work in tandem to exacerbate disaster impacts on specific populations, such as low-income residents (Chmutina & von Meding, 2019; Cutter et al., 2003). Indeed, U.S. Department of Housing and Urban Development (HUD) subsidized housing renters are less prepared for disasters than other renters (McCarthy & Friedman, 2023), often live in areas with very high or relatively high risk of negative impacts from hazards (Aurand et al., 2023; Gabbe & Pierce, 2020; NLIHC, 2012; Rosoff & Yager, 2017), and are subject to high rates of post-disaster displacement because their units are often not prioritized for repair, and are instead torn down after a disaster (American Planning Association, 2014; Hamideh &

Rongerude, 2018; Khajehei, 2019). Their risk of displacement is only exacerbated by the dwindling stock of affordable housing due to burgeoning income inequality across the U.S. (Desmond, 2018) and the federal government's chronic underfunding of housing infrastructure (Allegrante & Sleet, 2021; Huang & Taylor, 2019).

Past disasters have highlighted the negative effects of insufficient disaster planning for low-income renters. For example, the primary housing revitalization program implemented after Hurricane Katrina, the "Road Home Program," primarily allocated assistance to homeowners instead of displaced renters, who waited years for assistance, if they even received any. At the same time, local ordinances were implemented that inhibited the development of affordable housing in the disaster-impacted area for renters (Adams, 2013; Green & Olshansky, 2012). As a result, many residents of majority Black public housing projects were displaced after Hurricane Katrina when units were demolished and not rebuilt (Byrnes, 2014), or replaced with mixed-income properties (Graham, 2012).

Public Housing Authorities (PHAs), who oversee HUD subsidized housing units and are quasi-governmental agencies that receive HUD funding, are responsible for managing and operating federal housing programs at local levels, including administering the application process, providing written notification of acceptance or rejection, managing waiting lists, and ensuring that housing units meet health criteria (Kleit & Page, 2015). As a result of federal restriction and requirements and an increasingly neoliberal approach to housing policy, PHAs are pushed to use both public and private sources of funding to carry out organizational goals, such as supporting the growth of affordable housing units (Kleit & Page, 2015).

On top of the challenges that PHAs experience during their day-to-day work, and despite the enormous consequences faced by residents served by PHAs, there is currently no universal

approach or requirement for PHAs to plan for disaster preparedness, response, and recovery, otherwise referred to as disaster risk management (DRM) (HUD, n.d.-a; Khan et al., 2023). Although they are required by HUD to develop five-year plans describing their organizational missions and goals, disaster preparedness, response, or recovery are not included as one of the 19 required PHA plan components (Gramlich, 2021). While HUD has published a guidance document for PHA disaster readiness, response, and recovery in 2016 (updated in 2022), the utilization of this guide by PHAs has yet to be investigated (HUD, 2016, 2022d). The fourth phase of DRM, mitigation, was not explicitly included in this study due to the focus on disaster readiness, response, and recovery in HUD's guidance document, which informed the methods. Thus, this research addresses a crucial knowledge gap and addresses the following research question: *What external and internal factors influence PHA DRM strategy implementation?*

### 3.2.1 Determinants of PHA DRM Implementation

There has been very limited research of the environmental and policy determinants of PHA engagement in DRM. For example, experience with past disasters contributes to improved preparedness for future disasters among organizations and businesses (Dahlhamer & D'Souza, 1997b; Oetzel & Oh, 2021; Sadiq & Graham, 2016). However, for PHAs specifically, the influence of experience with past disasters on implementation of DRM strategies remains to be investigated. Moreover, while federal initiatives have greatly expanded the scope of local PHA action, promising more flexibility for local strategy adoption (Kleit & Page, 2008), there remains a gap in research on how these initiatives have influenced local adoption of DRM initiatives. For example, the Moving to Work (MTW) program is a HUD-led demonstration program that provides some PHAs with flexible opportunities to design and test innovative, locally-guided

strategies to use federal funding more efficiently, increase housing choices for low-income families, and apply for exemptions from existing rules around using funding (HUD, 2022b). Another popular program is HUD's Rental Assistance Demonstration (RAD), which helps PHAs transition from a traditional public housing model to project-based Section 8 rental assistance contracts (HUD, 2023d). In a recent study that conducted semi-structured interviews with staff at MTW PHAs, researchers found that although the implementation of innovative strategies at MTW agencies is often limited by bureaucratic, resource, and market constraints, these PHAs have come up with creative solutions to overcome such challenges (Walter et al., 2020). It remains to be investigated if and how PHAs who have transitioned to federal initiatives, such as MTW and RAD, engage in implementing DRM strategies.

### 3.2.2 Implementation Science

Given the many challenges that PHAs face in a rapidly changing climate and a concurrent affordable housing crisis, there remains a gap in understanding if and why DRM strategies are implemented among PHAs. As such, it is necessary to identify the factors that influence implementation of DRM strategies at PHAs, which may include external (e.g., policies, disaster experience) or internal aspects of an organization (e.g., planning). Implementation science identifies the factors that impact the uptake of an innovation into routine use, as well as strategies to increase their adoption (Bauer & Kirchner, 2020). While implementation science is commonly used in health services research (Bauer & Kirchner, 2020; Damschroder et al., 2009), it has also been used in recent years to study disaster interventions, such as disaster planning at nursing homes (Bell et al., 2023) and rapid response policies to large public health crises (Eisman et al., 2022; Wensing et al., 2020). Accordingly, implementation science offers an opportunity to

identify barriers and facilitators that affect PHAs' engagement in DRM. In this study, we use the 2022 version of the Consolidated Framework for Implementation Research (CFIR) (CFIR, 2024), a compilation of 48 constructs arranged across five domains that have been linked to effective implementation of innovations: Innovation (i.e., DRM strategies); Outer Setting (i.e., external organizational factors); Inner Setting (i.e., internal organizational factors); Individuals (i.e., individual factors related to DRM strategies); and Implementation Process (i.e., activities used to implement DRM strategies) (CFIR, 2020; Damschroder et al., 2022). The current study used the CFIR to assess the external (Outer Setting) and internal (Inner Setting) organizational factors that influence implementation of DRM strategies at PHAs, as related to the research question of interest. Identifying the barriers and facilitators to implementing DRM strategies, as well as opportunities for strengthening the implementation of such strategies, can support development of responsive policy solutions that center the needs and lived experiences of organizations that are responsible for low-income housing residents, enhance overall community resilience, and prevent housing displacement among PHA residents, ultimately improving well-being.

### 3.3 METHODS

Through semi-structured key informant interviews, this study aimed to identify external and internal factors that influence PHA DRM strategy implementation.

#### 3.3.1 DATA COLLECTION

Interviewee inclusion criteria were defined as PHA, federal and state government, and non-profit professionals with knowledge of high-level decisions being made around disaster

preparedness, response, and recovery in PHAs, and who were aware of federal procedures and challenges related to HUD-subsidized housing and disasters. Purposive sampling was utilized to identify an initial list of ten key informants (KIs) that the NLIHC had previously established relationships with, including PHAs and non-profit professionals. These ten initial KIs were each sent an email outlining study details. Once those initial contacts were exhausted, ten additional PHA representatives were purposefully recruited from the publicly-available HUD Contact Information Sheet (HUD, n.d.-b) to include PHAs from states that experience different types of hazards, varying city sizes, and rural versus urban status. Additional nonprofit interviewees were identified from the National Low Income Housing Coalition's (NLIHC) Disaster Housing Recovery Coalition Members list (National Low Income Housing Coalition, n.d.). Finally, individuals in executive positions at federal and state agencies were emailed from public staff directories and asked for the appropriate person to speak to about DRM. As interviews progressed, snowball sampling was used wherein interviewees were asked for recommendations for additional individuals who met inclusion criteria from PHAs, federal and state agencies, and/or nonprofits. Participant recruitment occurred between October and December 2022. If no response was received after an initial email, a follow-up email was sent 2 weeks later. Further information on the total count of agencies contacted and interviewed is provided in the supplementary materials (see **Appendix B**).

A semi-structured interview guide, informed by the CFIR (CFIR, 2024) and HUD's guidance document on disaster readiness, response, and recovery (HUD 2022b), was developed and used to explore determinants of implementation of DRM programs (see **Appendix C**), and three versions were adapted for KIs at PHAs, non-profits, and federal or state organizations. The Outer and Inner Setting Domain interview questions were adapted to create questions specific to

implementation of DRM strategies. The interview guide was structured into three sections: one section that collects basic information on the demographics of the PHA and current DRM strategies being implemented, and one section each on the CFIR's Outer and Inner Setting domains, which explored the domain's constructs to determine if and how they influenced implementation of PHA DRM strategies, and what opportunities exist for improved implementation of such strategies.

One investigator (AK) conducted 30–45 minute semi-structured interviews in English via Zoom from November 11, 2022 to January 26, 2023. Data collection continued until thematic saturation was achieved (Fusch & Ness, 2015). Member checking was used to enhance qualitative credibility (Forero et al., 2018). Each interviewee was emailed a summary memo within two weeks of the interview that summarized the key themes identified in their interview, and any feedback that they provided was incorporated into the memos. Informed consent was obtained verbally from each interviewee before the interview, and all interviews were recorded and professionally transcribed.

### 3.3.2 DATA ANALYSIS

The framework method approach (Gale et al., 2013) was used to analyze interview data. This approach allows for comparing and contrasting data by themes across interviewees. A codebook was deductively developed based on the CFIR's Outer and Inner Setting domains (see **Appendix D**). Following data familiarization (achieved by re-reading interview transcripts and notes), the codebook was refined to remove and/or consolidate codes based on the actual discussions. Ten percent of the transcripts, or two interviews, were co-coded by two investigators (AK & JV) to ensure validity of code application and reliability of the codebook instrument.

After the first round of co-coding, there was 95% agreement between co-coders in code application, and the investigators refined code definitions as necessary, with minimal changes made. A memo recording any observations or patterns while coding was maintained throughout the coding process to ensure qualitative confirmability (Forero et al., 2018). One investigator (AK) coded the remaining 13 transcripts. After coding was complete, the data were synthesized into code-level summaries to identify emergent, key themes by transcript to build out an overall framework. Code-level analysis memos were created synthesizing highlighted key themes across interviews, followed by an analysis memo synthesizing findings to address the research question.

### 3.4 RESULTS

Fifteen total interviews were conducted with 20 interviewees (Hennink & Kaiser, 2022). The nine PHAs represented by interviewees ranged from 12 to 450 employees, serving 500 to 120,000 total clients. Three of their PHAs were small-sized, with 12-14 employees and serving 500-1,000 clients; three were mid-sized, with 68-300 employees and serving 14,000 clients, and three were large-sized with about 450 employees and serving 26,000-120,000 clients. Interviewees reported their PHAs ran a variety of programs, including project- and tenant-based Section 8 vouchers, public housing, and Low Income Housing Tax Credit (LIHTC). All nine PHAs had voucher programs, seven had public housing, and six had LIHTC. They reported that some of their PHA's units are either owned and managed by the PHA or owned by the PHA but privately managed. Interviewees identified DRM strategies undertaken by PHAs, local government (e.g., county or city; police/fire department) and non-government agencies (e.g., non-profits; food banks), state, and federal government. These examples specifically include disaster preparedness measures, partnership building strategies, disaster recovery strategies, and

strategies prioritizing PHA residents and staff. These specific examples are provided in the supplementary materials (see **Appendix E**). A variety of external and internal factors were identified that influence DRM implementation at PHAs, including facilitators, barriers, and opportunities for their implementation (**Table 3.1**).

Overall, results indicate that factors external to PHAs, such as federal policies, relationships, and experience with past disasters, were emphasized more often when discussing DRM strategy implementation than factors internal to PHAs, such as PHA planning and organizational structure.

**Table 3.1:** Summary of identified facilitators, barriers and potential opportunities for implementation of PHA DRM strategies, organized by theme

Theme	Facilitators	Barriers	Opportunities
<i>External Factors</i>			
Experience with Disasters or Hazard Risk	<ul style="list-style-type: none"> <li>· Experience with past disasters</li> <li>· Awareness of climate and disaster risk</li> </ul>	<ul style="list-style-type: none"> <li>· Low prioritization of DRM among PHAs that have not experienced a disaster</li> <li>· Compounding impacts of sequential disasters limit ability to prepare for future events</li> </ul>	<ul style="list-style-type: none"> <li>· Enhance PHA knowledge of hazard risk</li> <li>· Use post-disaster reconstruction as an opportunity to rebuild better and minimize damage from future disasters</li> </ul>
Strong Partnerships and Inter-Agency Communication	<ul style="list-style-type: none"> <li>· Partnerships that support access to resources, services, and training opportunities</li> <li>· Relationships with residents</li> </ul>	<ul style="list-style-type: none"> <li>· Lack of proactive engagement with community-based organizations among PHAs and HUD</li> <li>· Exclusion of PHAs in local government planning conversations</li> <li>· Lack of PHA-state agency relationships, resulting in effort duplication</li> <li>· Poor communication from federal partners to PHAs</li> </ul>	<ul style="list-style-type: none"> <li>· Engage PHAs in local government planning to advocate for their residents</li> <li>· Create spaces for PHA risk managers to collaborate, such as a national PHA meeting</li> </ul>
Administrative and Financial Barriers		<ul style="list-style-type: none"> <li>· Delays in receiving federal resources and poor communication from federal agencies</li> <li>· Lack of temporary or longer-term sheltering for PHA residents, including after FEMA leaves</li> <li>· Lack of funding specific to PHA DRM</li> </ul>	<ul style="list-style-type: none"> <li>· Pre-establish temporary and long-term sheltering solutions for PHA residents to reduce administrative complications</li> <li>· Provide PHAs with additional financial resources for DRM, including immediately after an event</li> </ul>

		<ul style="list-style-type: none"> <li>· Disconnection between federal agencies and PHAs on DRM funding needs</li> </ul>	
Structural Inequities and At-Risk Groups		<ul style="list-style-type: none"> <li>· Structural inequities in housing and the affordable housing crisis</li> </ul>	<ul style="list-style-type: none"> <li>· Invest and improve PHA properties</li> <li>· Center PHA residents' needs in DRM strategies</li> </ul>
External Policies	<ul style="list-style-type: none"> <li>· Revenue and flexibility associated with transition to a modern housing model</li> <li>· Use of HUD housing vouchers to get displaced residents housed in neighboring areas</li> </ul>	<ul style="list-style-type: none"> <li>· Lack of federal mandate and direction around PHA DRM</li> <li>· Incongruence between high federal expectations of PHA engagement in DRM and lack of federal requirements/resources</li> </ul>	<ul style="list-style-type: none"> <li>· Establish HUD requirements on the use of risk assessment tools to ensure building safety or that PHAs doing RAD redevelopment concurrently include DRM strategies</li> <li>· Establish state or local requirements that PHAs make infrastructure improvements during post-disaster reconstruction</li> </ul>
Community Expectations		<ul style="list-style-type: none"> <li>· Incongruence between high community expectations of PHA roles in DRM and lack of PHA resources or capacity</li> </ul>	
<i>Internal Factors</i>			
Lack of Staff Capacity and DRM Expertise	<ul style="list-style-type: none"> <li>· Conducting activities such as tabletop exercises and utilizing publicly available federal resources to train staff</li> <li>· Ongoing engagement in resident fire safety and evacuation training</li> </ul>	<ul style="list-style-type: none"> <li>· Staff capacity, particularly among rural PHAs</li> <li>· Lack of DRM training for both PHA staff and residents</li> </ul>	<ul style="list-style-type: none"> <li>· Create and resource a full time PHA-level DRM role that develops and/or reviews the PHA's DRM policies, plans, and partnerships</li> <li>· Provide training to PHA staff on DRM, particularly in rural PHAs</li> </ul>
Leadership and Culture	<ul style="list-style-type: none"> <li>· Leadership that prioritizes DRM innovation, with cascading benefits to informed decision making and reduced bureaucracy</li> <li>· Inclusive organizational culture at PHAs that encourages staff to care for low-income</li> </ul>		<ul style="list-style-type: none"> <li>· Encourage PHA leadership (e.g., executive directors) to create a DRM role, which does not usually exist at a PHA</li> </ul>

	residents before and after an event		
PHA Structure	<ul style="list-style-type: none"> <li>· Situating a PHA within a community’s organizational structure to support its ability to engage in DRM activities, including by providing access to local resources and integration into local DRM processes</li> </ul>		<ul style="list-style-type: none"> <li>· Incorporate PHAs into county or city structure to provide tangible benefits and accountability checks, such as a position on local DRM committees or mandatory DRM plan updates</li> </ul>
PHA Planning and Communications	<ul style="list-style-type: none"> <li>· Organizational DRM planning, such as having DRM plans in place</li> <li>· Establishing internal committees or work groups that discuss DRM planning and staff and resident concerns</li> <li>· Having internal communication procedures in place</li> </ul>	<ul style="list-style-type: none"> <li>· Insufficiency of and lack of detail in HUD’s guidance document for PHA disaster readiness and response</li> <li>· Lack of applicability of FEMA’s general disaster planning templates to PHA needs</li> <li>· Difficulties communicating with staff and residents during and after a disaster</li> </ul>	

### 3.4.1 EXTERNAL FACTORS THAT INFLUENCE IMPLEMENTATION OF PHA DRM STRATEGIES

#### 3.4.1.1 EXPERIENCE WITH DISASTERS OR HAZARD RISK

Experience with past disasters were reported to shape PHA DRM practices and influence PHAs to adopt physical mitigation solutions, such as structural updates to units. All interviewees at PHAs, state housing agencies, and nonprofits, discussed their past experiences with disasters, including hurricanes, flooding, COVID-19, wildfire smoke, heatwaves, ice and snowstorms, building fires, and earthquakes. One interviewee addressed the counterfactual, by explicitly stating that DRM is not a high organizational priority for PHAs who have not experienced any

major disasters in the past. However, a couple of interviewees at PHAs also brought up the compounding impact of sequential disasters, which has required them to be in a constant state of response and recovery, limiting their ability to prepare for future events. For example, one interviewee said:

*“It’s like you’re drowning in the ocean, and someone’s saying, ‘But you got to learn how to swim.’ It’s too late to learn how to swim. I can’t learn how to swim now. I’m drowning. So we are definitely in that mode of still drowning and still trying to recover. And so our planning and preparation for what’s next is severely lacking.” - PHA 4*

About a third of interviewees at PHAs said that their units are at high risk of climate change impacts, and acknowledged their agency needs to prepare for the reality that disasters will get worse, while almost every PHA interviewee said that they are knowledgeable of general hazard risk (e.g., earthquake; wildfire) to their units. Because of these risks, these interviewees noted that their PHAs need to start implementing DRM strategies, such as using post-disaster reconstruction as an opportunity to improve the rebuilding process to minimize damage from future disasters.

#### *3.4.1.2 STRONG PARTNERSHIPS AND INTER-AGENCY COMMUNICATION*

Every interviewee emphasized the importance of building partnerships and enhancing communication between local, state, and federal agencies for successful implementation of PHA DRM strategies. These relationships primarily support PHAs to engage in DRM by providing them with resources, services, and training opportunities.

*Local partnerships:* All interviewees representing PHAs reported that local governmental agencies provide DRM services and training to PHAs. Examples of local partnerships include

working with health departments to provide vaccinations on-site for residents, collaborating on DRM PHA staff trainings with local first responders, and receiving services, such as buses for resident evacuation from local transportation agencies. A third of interviewees at PHAs discussed barriers to engagement with their local government on DRM strategies. This included their perception of their local government's inefficiency in opening post-disaster sheltering and not including PHAs in planning conversations. However, one of these interviewees also added how local government views of PHAs are changing for the better, as they are realizing that PHA residents do not have the same monetary options and privileges as others who can evacuate an area.

All PHA interviewees discussed the importance of local, non-governmental partnerships in strengthening DRM, specifically for providing PHAs with resources or services, including the American Red Cross, local food banks, and other community nonprofits. Only one interviewee at a PHA said that they have local relationships where they can rely on hotel arrangements for temporary resident housing.

However, other interviewees brought up that PHAs lack proactive engagement with community-based organizations and presence in local conversations around DRM. For example, one interviewee at a non-profit said that although PHA input is needed, they have never seen them participate in the weekly calls that a local non-profit organization hosts to share resources with the public about disabilities and disasters. The other non-profit said that a structural barrier they often see is that there is an exclusion of PHAs in local government planning conversations. They emphasized the need for PHAs to be brought in to advocate for their residents and learn about local policy. This sentiment was confirmed by about half of interviewees at PHAs, who

expressed that they do not currently have collaborative meetings with community partners but would like to when time and resources permit.

*Inter-PHA partnerships:* About half of interviewees at PHAs discussed having relationships with other PHAs related to DRM, including one that reported having calls to discuss lessons learned post-disaster, and another that connected with other PHAs to discuss available units for resident placement during a response. A couple of these interviewees said that creating spaces for PHA risk managers to collaborate on DRM, such as a national PHA meeting, would be helpful.

*State partnerships:* Half of interviewees at PHAs said they have DRM relationships with state government agencies, such as emergency management, health authorities, and housing agencies. State partners were reported to have reviewed PHA DRM plans and coordinated housing vouchers. One interviewee at a PHA without state agency relationships said that during COVID-19, there were many agencies across their state that lacked direction and coordination, resulting in effort duplication.

However, both interviewees from state agencies expressed confusion about their role in DRM and frustration when communicating with PHAs about available units post-disaster. The other interviewee stated that their role is to bring state agencies together around housing issues, such as through a statewide housing conference that they coordinate to discuss business practices, including DRM.

*Federal partnerships:* Most interviewees at PHAs discussed how federal agency partnerships both positively and negatively impact their ability to implement DRM strategies. A few interviewees at PHAs reported positive experiences with federal agencies, including collaboration to expedite post-disaster vouchers, receiving pre-disaster guidance, and facilitation

of weekly, post-disaster calls. However, almost every PHA added that they experienced administrative issues engaging with federal systems and poor communication from federal partners. About half of interviewees at PHAs experienced frustrations with federal DRM resources and processes, such as complicated aid applications and business continuity plan templates that do not address the complexity of housing marginalized residents. Lack of coordination between federal agencies was described to lead to inadequate support for PHA-level DRM by a couple of PHA interviewees. One of these interviewees said of the relationship between FEMA and HUD:

*“... there is this continual game of hot potato between FEMA and HUD that becomes very frustrating, postdisaster, even predisaster. The PHA is immediately looked to, to say, ‘How are you responding? What are you doing?’ ... We can do very little without FEMA funding, and we can do even less without HUD support... a whole lot of finger-wagging from both HUD and FEMA saying, ‘You’re not taking care of your people.’ But we didn’t have the resources or the staff capacity to do it.” - PHA 2*

Both federal interviewees noted their perspective that implementing DRM is ultimately a PHA’s responsibility, although federal agencies can provide technical assistance and other incentives. For example, one federal interviewee said:

*“... it’s all locally driven. They [PHAs] have to do it. It’s not something that we can certainly mandate. We can incentivize. Yay, if you do all of these great things we’ll be there to help you. We can provide you with technical assistance. There might be some additional funding. But it really stems from them.” - Federal Interviewee 1*

### 3.4.1.3 ADMINISTRATIVE AND FINANCIAL BARRIERS

Administrative barriers largely centered around delays in receiving federal resources and communication issues with federal agencies, which was discussed by two-thirds of interviewees at PHAs, a non-profit interviewee, and both interviewees at state agencies. For example, a couple of interviewees representing PHAs discussed how post-disaster federal dollars and case management services are often delayed for years. Interviewees at state agencies also expressed frustration with the timeliness of federal aid and said that they often have a very short amount of time to spend any federal funds they receive. They added that there is a large gap in post-disaster support between when FEMA leaves and recovery funding is administered. A couple of interviewees at PHAs said financial resources are needed immediately post-disaster to meet response gaps, not months after an event.

A lack of temporary sheltering for PHA residents was a barrier discussed by about half of interviewees at PHAs, with a few also noting that there is an overall lack of resources or policies to fill the gap for PHAs once FEMA is done providing emergency sheltering. One of these interviewees said of the emergency sheltering process:

*"FEMA puts people in a hotel for X amount of time, and nobody's really clear what that timeframe is going to be... there's very little collaboration and communication on when they're actually going to get kicked out and then there's nothing for what's next. And that's when everybody turns to us and said, 'You're what's next?'" - PHA 5*

A couple of PHA interviewees introduced potential solutions to these sheltering barriers, including implementing local code compliance waivers set up in advance for large shelters and pre-establishment of where FEMA trailers will go to reduce administrative complications when housing displaced residents.

A lack of funding for PHA DRM was introduced by every interviewee across agencies. One of the nonprofit interviewees said that before addressing policy gaps, PHAs desperately need additional funding, as they “cannot be expected to deal with climate issues when they have pipes bursting daily.” At the federal level, there was a disconnect between federal agencies and PHAs on DRM funding needs. While both federal interviewees said that they support PHA goals and provide incentive through guidance and occasional funding opportunities, all interviewees representing PHAs said that they lack funding to prioritize DRM on top of everyday duties. A third of PHA interviewees added that additional financial resources for DRM are necessary. One shared:

*“The biggest issue that we’ve all found is that we’re all trying to do our work and run our organizations and nobody’s funding us to build these relationships... we have to do this collaborative work, but nobody supports it. They expect it, they want it. They might even require it, but there’s nobody, in terms of resources, who’s paying for my time... to do all this planning.” - PHA 6*

#### 3.4.1.4 STRUCTURAL INEQUITIES AND AT-RISK GROUPS

A couple of interviewees at PHAs and a couple of interviewees at non-profits introduced structural inequities in housing, such as a long-standing federal disinvestment in low-income housing, and the overall affordable housing crisis as barriers to implementing PHA DRM strategies. For example, both interviewees representing PHAs said PHA properties need investment, but little is done to prioritize improvement. One of these PHA interviewees added that income inequality will only continue to exacerbate the affordable housing crisis and must be addressed to improve DRM. An interviewee at a state agency added:

*“When you have aging structures, when you have less and less vouchers available, when you have less funding for staffing... then you have less ability to respond when an emergency strikes... we all want to quickly be able to address whatever crisis we have but we wouldn't have the crisis that we have if it wasn't for an underlying housing problem that's just been going on, truly, for generations.” - State Agency 1*

About half of interviewees at PHAs and an interviewee representing a non-profit discussed the importance of centering PHA residents in DRM strategies. Multiple PHA interviewees discussed how DRM at PHAs must be tailored to address specific needs (e.g., lack of resources) and demographics (e.g., low income) of PHA residents given their high risk.

#### *3.4.1.5 EXTERNAL POLICIES*

All interviewees discussed how external policies, including a lack of federal mandates, changes to federal funding models, voucher flexibility, and requirements to make infrastructure improvements during post-disaster reconstruction contribute to PHA DRM implementation. Interviewees from all agency types discussed how the lack of federal mandates and direction from the federal government around DRM was detrimental to successful implementation of DRM strategies. This lack of direction was reported to result in extra PHA burden and need for PHAs to be innovative with time and funding. While a couple of interviewees representing PHAs discussed HUD's guidance document for PHA disaster readiness and preparation (HUD, 2016, 2022d), they both reported that it only provided a basic template and did not meet their needs. One PHA interviewee said that while PHAs are often subject to HUD requirements, there are none specific to DRM. Interviewees at non-profits also discussed the lack of federal mandates around DRM, and one suggested that HUD could require use of risk assessment tools to ensure

building safety or that PHAs doing RAD redevelopment concurrently include DRM strategies. On the other hand, federal interviewees confirmed that despite the lack of formal requirements, they expect PHAs to follow the DRM guidance provided, which they incentivize through training support and occasional grants.

Transitioning to a modern housing model was reported as instrumental to revenue generation and avoiding HUD requirements, and thus, having more flexibility to implement DRM strategies. A third of interviewees at PHAs said that they have transitioned away from the traditional Section 9 Public Housing model to the Section 8 project-based rental assistance model using RAD or streamlined voluntary conversion, and a couple of these PHAs had MTW status. One interviewee representing a PHA with MTW said:

*“... getting out of the public housing authority world was the best thing we ever did. Because the way HUD funds housing authorities, we never had enough money to do anything. And now that our properties actually cash flow, and we're in a modern housing model... if we were ever going to be in a position to put a generator in or put Internet... Those are the kinds of things that HUD wouldn't fund... right now, we're not subject to any HUD policies or requirements or mandates because we're not under HUD public housing.” - PHA 7*

Use of HUD housing vouchers was reported as a useful post-disaster tool to get displaced residents housed in neighboring areas, especially as landlords raise rents after an event. However, a few interviewees at PHAs noted that these vouchers are not without drawbacks: not everyone qualifies for housing vouchers and the waitlist for properties is years long due to lack of supply, even with priority given to those displaced by disasters.

Two-thirds of PHAs brought up how local or state policies that require them to make infrastructure improvements during post-disaster reconstruction are an opportunity for strengthening PHA DRM strategies. For example, a PHA interviewee spoke of how these policies help the PHA be more thoughtful during the rebuilding process:

*“At the state level... if you're applying for low-income housing tax credits, you are required to follow resilient rebuilding methodologies... So I think as we rebuild, that rebuilding effort is preparing us for the next storm. So we're rebuilding better. We're more prepared and more thoughtful as we do that.” - PHA 3*

#### 3.4.1.6 COMMUNITY EXPECTATIONS

A third of interviewees at PHAs said that they are expected by their local community to take care of all their residents' needs when a disaster happens because they are regarded as a public entity, yet they are not appropriately funded to do so. They added that on top of these expectations, they are still trying to manage their day jobs during a disaster and are expected to provide housing advice to displaced residents. A PHA interviewee said of these expectations:

*“... they look at us as coming to solve all of the problems related to development and housing and resilience, flood recovery, fire recovery... we're just here trying to provide affordable housing.” - PHA 9*

### 3.4.2 INTERNAL FACTORS THAT INFLUENCE IMPLEMENTATION OF PHA DRM STRATEGIES

#### 3.4.2.1 LACK OF STAFF CAPACITY AND DRM EXPERTISE

All interviewees discussed the need for additional DRM training, either for staff or residents, as well as additional staff capacity, either overall or specific to DRM.

Two-thirds of interviewees representing PHAs expressed the need for a full-time disaster planner or risk manager, who specifically develops and/or reviews the PHA's policies and plans, as well as builds DRM partnerships. About half of interviewees at PHA reported already having a DRM role in place, but they all still expressed a need for more DRM-trained staff. A third of PHA interviewees who were located in rural areas reported specific staffing problems they experienced, such as only having part-time staff and staff being located far from town in the event of a disaster, thus preventing them from helping during and after a disaster. One of these interviewees said of building in-house DRM capacity:

*“What I would like to see is funding of local staff to get the expertise to do mitigation, to do risk management... if we have that local knowledge and expertise, we're going to be much better at managing and preventing severe damage... I'm more than happy to have every consultant in the world come in and... fill us with knowledge and information, but then they all leave, and we need that knowledge and information locally.” - PHA 2*

Two-thirds of interviewees at PHAs reported that they have actively engaged their staff in some type of DRM training, while a couple of other PHA interviewees said that they plan to or would like to engage staff in training. For PHAs that already implement staff training, this included conducting tabletop exercises, utilizing publicly available federal resources to train staff. About half of interviewees from PHAs described the need for more DRM resident training, and a few of these interviewees said they were currently engaged in fire safety and evacuation training and have used operating funds to encourage residential participation in such training.

### 3.4.2.2 LEADERSHIP AND CULTURE

About half of interviewees at PHAs and a federal interviewee discussed the positive impact of leadership that prioritizes DRM innovations and informed decision making, which ultimately reduces bureaucracy during disaster. A couple of PHA interviewees shared that their executive director supported the creation of a DRM role, which they said does not usually exist at a PHA. A federal interviewee emphasized:

*“When you have those visionary executive directors with a very strong board, that's where you begin to see innovative kinds of ideas and programming and housing solutions and partnerships” - Federal Interviewee 2*

The culture of the PHA was also reported to influence engagement in DRM. Half of PHA interviewees and a federal interviewee brought up how inclusive organizational culture at PHAs can encourage staff to care for low-income residents before and after an event. One interviewee said of their PHA's culture:

*“We've created a philosophy and approach of how we want to handle these events. As an organization, we know we are going to go above and beyond and do whatever we can do to take care of the people that live in our properties.” - PHA 6*

### 3.4.2.3 PHA STRUCTURE

A PHA's place within a community's organizational structure was reported to influence its ability to engage in DRM activities. A third of interviewees representing PHAs shared how the organizational structure that their agency is a part of is useful to DRM strategy implementation, with a few reporting incorporation into their city or county government structure, allowing access to local resources and integration into local DRM processes. PHAs

reported tangible benefits and accountability checks, such as a seat on emergency management committees and mandatory DRM plan updates.

#### *3.4.2.4 PHA PLANNING AND COMMUNICATIONS*

Organizational DRM planning was identified as a productive strategy for improving implementation of DRM at PHAs. Two-thirds of interviewees at PHAs reported that their PHA has some type of disaster plan or protocol in place and half of these interviewees also said there were hazard-specific plans in place. In addition, a third of overall PHA interviewees said they have business continuity plans in place. A couple of PHA interviewees mentioned using HUD's guidance document for PHA disaster readiness and preparation (HUD, 2016, 2022d) as a template for their own PHA's emergency plan, but added that it was insufficient and only served as a rough outline. A third of interviewees representing PHAs also said that they have internal committees or work groups that discuss DRM planning and staff and resident concerns. For example, one of these interviewees said a working group at their PHA sends out an annual staff survey to understand staff skills and preferences in order to fit them to DRM tasks. A few interviewees at PHAs noted that FEMA's general disaster planning templates are too long, do not address the specific needs of their low-income residents, and do not include inclusive language. While two-thirds of interviewees at PHAs said they have plans in place, a couple of these interviewees also added that plans have not necessarily helped them respond to past disasters and the relationships they had were what really helped them. For example, one of these PHAs said:

*"I'm not sure spending the time and effort to put a document on paper is necessarily where we're going to end up... I could have been here for 10 years and never had an*

*issue and then have one... But each one [disaster] has built a little bit more experience and stronger relationships.” - PHA 8*

Communication was also identified as an important component of DRM implementation. Two-thirds of PHA interviewees reported having internal communication procedures that work well for them, such as creating internal reports, assigning out duties in a Google chat, creating after action reviews with lessons learned, and sending out disaster preparedness notices internally. Yet, a third of interviewees at PHAs discussed challenges associated with communicating with staff and residents during and after a disaster, since they do not have communication systems in place to use when phone and internet are down.

### 3.5 DISCUSSION

Through semi-structured interviews with interviewees at federal and state agencies, PHAs, and nonprofits, this study identifies a variety of DRM strategies implemented by PHAs and their partners, enumerates the unique challenges that PHAs face while preparing for and responding to disasters, and identifies corresponding opportunities to improve PHA DRM and protect their residents. Despite limited resources, PHAs reported innovative approaches to DRM implementation, including internal structural renovations and strong local partnerships.

While past research has shown that prior disaster experience significantly influences personal disaster preparedness (Kohn et al., 2012), less is known about how previous disaster experience impacts implementation of preparedness measures at the organizational level. For example, researchers conducted a survey among adults in Chile to explore the influence of experiences and sociodemographic variables on disaster preparedness and found that direct prior disaster experience and higher frequency of exposure to hazards generated the highest level of

individual preparedness among survey recipients (Castañeda et al., 2020). Other research has shown that individuals who have experienced multiple disasters are more likely to engage in preparedness measures, such as storing heavier objects on a ground floor and having fire extinguishers accessible in the home (Oral et al., 2015). At the organizational level, prior research has shown through employee surveys that organizations that have experienced disasters are more likely than those who have not to adopt preparedness activities among their employees (Sadiq & Graham, 2016). Our interviewees echoed these sentiments, reporting that disaster experience influenced their engagement in DRM. At the same time, PHA interviewees that reported experience with consecutive disasters said that they lack the capacity to engage in DRM because they are still in recovery mode due to the compounding impacts of disasters. Accordingly, this research adds to the current literature on this topic by both identifying how past disaster experience at PHAs influences their engagement in DRM, as well as inherent limitations to engagement. Future PHA planning should incorporate lessons learned from past disasters, including experiences of being in a constant state of response and recovery due to the compounding impacts of consecutive disasters. This information should be shared with other PHAs who experience similar hazard risks.

Every interviewee reported that strong partnerships facilitate PHA engagement in DRM. The importance of interagency collaboration in disaster planning and preparedness has been well established (Acosta et al., 2018; Dunlop et al., 2016; Kapucu & Garayev, 2011; Poncelet & de Ville de Goyet, 1996). Kapucu discusses how a “whole community approach,” or engaging multiple partners across public and private sectors, in emergency management contributes to more effective disaster preparedness, thus increasing community resilience (Kapucu, 2015). Every community has different needs and vulnerabilities, which requires a variety of strategies to

reduce the adverse effects of disasters. However, incorporating local leaders and community members into community DRM planning has consistently been shown to support execution of inclusive DRM (Ge et al., 2023; Kapucu, 2015). This was echoed by every interviewee in our study, who each emphasized that reliable partnerships and collaborations with multiple agency types was a strong facilitator to PHA DRM engagement. Interagency collaboration provides resources and training to PHAs that they otherwise would not have access to, as they are severely underfunded and lack staff capacity to effectively engage in DRM. However, while partnerships provide an essential DRM resource for PHAs, many interviewees reported a lack of PHA incorporation into local disaster planning efforts. Local and state policies should incorporate PHAs into DRM planning to improve housing response and recovery outcomes among low-income renters and leverage PHA expertise. Future research should explore the impact of innovative approaches to incorporating PHAs into local planning processes (e.g., establishment of a specific DRM staff position; creation of a collaborative community housing recovery plan focused on low-income renters), as well as post-disaster outcomes of PHA units and residents among PHAs engaged in DRM.

PHA interviewees reported a lack of federal mandates and directives around DRM as a significant barrier to engaging in DRM. On the other hand, federal interviewees said that they believe that their guidance document for PHA disaster readiness and preparation, along with ad hoc training and small grant opportunities, are sufficient to motivate PHA engagement. Given these disparate views, there was a disconnect between PHAs and federal agencies perspectives of PHAs' capacity for and prioritization of DRM engagement, as well as the roles of federal partners. Moving forward, developing joint DRM solutions between PHAs and federal agencies must be prioritized. For example, HUD and FEMA should facilitate listening sessions with

PHAs to better understand specific PHA needs and identify solutions to support PHA engagement in DRM, along with appropriate funding and staffing resources to implement such engagement.

In addition to the gaps in PHA DRM engagement illuminated through this study, prior research has also shown that PHAs are rarely assigned roles or responsibilities around DRM within state-level plans (Khan et al., 2023). Preparedness for the needs of low-income renters is often overlooked without PHA engagement in DRM within their own agency or in collaboration with others. Federal policy requirements or incentives are necessary to close this gap. Examples of such federal policies could include a PHA disaster plan mandate, requirement to create PHA DRM task forces, appropriation of federal emergency funding to support PHA residents, or requirement to implement structural improvements during post-disaster rebuilding/reconstruction. Congress should appropriate federal funding for PHAs to create and resource DRM-specific staff positions, as multiple PHA interviewees in this study said that any effective policy changes must be supplemented monetarily. Additional research is necessary to assess the preferences and perceived impact of implementing such solutions, for example through a national PHA survey.

### 3.5.1 LIMITATIONS

This work assessed DRM implementation among PHAs within the US and may not be generalizable to other housing organizations or internationally. In addition, there was limited representation from federal (including lack of representation from FEMA), state, and non-profit organization representatives. Moreover, participants from agencies with robust DRM programs or with interests in DRM may have been more likely to respond to requests to participate,

resulting in selection bias. Additional perspectives from such agencies may have identified additional barriers or alternative opportunities to PHA DRM. Mitigation was not explicitly included as a defined category of DRM in this study, which future studies could incorporate to better identify specific mitigation strategies being implemented at PHAs, and barriers to their implementation. Finally, recall and social desirability bias may have influenced participant responses, and recall bias may have been more pronounced among PHAs with limited or distant disaster experience.

### 3.6 CONCLUSION

As the concomitant impacts of climate change and the affordable housing crisis escalate in the US, PHA engagement in DRM is necessary to protect low-income HUD-subsidized renters. Our study identifies a variety of DRM strategies being undertaken by PHAs across the U.S., including disaster preparedness measures, partnership building, disaster recovery strategies, and PHA prioritization of residents and staff. However, a variety of external and internal factors influence implementation of DRM strategies at PHAs. Specifically, PHAs are limited by: a lack of local relationships; administrative and financial obstacles, including those imposed by federal processes associated with DRM; lack of federal mandates or direction around DRM, including insufficient planning guidance; the affordable housing crisis; and PHA staff capacity and technical expertise. Opportunities to address these limitations include investing in staff capacity, interagency partnerships, and development of additional federal guidance and/or requirements. Results from this study should be used by local, state, and federal agencies to inform strategies that support implementation of DRM among PHAs.

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Chapter 4. EXPLORING IMPLEMENTATION OF DISASTER RISK  
MANAGEMENT STRATEGIES BY PUBLIC HOUSING AUTHORITIES: A  
NATIONAL SURVEY

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## 4.1 ABSTRACT

The United States is experiencing an affordable housing crisis. Simultaneously, disasters are increasing in frequency and intensity partly due to anthropogenic climate change. Disasters exacerbate adverse impacts on extremely low-income renters living in federally-subsidized housing units managed by Public Housing Authorities (PHAs). To date, there is an overall lack of knowledge around what disaster risk management (DRM) strategies are being implemented by PHAs, as well as factors that influence PHA DRM implementation. A national survey was administered to PHAs to assess their implementation of DRM strategies. Survey results, along with secondary data, were analyzed using descriptive statistics. Fisher's exact test of independence was used to calculate the association between each binary DRM strategy variable ("Yes" versus "No") and each PHA characteristic. Findings suggest that PHA Moving To Work (MTW) status, PHA size, urban classification, state-level political affiliation, and perceived hazard risk influence PHA DRM implementation.

## 4.2 INTRODUCTION

The United States (US) is experiencing a housing crisis due to a lack of affordable housing stock, disproportionately impacting renters, particularly low-income renters (Aurand et al., 2024). Simultaneously, anthropogenic climate change is contributing to a rapid increase in the frequency and intensity of disasters (AghaKouchak et al., 2020; NOAA, 2021; Smith, 2022). Disasters have been shown to have profound economic consequences by severely impacting housing market stocks (Hallegatte & Przulski, 2010) and damaging large amounts of housing (Shaw, 2004; Stroebe et al., 2021), further intensifying social inequities (Howell & Elliott, 2019). This can lead to disproportionate displacement of marginalized populations (Levine et al., 2007; Myers et al., 2008), result in environmental health concerns around housing (e.g., mold,

airborne toxicants) (Lichtveld et al., 2020; Steinberg et al., 2004), and subsequently cause and exacerbate adverse mental and physical health outcomes (Fussell & Lowe, 2014).

Although the detrimental impacts of disasters are often discussed as if they are attributed to a hazard itself, it is the societal structures in place, such as policies and social stratifications of wealth and race, that contribute to shaping population impacts (Tierney, 2019). As such, disasters are, in fact, not “natural” and impact communities unequally due to poor urban planning, increasing socioeconomic disparities between groups, lack of equitable policies, and structural racism (Chmutina & von Meding, 2019). The monetary and social disparities between whites and people of color have been caused and compounded by historically racist policies (e.g., residential segregation through redlining, discriminatory mortgage lending practices) and disinvestment in communities of color, contributing greatly to housing insecurity and its subsequent health disparities across racial and socioeconomic lines (Nardone et al., 2020; Rothstein, 2017).

Health and economic impacts of disasters are especially pronounced among renters, who are more often low-income and racial minorities when compared to higher income, white homeowners (Aurand et al., 2024; J. Y. Lee & Van Zandt, 2019; Peacock et al., 2014). Renters have also been shown to experience disparate challenges in obtaining post-disaster assistance, which can often result in housing displacement (Burby et al., 2003; Fussell & Harris, 2014; Lee & Van Zandt, 2019). Renters living in federally-subsidized housing units, overseen by the US Department of Housing and Urban Development (HUD), may be especially vulnerable to disaster impacts given their intersectional lived experiences of low-income economic status, race, disability status, and age (McCarthy & Friedman, 2023). Federally-subsidized housing units account for roughly 10% of the national rental housing stock and serve as a critical resource

for the lowest-income renters in the country (i.e., households with incomes 30% of the Area Median Income (AMI) or less) (Aurand et al., 2023). A 2023 report by the National Low Income Housing Coalition (NLIHC) found that 24% of federally-subsidized homes are located in US census tracts with the highest risk of adverse impacts from disasters and within eight states, over half of federally-subsidized homes are within high-risk census tracts (Aurand et al., 2023). In addition, renters living in federally-subsidized housing are significantly less prepared for disasters than homeowners and unsubsidized renters (McCarthy & Friedman, 2023), are at higher risk of post-disaster housing displacement than private market renters (Fussell & Harris, 2014), and lack control over reconstruction and recovery decisions of their housing units (Khajehei & Hamideh, 2024).

Public housing authorities (PHAs), who are quasi-governmental entities responsible for managing and overseeing federally-subsidized housing units, face significant challenges as disasters escalate in frequency and intensity and as affordable housing shortages persist across the US. Traditionally, PHAs played a primary role as affordable housing providers for HUD-subsidized housing units. However, this role has vastly changed as federal housing policy has shifted from the production and management of affordable housing to more neoliberal policies centered on demand-side rental assistance, through strategies such as housing vouchers (Kleit & Page, 2008). This has been accompanied by an overall decline in federal funding for public housing development, resulting in largely under-resourced and underfunded PHAs (Dolbeare et al., 2004).

While HUD recommendations on disaster readiness, response, and recovery exist (HUD, 2022d), PHAs lack mandates from HUD or the Federal Emergency Management Agency (FEMA) around managing disaster risk. Concurrently, there are no protections or policies in

place to preserve federally-subsidized units after disasters, with some being torn down post-disaster (Hamideh & Rongerude, 2018). For example, in the years following Hurricane Katrina, New Orleans public housing units were reduced by 70% as part of a privatization effort by HUD and some were replaced with units subsidized by the Low-Income Housing Tax Credit, despite local resistance against the efforts (Sinha & Browne-Dianis, 2008).

Although PHAs hold a tremendous amount of responsibility overseeing federally-subsidized housing units, little is known about the disaster preparedness, response, and recovery strategies they are currently engaged in, hereon referred to as disaster risk management (DRM). Such strategies may include having plans, partnerships, and DRM-specific roles in place, as well as having appropriate resources to engage in DRM. While some studies have explored the impacts of disasters on residents living in federally-subsidized housing units (Gabbe & Pierce, 2020; Hernández et al., 2018; Khajehei & Hamideh, 2024), few studies have assessed PHA implementation of organizational-level DRM strategies, and how implementation differs by community- and organizational-level factors.

#### 4.2.1 Research Objective and Questions

As housing need among renters grows due to more frequent disasters and federal funding limitations continue to exist (Fischer & Sard, 2017), PHAs will continue to struggle with meeting affordable housing needs of current and prospective residents. Investing in DRM strategies is a necessary and overdue need for PHAs, yet the scope of current PHA engagement in DRM is largely unknown. This study provides an overview of current PHA DRM strategy implementation in the US, and addresses the following research questions:

*Research Question 1:* How does implementation of PHA DRM strategies vary by community- and organizational-level characteristics, including PHA size, Moving To Work status, urban classification status, and political affiliation of state governors?

*Research Question 2:* How does implementation of PHA DRM strategies vary by a PHA's perceived hazard risk?

Six DRM strategies were identified from previous research on organizational disaster preparedness and data was collected through an online survey. These DRM strategies include having dedicated DRM funding in place, implementation of disaster plans, having adequate staff and technical capacity to engage in DRM, having adequate financial resources to engage in DRM, having a DRM role or department in place, and having partnerships in place to support DRM engagement. A description of each of these DRM strategies is provided below, along with relevant literature. In addition, secondary data on four community- and organizational-level characteristics of interest was collected. These community- and organizational-level characteristics include PHA size, Moving to Work (MTW) status, urban classification, and political affiliation of state governors. Data on one additional organizational-level characteristic, perceived hazard risk, was collected through the online survey. A description of these five community- and organizational-level characteristics, along with relevant literature, is also provided below.

#### 4.2.2 DISASTER RISK MANAGEMENT STRATEGIES

##### 1. Dedicated DRM Funding

Organizational financial preparedness can help to alleviate the detrimental and unexpected short-term expenses that arise post-disaster (Eisenman et al., 2007). For example,

past research has shown that government agencies that have experienced a past disaster are more likely to set aside funds for future disasters, which improves their ability to engage in effective disaster preparedness (Lee & Chen, 2022). Specifically for low-income communities, who are at higher risk of detrimental post-disaster impacts (Hallegatte & Przulski, 2010), setting aside dedicated funds may help reduce the risk of residents falling into poverty if housing is lost or damaged. To date, it is currently unknown if PHAs are setting aside dedicated funds to engage in DRM.

## 2. Disaster Plan Implementation

It has been well-established in the planning literature that investing time and resources into disaster planning is a viable strategy for improving post-disaster outcomes (Berke et al., 1993; Berke & Campanella, 2006). Yet, incorporation of PHAs in disaster planning among state and local governments is largely lacking. A recent analysis of state-level emergency operation and disaster plans found that PHAs are rarely included or considered in plans (Khan et al., 2023). A case study conducted in Utah County confirmed this lack of PHA inclusion in planning at a more local scale (Khajehei & Chandrasekhar, 2023). Authors conducted semi-structured interviews with local emergency management, city planning, and housing officials, finding an overall lack of pre-disaster plans for public housing recovery (Khajehei & Chandrasekhar, 2023). In addition, while it is recommended by HUD for every PHA to implement a disaster plan (HUD, 2022d), it is currently unknown if PHAs are currently implementing their own organizational disaster plans.

## 3. Adequate Staff/Technical Capacity

The importance of administrative capacity in disaster planning has been emphasized in numerous studies (Adams et al., 2018; Gerber et al., 2005; McGuire & Silvia, 2010). For

example, researchers conducted semi-structured interviews with seven local health departments, identifying that funding for specific programs and adequate staffing are essential needs for their staff to engage communities in disaster preparedness (Schoch-Spana et al., 2013). While PHAs lack staff and technical capacity (Greenlee et al., 2018), it is largely unknown if this lack of capacity impacts implementation of DRM strategies. Identifying administrative capacity needs can help to inform future DRM resource allocation.

#### 4. Adequate Financial Resources

At the same time, a lack of financial resources at the organizational level has consistently been shown to be a limiting factor in implementing DRM strategies (Bostrom et al., 2006; Sadiq & Weible, 2010), as well as a barrier for implementation of effective affordable housing policy for PHAs in general (Kleit & Page, 2015). A qualitative study using interviews with community-based homeless organizations in Los Angeles found that financial resources and staff time were significant barriers to organizational engagement in disaster preparedness (Gin et al., 2016). To date, no research has investigated if PHAs have adequate financial resources for engaging in DRM.

#### 5. DRM Role and/or Department

At the organizational level, creating specific PHA roles or departments centered on DRM may be a viable preparedness strategy, as previous studies have highlighted the importance of risk managers in managing organizational risks (Sadiq & Weible, 2010). One study conducted interviews with fifteen organizations and disseminated a survey to organizations in Memphis and found that hiring of a risk manager results in adoption of risk-reducing measures (Sadiq & Graham, 2014), suggesting that having a DRM role or department in place may reduce the

impacts of disasters on organizations. In a PHA context, the presence or utility of a DRM-specific role or department remains to be investigated.

## 6. Partnerships

Numerous studies have demonstrated that establishing collaborative, interdisciplinary relationships before disasters results in a more successful disaster response (Adams et al., 2018; Ge et al., 2023; Moynihan, 2005). In a Georgia case study that utilized interviews with businesses, local government, and academics, Buehler et al. found that strong partnerships between public health and business leadership led to expanded shared learning opportunities, ultimately improving emergency response (Buehler et al., 2006). While research on cross-sectoral and interdisciplinary DRM partnerships has been conducted in fields such as public health (Buehler et al., 2006; Schoch-Spana et al., 2013), a deeper study of DRM partnerships remains absent in the field of affordable housing, among PHAs specifically.

### 4.2.3 COMMUNITY- AND ORGANIZATIONAL-LEVEL CHARACTERISTICS

#### 1. PHA size

Numerous studies have demonstrated that organizational size is a predictor of preparedness (Chikoto et al., 2012; Dahlhamer & D'Souza, 1997a; Sadiq, 2010; Sadiq & Graham, 2016; Webb et al., 2000), as larger organizations are more likely to have formalized DRM initiatives (Fowler et al., 2007) and more resources to invest in DRM strategies (Sadiq & Graham, 2016). PHAs vary widely in the number of units they administer and their jurisdiction sizes, some being at the county- or city-level, while others serve large rural areas. There are roughly 4,000 PHAs in the U.S., and majority of these are small (69.3% of PHAs are responsible for overseeing fewer than 250 units total) and medium-sized (21.3% of PHAs are responsible for

overseeing 250-1,249 units total), but large PHAs are responsible for the majority of federal housing assistance (6.4% of PHAs are responsible for overseeing 1,250-10,000+ units total) (Congressional Budget Office, 2015; HUD, 2022c). Using administrative data and interviews with executive directors of small PHAs in Illinois, researchers found that smaller PHAs (i.e., serving less than 1,000 units) are less likely to be designated as “high-performing,” based on HUD’s Public Housing Assessment System (Greenlee et al., 2018). To date, there remains a gap in understanding how implementation of DRM strategies varies by PHA size. Given previous research in other sectors, it is plausible that PHA size may be associated with implementation of DRM strategies as larger PHAs may be better resourced.

## 2. Moving To Work (MTW) status

In the past 25 years, federal initiatives have greatly expanded the scope of local PHA action, which has both created conflicting goals for PHAs and promised them more flexibility for adopting new strategies at the local level (Kleit & Page, 2008; Nguyen et al., 2012). For example, the MTW program is a HUD-led demonstration program that provides some PHAs with opportunities to design and test innovative, locally-guided strategies to use federal funding more efficiently and provide exemptions from existing rules around using funding (HUD, 2023a). Other than providing more flexibility for use of funds, the MTW program can foster expanded partnerships with organizations to provide more affordable housing and fund hybrid social service programs to improve self-sufficiency among residents (Nguyen et al., 2012). While programs such as MTW have potential to influence PHA planning decisions (Walter et al., 2020) by allowing more resources to be allocated towards DRM, it remains to be investigated if and how MTW PHAs may differ from non-MTW PHAs in their ability to implement DRM strategies.

### 3. Urban classification

Disasters have been shown to impact metropolitan and rural areas disparately, which may be due to an overall lack of human capacity and financial resources in rural communities (Tootle, 2007), which is especially exacerbated post-disaster (Kapucu et al., 2013). A 2023 report from the NLIHC found that 30% of federally-assisted homes in rural areas are in census tracts with greatest risk hazard, compared to 23% of federally-assisted homes in urban or metropolitan areas, highlighting the higher risk that rural residents living in units managed by PHAs face (Aurand et al., 2023). At the same time, rural communities may be more self-reliant and have stronger social networks and a sense of community that can enhance resilience to disasters (Cutter et al., 2016). Little research exists on the unique experiences of metropolitan, micropolitan, and rural PHAs (Greenlee et al., 2018). Given the differences between urban classification status of PHAs, it remains to be investigated if implementation of DRM strategies differs among them.

### 4. Political affiliation of state governors

Research suggests that the political affiliation of state governors may influence decision-making around DRM (Daniels, 2011; Gasper & Reeves, 2010; Grossman et al., 2020; Gusmano et al., 2020; Smith et al., 2018). For example, the COVID-19 pandemic highlighted stark differences between policy implementation by Republican and Democratic state governors (Gusmano et al., 2020). In general, Republican governors were much slower than Democratic governors to adopt policies that encouraged social distancing and stay-at-home orders, ultimately leading to adverse public health impacts (Gusmano et al., 2020). These differences in approaches to decision-making may be due to the more conservative leanings of Republican politicians, who often desire a limitation of governmental intervention on a day-to-day basis (Smith et al., 2018).

The association between the political affiliation of state governors and implementation of DRM strategies at PHAs has yet to be investigated.

#### 5. Perceived hazard risk

Past research has demonstrated that public agencies are more likely to engage in preparedness activities if they perceive a high level of hazard risk (Han & Nigg, 2011; Sadiq, 2010; Sadiq & Graham, 2016). While there are discrepancies around the definition of “perceived hazard risk” across studies, a general consensus is that if hazard risk is recognized at the managerial level, it is more likely to be prioritized across organizations (Larson & Fowler, 2009; Xiang, 2022). The association between perceived hazard risk and organizational engagement in preparedness has been conducted at specific types of agencies, such as public transportation providers (Xiang, 2022), yet a gap remains on studying this association specifically at PHAs.

### 4.3 METHODS

We developed and distributed a survey tool to 3,362 PHA executive directors across the US. Survey results were analyzed, along with secondary data, to understand how implementation of six DRM strategies vary by five community- and organizational-level characteristics (i.e., PHA size, MTW status, urban classification status, political affiliation of state governors) and perceived hazard risk. The University of Washington Human Subjects Division determined this study to be human subjects research that qualifies for exempt status on September 13, 2023.

#### 4.3.1 DATA COLLECTION

A survey tool (**Appendix F**) was developed and informed by findings from previous literature and semi-structured interviews previously conducted with key informants by the

research team (*see Chapter 3, Results*). Survey recipients were identified from a comprehensive list of PHA executive directors, which is maintained by HUD on ArcGIS' Open Data website (HUD, 2023b). At the time of survey dissemination, the PHA executive director contact information had last been updated on March 6, 2023, and there were a total of 3,828 PHA executive director emails in the original dataset. After deleting any records without emails, records not located in the 50 US states (e.g., DC, US territories), and duplicate records, there were 3,649 PHA executive director emails remaining. An initial email was first sent out on October 16, 2023 to prospective recipients through a University of Washington study email address in order to collect bounceback emails. For bouncebacks received, one investigator (AK) consulted the PHA's website to identify an alternative executive director email address. If an alternative email was identified, the contact sheet was corrected, and if not, the PHA was removed from the contact sheet. There were a total of 312 bounceback emails and 31 replacement emails were manually identified online. The survey was administered via REDCap software and distributed electronically by email on October 24, 2023 to 3,368 recipients. Previous work by Dillman has demonstrated that repeated, appropriate contact with survey recipients can substantially increase survey response rate, specifically five varied points of contact regarding the survey (Dillman, 2000; Rosenbaum & Lidz, 2007). Thus, five survey reminders were sent out about 1 week apart on alternating weekdays. The survey was officially closed on November 23, 2023. There were a total of six survey recipients who asked not to be included in the recipient list, resulting in a final count of 3,362 survey recipients. Survey questions that measured PHA DRM implementation include:

- **Dedicated funding:** Does your PHA currently have dedicated funding set aside for disasters?

- **Plans:** Does your PHA currently have emergency/disaster plans in place?
- **Staff/technical capacity:** Does your PHA have adequate staff and/or technical capacity to engage in DRM?
- **Financial resources:** Does your PHA have adequate financial resources available to engage in DRM?
- **DRM department/role:** Does your PHA have a DRM department and/or role?
- **Partnerships:** Does your PHA have partnerships that support DRM?

Publicly-available secondary data was utilized for four community- and organizational-level characteristics in the analysis. A fifth organizational-level characteristic “perceived hazard risk” was collected through the survey tool. These five community- and organizational-level characteristics are provided in **Table 4.1**, along with data types, values, definitions, and sources.

**Table 4.1:** Community- and organizational-level characteristics, types, values, definitions, and data sources used in analysis

Community- or Organizational-Level Characteristic	Data Type	Data Values	Definition	Data Source
PHA Size	Categorical	Extra Large (5,000+) Large (1,000-4,999) Medium High (300-999) Medium Low (100-299) Small (50-99) Very Small (0-49)	Combined Size Category based on unit count of Low Rent and Section 8 units	HUD PHA ArcGIS Open Data website <sup>a</sup>
Office of Management and Budget (OMB) Urban Classification	Categorical	Metropolitan Statistical Areas (MSAs) Micropolitan Statistical Areas (μSAs) Rural Areas	MSAs consist of the county or counties (or equivalent entities) associated with at least one urban area of at least 50,000 population. <sup>b</sup> μSAs consist of the county or counties (or equivalent entities) associated with at least one urban area of at least 10,000 but less than	HUD PHA ArcGIS Open Data website <sup>a</sup>

			50,000 population. <sup>b</sup> Rural areas consist of any areas that are not defined as MSAs or $\mu$ SAs. <sup>c</sup>	
Moving to Work (MTW) Status	Categorical	MTW Status No MTW Status	PHAs with Standard Agreements for MTW status designated prior to 2021 (i.e., Initial Agencies) were included. All other PHAs were grouped into the “No MTW status” including PHAs selected for MTW expansion, since full MTW authority was not granted to these agencies. There were a total of 36 MTW agencies.	HUD MTW Agency website <sup>d</sup>
Political Affiliation of State Governors	Categorical	Republican Democrat	State governor affiliation in October 2023 (at time of survey distribution)	Ballotpedia, Partisan composition of governors <sup>e</sup>
Perceived Hazard Risk	Categorical	Yes No	The survey question that measured perceived hazard risk was “Is your PHA at risk of experiencing impacts from disasters/hazards?”	Survey tool ( <b>Appendix F</b> )

<sup>a</sup> (HUD, 2023c)

<sup>b</sup> (US Census Bureau, 2023)

<sup>c</sup> (HHS, 2020)

<sup>d</sup> (HUD, 2023a)

<sup>e</sup> (Ballotpedia, n.d.)

### 4.3.2 DATA ANALYSIS

Descriptive statistics, specifically Fisher’s exact test of independence, were used to calculate the association between each binary DRM strategy variable (“Yes” versus “No”) and each PHA characteristic outlined in **Table 4.1**. Fisher’s exact test is used to determine if there is a statistically significant difference in the proportions of categories in two variables and can be used for small sample sizes (<5), allowing for flexible use across the dataset. The “Do Not Know” answers for each DRM strategy variable were dropped at the survey question level, as inclusion did not specifically address implementation of DRM strategies. However, collection of

“Do Not Know” data was important to measure because it provides an overview of knowledge of DRM strategy implementation by PHA representatives. “Do Not Know” response counts per DRM strategy are provided in **Appendix G**. All data cleaning and descriptive statistics were performed in R Studio Version 4.1 (R Core Team, 2023).

#### 4.4 RESULTS

A total of 559 PHA representatives responded to the survey out of 3,362 recipients, resulting in an overall 16.6% response rate. At least one PHA from every state, except for Hawai’i, responded to the survey and were represented in the sample. **Table 4.2** presents the overall count and percentages of survey respondents, organized by five community- and organizational-level characteristics (i.e., PHA size, MTW status, urban classification, political affiliation of state governors, perceived hazard risk). These results indicate that almost half of survey respondents represent PHAs of medium low and medium high size, while only 5.4% represent extra large PHAs. More than half of survey respondents represented PHAs in metropolitan areas. While only 2% of respondents represented PHAs with MTW status, this is expected as there are only 36 MTW agencies who were sent the survey (see **Table 4.2**). Political affiliation of state governors was distributed equally among PHA survey respondents. Over half of respondents reported that they perceived hazard risk at their PHAs. The sample of survey respondents was representative of survey non-respondents, as demonstrated in **Table 4.2**.

**Table 4.2:** Percentages of responses from survey respondents, survey non-respondents, and overall survey recipients, organized by community- and organizational-level characteristics

	Survey respondents (n= 559)	Survey non-respondents (n= 2803)	Overall (n= 3362)
<b>PHA Size</b>			
Extra Large (5,000+)	5.4%	3.0%	3.4%
Large (1,000-4,999)	20.2	14.5	15.4
Medium High (300-999)	24.2	23.2	23.3
Medium Low (100-299)	23.8	25.8	25.5
Small (50-99)	13.1	14.4	14.2
Very Small (0-49)	13.4	19.2	18.2
<b>MTW Status</b>			
MTW Status	2.1	0.9	1.1
No MTW Status	97.9	99.1	98.9
<b>OMB Urban Classification</b>			
Rural	24.5	26.1	25.8
Micropolitan	18.8	21.2	20.8
Metropolitan	56.7	52.7	53.4
<b>Political Affiliation</b>			
Republican	49.7	48.7	48.9
Democratic	50.3	51.3	51.1
<b>Perceived Hazard Risk<sup>a</sup></b>			
Yes	56.0 <sup>b</sup>	N/A	N/A
No	44.0 <sup>b</sup>	N/A	N/A

<sup>a</sup>Overall n is smaller (n=482) for “Perceived Hazard Risk” due to 77 “Do Not Know” responses from survey respondents.

<sup>b</sup>Percentages are calculated to be out of 482 for “Perceived Hazard Risk”

Overall, the most commonly implemented PHA DRM strategies were having partnerships in place that support DRM (66%) and having PHA disaster plans in place (88%).

The DRM strategies that were reported to be implemented the least were having dedicated disaster funding set aside for DRM (18%) and having a specific DRM department and/or role in place (21%). Thirty-two percent of respondents reported having adequate staff and/or technical capacity to engage in DRM, while 37% had adequate financial resources to engage in DRM.

**Table 4.3** describes the proportion of PHAs by each disaster risk management strategy:

Dedicated disaster funding; Disaster plan(s) in place; Adequate staff and/or technical capacity; Adequate financial resources; DRM department and/or role; and Partnerships. For in-depth tables that include an overview of “No” responses per DRM strategy, refer to **Appendix H**.

#### *Dedicated Disaster Funding*

Overall, only 18% of respondents said that they currently have dedicated funding set aside for disasters. A higher proportion of extra large (4%) and large PHA respondents (5%) reported having dedicated disaster funding, while only one very small PHA said that they have dedicated disaster funding in place (0.5%). There was a statistically significant association between PHA size and dedicated disaster funding ( $p= 0.05$ ), and between MTW status and dedicated disaster funding ( $p= 0.005$ ). However, no statistically significant associations between dedicated disaster funding and urban classification, political affiliation, and perceived hazard risk were identified ( $p \leq 0.05$ ).

#### *Disaster Plan(s) in Place*

The majority of PHAs reported currently having disaster plan(s) in place (88%). Eleven of 12 MTW PHAs respondents said that they have disaster plans in place (5%), while metropolitan PHAs had the highest response to implementing disaster plans (63%) compared to

micropolitan (15%) and rural PHAs (10%). In addition, a higher proportion of PHAs with perceived hazard risk responded that they have implemented plans (66%) than PHAs without perceived hazard risk (22%). Overall, there were no statistically significant associations between having PHA disaster plans in place and any of the community- and organizational-level characteristics ( $p \leq 0.05$ ).

#### *Adequate PHA Staff and/or Technical Capacity*

Most respondents said that they do not have adequate PHA staff and/or technical capacity to engage in DRM (68%). A higher proportion of medium-high sized PHA respondents reported having adequate PHA staff and/or technical capacity (10%), while extra large sized PHA respondents had the lowest proportion (2%). Five out of 11 respondents with a MTW PHA reported adequate PHA staff and/or technical capacity to engage in DRM (1.2%). There were no statistically significant associations between adequate PHA staff and/or technical capacity and any of the community- and organizational-level characteristics ( $p \leq 0.05$ ).

#### *Adequate Financial Resources*

Thirty-seven percent of respondents said that they have adequate PHA financial resources to engage in DRM strategies. Notably, about half of very small PHA respondents (5.5%), as well as six out of ten PHAs with MTW status (1.5%), said that they have adequate financial resources for engaging in DRM. Among 223 PHAs with perceived hazard risk (56%), about one-third of them reported that they have adequate financial resources available to engage in DRM (19%). There were no statistically significant associations between having adequate financial resources

to engage with DRM and any of the community- and organizational-level characteristics ( $p \leq 0.05$ ).

#### *DRM Department and/or Role*

Twenty-one percent of respondents said that their PHA has a DRM department and/or role in place. Lower proportions of respondents from small (1.7%) and very small PHAs (0.65%) reported having a DRM department and/or role. Eight of 12 respondents with MTW status (1.7%) answered “Yes” to having a DRM department and/or role at their PHA. A higher proportion of respondents with perceived hazard risk reported having a DRM department and/or role in place (15%) compared to those with no perceived hazard risk (6%). Having a DRM department and/or role in place was statistically significantly associated with all community- and organizational-level characteristics, except for political affiliation ( $p \leq 0.05$ ).

#### *Partnerships*

Overall, 66% of respondents reported that they have PHA partnerships in place that support DRM. Within every PHA size category except “Very Small”, more respondents reported having partnerships in place that support DRM than not having such partnerships in place. Similarly, more metropolitan (44%) and micropolitan (12%) respondents reported having partnerships in place that support DRM than not having such partnerships in place. Having partnerships in place that support DRM was statistically significantly associated with all community- and organizational-level characteristics, except for MTW status ( $p \leq 0.05$ ).

**Table 4.3:** Status of six PHA DRM strategies by PHA size, MTW status, OMB Urban Classification, Political Affiliation, and Perceived Hazard Risk

	Dedicated disaster funding (n= 196 <sup>a</sup> ) n (%)	p-value	Disaster plan(s) in place (n= 207 <sup>a</sup> ) n (%)	p-value	Adequate staff and/or technical capacity (n= 429) n (%)	p-value	Adequate financial resources (n= 401) n (%)	p-value	DRM department and/or role (n= 464) n (%)	p-value	Partnerships (n= 436) n (%)	p-value
<b>Total “Yes” responses</b>	35 (17.9%)		182 (87.9%)		137 (31.9%)		149 (37.2%)		99 (21.3%)		288 (66.1%)	
<b>PHA Size</b>		<b>0.05*</b>		0.74		0.22		0.52		<b>6.8e-05***</b>		<b>1.5e-04***</b>
Extra Large (5,000+)	8 (4.1)		20 (9.7)		8 (1.9)		8 (2.0)		14 (3.0)		23 (5.3)	
Large (1,000-4,999)	9 (4.6)		47 (22.7)		29 (6.8)		28 (7.0)		25 (5.4)		73 (16.7)	
Medium High (300-999)	6 (3.1)		59 (28.5)		43 (10.0)		37 (9.2)		29 (6.2)		80 (18.3)	
Medium Low (100-299)	7 (3.6)		29 (14.0)		26 (6.1)		38 (9.5)		20 (4.3)		58 (13.3)	
Small (50-99)	4 (2.0)		15 (7.2)		19 (4.4)		16 (4.0)		8 (1.7)		34 (7.8)	
Very Small (0-49)	1 (0.51)		12 (5.8)		12 (2.8)		22 (5.5)		3 (0.65)		20 (4.6)	
<b>MTW Status</b>		<b>0.005**</b>		1.0		0.34		0.18		<b>7.7e-04***</b>		0.76
MTW Status	6 (3.1)		11 (5.3)		5 (1.2)		6 (1.5)		8 (1.7)		8 (1.8)	
No MTW Status	29 (14.8)		171 (82.6)		132 (30.8)		143 (35.7)		91 (19.6)		280 (64.2)	
<b>OMB Urban Classification</b>		0.40		0.22		0.51		0.88		<b>6.9e-04***</b>		<b>3.2e-05***</b>
Rural	3 (1.5)		20 (9.7)		27 (6.3)		33 (8.2)		12 (2.6)		45 (10.3)	
Micropolitan	4 (2.0)		31 (15.0)		26 (6.1)		27 (6.7)		14 (3.0)		51 (11.7)	
Metropolitan	28 (14.3)		131 (63.3)		84 (19.6)		89 (22.2)		73 (15.7)		192 (44.0)	
<b>Political Affiliation</b>		0.85		0.53		1.0		0.53		0.37		<b>0.01***</b>
Republican	16 (8.2)		87 (42.0)		67 (15.6)		77 (19.2)		46 (9.9)		137 (31.4)	

Democratic	19 (9.7)	95 (45.9)	70 (16.3)	72 (18.0)	53 (11.4)	151 (34.6)
<b>Perceived Hazard Risk</b>	1.0	0.81	0.60	0.35	<b>5.9e-04***</b>	<b>4.2e-07***</b>
Yes	27 (13.8)	137 (66.2)	80 (18.6)	78 (19.4)	70 (15.1)	194 (44.5)
No	8 (4.1)	45 (21.7)	57 (13.3)	71 (17.7)	29 (6.2)	94 (21.6)

\*Significant at p<0.1

\*\*\*Significant at p<0.05

<sup>a</sup> “n” for “Dedicated disaster funding” and “Disaster plan(s) in place” is smaller due to formatting of parent-child questions in the survey. See **Appendix F** for the survey tool.

## 4.5 DISCUSSION

Disasters resulting from climate-sensitive hazards and the affordable housing crisis are concurrently intensifying in the US (Aurand et al., 2024; NOAA, 2021), making it essential to engage PHAs in DRM activities so that they can better support the housing needs of low-income residents. Using a national-level online survey distributed to PHAs, this study provides a cross-sectional assessment of implementation of six DRM strategies at PHAs. The most frequently implemented DRM strategies at PHAs were having partnerships in place that support DRM and having PHA disaster plans in place. The least frequently implemented DRM strategies at PHAs were having dedicated disaster funding set aside for DRM and having a specific DRM department and/or role in place. The quality of PHA disaster plans in place remains to be investigated, given the low proportion of PHAs who reported adequate staff/technical capacity and specific DRM departments/roles in place. This study also expands understanding of the association between implementation of DRM strategies and community- and organizational-level characteristics, including PHA size, MTW status, urban classification status, political affiliation of state governors, and perceived hazard risk.

Findings from this study suggest that PHAs who have more resources and flexibility in funds, such as through the MTW program, are more likely to participate in implementation of DRM strategies. Past research has demonstrated that MTW provides PHAs with an avenue to gain flexibility in funding structures, allowing PHAs to customize their programs based on local priorities (Levy et al., 2020; Nguyen et al., 2012). A recent qualitative study that used interviews with PHA, federal and state government, and non-profit professionals found that MTW allowed PHAs to generate cash flow and not be tied to HUD requirements, thereby allowing them to better implement DRM strategies, such as purchasing generators or communication systems for

their units (*see Chapter 3, Results*). Our findings expand on current literature and suggest that PHAs with MTW status may be more equipped to implement DRM strategies, highlighting the utility of flexible spending programs as a potential policy tool for PHAs to better engage in implementation of DRM strategies. However, the benefits of MTW with regard to DRM may not necessarily outweigh MTW's opportunity costs of providing fewer Housing Choice Vouchers or making critical capital repairs to public housing (Buron et al., 2017). Advocates also argue that there are potentially adverse impacts of MTW features in some cases, such as work requirements and higher rents (Fischer & Sard, 2017). Further research is necessary to understand the full scope of MTW utilization as a flexible funding mechanism for PHAs, including in DRM.

At the same time, our findings indicate that PHA size is significantly associated with implementation of numerous DRM strategies. These findings complement previous literature on large organizational size as a determinant of disaster preparedness, as larger organizations often possess more resources, resulting in more technical capacity and knowledge among staff (Fowler et al., 2007; Sadiq & Graham, 2016). Rural PHAs, who are often smaller in size, face unique challenges because they are often under-resourced, their staff lack technical training (Greenlee et al., 2018), and rural areas receive less federal disaster aid compared to urban areas (Seong et al., 2022). Future research should explore how smaller and rural housing authorities can better collaborate and consolidate resources, and if and how that ultimately improves preparedness, response, and recovery for future disasters.

Currently, no HUD mandates or requirements exist for PHAs to implement DRM strategies, and dedicated DRM resources from HUD are lacking. In absence of mandates, HUD has compiled a PHA disaster readiness, response, and recovery guidebook (HUD, 2022d), which clarifies the roles of PHAs in disasters. Yet without appropriate funding and resource provision,

qualitative research has shown that PHAs struggle to meet the recommended guidelines (*see Chapter 3, Results*). While HUD published a 2021 Climate Action Plan (HUD, 2021) and a 2024 Climate Adaptation Plan (HUD, 2024a) for guiding HUD to take appropriate adaptation measures to reduce climate risk and identify measures to help their communities build resilience, both documents fail to address PHA roles around climate change adaptation and resilience. Given this gap of PHA inclusion in climate change and disaster planning, HUD should prioritize providing DRM-focused technical assistance and staff training to PHAs to better help them prepare for disasters and adapt to climate change. Recently, HUD has created and shared a hazard-specific webinar series (HUD, 2022a) and fact sheets (HUD, 2024b) on PHA disaster readiness, response, and recovery, yet it is unknown if PHAs are utilizing these resources, especially as they struggle with an overall lack of funding to engage in DRM (*see Chapter 3, Results*). Moving forward, Congress must dedicate monetary resources to HUD, and subsequently to PHAs, to implement effective technical assistance and educational strategies around DRM. HUD can also help facilitate relationships between PHAs and affordable housing non-profit organizations. Nonprofits can serve as a valuable partner for PHAs, as they possess technical expertise and local relationships that are crucial when disasters happen.

#### 4.5.1 LIMITATIONS

While this study was conducted at a national scale in the US and captures a first of its kind overview of DRM strategy implementation at PHAs, findings may not be generalizable to other types of housing organizations or to international housing providers. An additional limitation of this study is the potential presence of selection bias as the participants who chose to respond to the survey may be systematically different from those who did not. For example,

PHAs with recent disaster experience, high hazard risk, or DRM strategies in place may have been more likely to respond. However, the research team attempted to mitigate this bias by clarifying in the survey invitation that responses were sought from all PHAs, regardless of current engagement in DRM strategy implementation or recent experience with disasters. Response bias may also have been present, as most survey questions asked respondents to self-report their PHA's engagement in DRM. Two of the DRM strategies that were measured in the survey asked about adequate staff and/or technical capacity and adequate financial resources to engage in DRM strategies. Since public-serving agencies are often underfunded and understaffed, the wording of the questions could have resulted in more "No" or "Do not know" answers, as survey respondents may have erred on the side of caution when answering. Another limitation was that this research investigated self-reported perceived hazard risk among PHAs since a dataset of each PHA's units that they oversee was not available to match with an objective hazard risk dataset at an appropriate level of geography. Future research should incorporate objective hazard risk assessments to better quantify how PHA DRM strategy implementation may vary based on hazard risk. Lastly, mitigation was not specifically included within the definition of DRM in this study because it is not currently addressed in HUD's PHA disaster readiness, response, and recovery guidebook (HUD, 2022d). Future studies could incorporate mitigation strategies to better understand if they are being implemented at PHAs, since mitigation is essential to prioritize as structural improvements to aging housing stock will become increasingly important in the face of accelerating hazard exposure.

## 4.6 CONCLUSION

Increasing disaster risk, including those resulting from climate-sensitive hazards, along with an intensifying affordable housing crisis in the US, highlight the urgency of engaging PHAs in DRM to better protect low-income renters. Through a national-level survey, this research assesses implementation of DRM strategies among US PHAs, as well as the association of community and organizational-level characteristics with their implementation. Our findings suggest that MTW status, PHA size, urban classification, state-level political affiliation, and perceived hazard risk are all important characteristics that influence implementation of multiple DRM strategies. As well-resourced PHAs are more likely to engage in DRM activities, it is essential for policymakers to identify and make monetary resources available to HUD so that PHAs can engage in DRM capacity development.

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## Chapter 5. CONCLUSIONS

This dissertation conducted three interrelated research studies to assess various aspects of PHA DRM implementation across the U.S. All three studies demonstrate the urgent need for the prioritization of investment in PHA DRM, as current resources are insufficient for PHAs to productively engage in disaster planning. Together, findings from these studies inform tangible recommendations for PHAs, policy makers, federal and state-level agencies, and nonprofits to improve PHA DRM.

Chapter 2 described a content analysis of state-level disaster plans. The goal of this chapter was to identify if and how state-level disaster plans integrate PHA roles and responsibilities into disaster planning, including pre- and post-disaster activities and strategies, pre- and post-disaster partnerships and coordination, other agencies' collaboration with PHAs, and access and functional needs populations. Overall, roles and responsibilities were rarely assigned to PHAs within the collected disaster plans, demonstrating an urgent need for integrating PHAs in the disaster planning process. We also recommend that Disaster Housing Plans or other types of housing recovery plans be implemented at the state-level in collaboration with low-income housing providers.

Chapter 3 discussed the findings from semi-structured interviews with key informants, including PHA leaders, federal- and state-level housing officials, and housing non-profit staff. The goal of this chapter was to describe the barriers, facilitators, and opportunities for implementation of DRM strategies at PHAs. Our thematic analysis showed multiple barriers to PHA engagement in DRM, including financial and administrative hindrances, lack of policy, and lack of disaster training among PHA staff. However, past disaster experience, interagency partnerships, and designated DRM roles at PHAs were introduced as facilitators. We recommend

that PHA planning should include lessons learned from past disasters, joint DRM solutions (e.g., listening sessions, plans) should be developed between PHAs and federal agencies, and federal mandates for PHA disaster plans should be established, along with the necessary funding for PHAs to implement such strategies.

Chapter 4 provided a descriptive analysis of results from a nationwide survey disseminated to PHAs around DRM strategy implementation. In addition, secondary data on community- and organizational-level characteristics was used to calculate the association between each binary DRM strategy variable and each PHA characteristic. Findings from Chapter 4 suggest that PHA MTW status, PHA size, urban classification, state-level political affiliation, and perceived hazard risk influence PHA DRM implementation. We recommend that more flexible funding models, such as MTW, be researched further and considered as a policy strategy, as this may help PHAs to better engage in implementation of DRM strategies. Congress must dedicate monetary resources to HUD, so that PHAs are better positioned to implement effective technical assistance and education strategies around DRM. With the help of HUD, PHAs should also facilitate further relationships with local non-profits, as they can serve as a valuable DRM resource.

Lessons from this dissertation can collectively inform future studies on affordable housing disaster risk management to advance housing and disaster justice. Future studies can build on this research, and investigate how PHAs can improve long-term relationships with community partners and other PHAs to help improve DRM and disaster resilience. For example, prior to this dissertation work, no research explored how PHAs are collaborating with each other on climate change preparedness, yet in Chapter 3 interviews, PHAs shared that they would benefit from lessons other PHAs have learned from disasters. We specifically recommend that

future studies investigate how rural and/or smaller PHAs can combine resources to be more resilient as disasters increase in frequency and severity, as rural PHAs often lack resources and technical expertise (Greenlee et al., 2018).

Ultimately, PHAs lack the monetary resources that they require to effectively engage in DRM. Dedicated funding can open doors for educational training for staff and residents on DRM, staff hiring and retention, preparedness resources (e.g., generators, communication systems), and thus, an overall culture of disaster resilience. While some PHAs can use existing resources to carry out low-burden DRM strategies, such as partnership building and creation of internal work groups, this dissertation confirms that much of their ability to implement robust DRM strategies is contingent on appropriate funding. Thus, we recommend that Congress immediately dedicate the resources that HUD urgently needs to build more disaster-resilient affordable housing and invest in PHA DRM.

The U.S. is faced with a myriad of challenges as disasters exacerbate, including preventing climate displacement by keeping marginalized communities housed and healthy. As affordable housing organizations are confronted with existing and new climate change challenges, prioritizing disaster resilience is essential to protecting and advocating for low-income families who are dependent on federally-subsidized housing.

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## APPENDIX A

Total collected plans by state, plan type, year of plan, and the total number of plans

State	Plan Type	Year of Plan	# Plans
Alabama	EOP (includes ESF #6 and #14)	2022	3
Alaska	EOP (includes ESF #6 and #14)	2016	3
Arizona	EOP (includes ESF #6 and #14)	2019	3
Arkansas	Recovery Plan	2020	1
Arkansas	EOP (includes ESF #6)	2021	2
California	EOP	2017	1
California	ESF6	2022	1
California	Recovery Plan	2019	1
Colorado	EOP	2019	1
Colorado	Housing Recovery Plan	2021	1
Colorado	ESF6	No date	1
Connecticut	Recovery Plan	2019	1
Connecticut	EOP (includes ESF #6)	2019	2
Delaware	EOP	2019	1
Florida	Recovery Plan	2008	1
Florida	EOP (includes ESF #6)	2020	2

Georgia	EOP	2017	1
Georgia	ESF #14	2017	1
Georgia	ESF #6	2018	1
Hawaii	Recovery Plan	2019	1
Hawaii	EOP	2022	1
Hawaii	ESF #6	2022	1
Idaho	EOP (includes ESF #6 and #14)	2017	3
Illinois	Disaster Housing Plan	2021	1
Illinois	EOP	2021	1
Illinois	Recovery Plan	2021	1
Indiana	EOP (includes ESF #6)	2022	2
Iowa	Recovery Plan	2020	1
Iowa	EOP (includes ESF #6)	2022	2
Kansas	EOP (includes ESF #6 and #14)	2017	3
Kentucky	EOP (includes ESF #6 and #14)	2014	3
Louisiana	EOP (includes ESF #6 and #14)	2019	3
Maine	EOP (includes ESF #6 and #14)	2017	3

Maryland	EOP	2019	1
Massachusetts	EOP	2019	1
Massachusetts	ESF #14	2018	1
Massachusetts	Disaster Housing Plan	2015	1
Massachusetts	ESF #6	2018	1
Michigan	Recovery Plan	2014	1
Michigan	EOP	2019	1
Minnesota	EOP (includes ESF #6)	2015	2
Minnesota	Recovery Plan	2018	1
Mississippi	EOP	2022	1
Mississippi	ESF #6	2022	1
Montana	EOP	2022	1
Montana	ESF #6	2022	1
Nebraska	Recovery Plan	2020	1
New Hampshire	Recovery Plan	2015	1
New Hampshire	EOP (includes ESF #6)	2019	2
New Mexico	EOP (includes ESF #6 and #14)	(2013)	3
New York	ESF #6	2022	1
New York	EOP	2022	1

New York	Recovery Plan	2022	1
North Carolina	EOP (includes ESF #6)	2021	2
North Carolina	Recovery Plan	2020	1
Ohio	ESF #6	2020	1
Ohio	EOP	2021	1
Ohio	ESF #14	2018	1
Oklahoma	EOP (includes ESF #6 and #14)	2019	3
Oklahoma	Housing Recovery Plan	No date	1
Oregon	Disaster Housing Plan	2021	1
Oregon	EOP (includes ESF #6)	2017	2
Oregon	Recovery Plan	2018	1
Pennsylvania	EOP	2021	1
Rhode Island	EOP	2017	1
South Carolina	ESF #6	2022	1
South Carolina	EOP	2022	1
South Carolina	ESF #14	2022	1
Tennessee	EOP (includes ESF #6 and #14)	2018	3
Texas	ESF #6	2020	1

Texas	EOP	2020	1
Texas	Recovery Plan	2020	1
Utah	EOP (includes ESF #6 and #14)	2021	3
Vermont	ESF #6	2013	1
Vermont	EOP	2019	1
Vermont	Recovery Plan	2019	1
Virginia	EOP	2021	1
Virginia	Recovery Plan	2019	1
Washington	ESF #6	2016	1
Washington	EOP	2019	1
Washington	ESF #14	2019	1
West Virginia	ESF #6	2016	1
West Virginia	EOP	2016	1
Wisconsin	EOP (includes ESF #6)	2021	2
Wisconsin	Recovery Plan	2022	1
<b>Total Plans:</b>			119

## APPENDIX B

Summary of agencies contacted and interviewed, and total count of interviews and interviewees per type of agency

Agency type	Number of agencies contacted	Number of agencies interviewed	Number of interviews conducted	Total number of interviewees
PHA	27	9	9	12 <sup>b</sup>
State	5	2	2	3 <sup>c</sup>
Federal	3	1	2	2
Non-profit	9 <sup>a</sup>	2	2	3 <sup>d</sup>
<b>Total</b>	44	14	15	20

<sup>a</sup> Three of the nine nonprofits who were contacted were deemed to not meet inclusion criteria for the study after clarification

<sup>b</sup> One interview with PHA representatives included two interviewees and another included three interviewees

<sup>c</sup> One interview with state representatives included two interviewees

<sup>d</sup> One interview with non-profit representatives included two interviewees

## APPENDIX C

### **Assessing Public Housing Authority Disaster Risk Management Key Informant Interview Guide for Public Housing Authorities**

#### **Purpose of the Study**

We are conducting this research to understand the types of disaster risk management strategies being undertaken by Public Housing Authorities (PHAs), as well as barriers, facilitators, and opportunities for their implementation. In addition, we are interested in learning more about the external (e.g., financial resources) and internal (e.g., leadership) factors that influence PHA engagement in disaster preparedness, response, and recovery from your PHA's perspective.

#### **Study Procedures**

This study will consist of interviews with federal housing officials, PHA leaders, and affordable housing non-profit organizations' staff. Each interview will last approximately 30-45 minutes. We will not ask sensitive or personal questions during this interview; our questions focus on your organization's perspective about PHA disaster risk management.

Our study will result in a written report describing our findings. We will also share study findings through a policy memorandum that will be broadly distributed to PHAs and state and federal housing and disaster policymakers at FEMA, HUD, and state-level emergency management organizations. These reports will not include your name, organization, or any of your partner organization's information without your explicit written consent. Interview data that has been de-identified may be placed in a data repository for future research. Your name, organization, or contact information will not be associated with any data that is shared in such a repository or with other researchers. Despite these steps to protect your privacy and

confidentiality, it may be possible to deduce your identity or that of your organization based on your responses or other details that you share with us today.

Your participation is voluntary, meaning you may refuse to participate, and you can withdraw from this study at any time without penalty. There are minimal risks to participating in this research study, though it may be difficult to discuss past disaster experiences.

### **Questions**

Do you have any questions?

Do you consent to participate in this interview?

*We would like to audio record this interview to ensure we are accurately summarizing your responses in our final report. We will send this recording to a professional transcription service to transcribe the interview. Do you consent to have this interview recorded?*

**[turn recorder on]**

Pending consent: Great. We've turned the recorder on. State law requires us to document consent for recording. Can you please reconfirm that you consent to have this interview recorded?

### **Interview Guide**

First, we would like to learn more about your professional background, and your role and experience working within your organization.

1. Can you describe your role at your organization, and your experience with affordable housing or disaster-related work more broadly?
2. Can you describe the structure of your organization? *[Prompt: overall executive structure, housing programs operated, housing units/vouchers per program operated, the*

*number of full-time employees, age of organization, number of clients served annually on average]*

Thank you. Next, we'd like to get a better idea of your organization's disaster experiences and planning.

3. Has your organization experienced past disasters?

[If yes] Can you tell me more about your organization's experience during and after a past disaster? *[Prompt: magnitude of disasters, how units were affected and how many, how residents were affected and how many, what happened to residents, protocols that were used, interactions with community partners or federal agencies, aid received]*

4. [If they have experienced past disasters] [**Critical Incidents**] How do you think experience with past hazards or disasters influences your organization's engagement in disaster risk management?

5. Is your organization preparing for disasters?

a. [If yes] How is your organization preparing for disasters? What types of disaster risk management strategies are currently happening within your organization?

*[Prompt: joint planning meetings with local organizations; funding collaborations (grants/loans in place); past collaborations with other organizations/government; task forces; renovations on units to make them more resilient; mapping hazards; backup generators/moving hazards in units]*

b. [If no] What discussion has your organization had around planned or future engagement in work related to disaster risk management?

c. [If no discussion has been had] Why do you think these discussions haven't taken place? *[Prompt: no hazard risk, no experience with past disasters, no funding, no residential vulnerability, little bandwidth/capacity, low priority]*

6. **[Networks and Communications / Cosmopolitanism]** Can you tell me more about how your PHA collaborates with other government and community organizations to implement disaster risk management strategies? *[Prompt: embedded in emergency management structure, joint-level meetings, after-action reviews, partnerships to fill housing recovery need, involvement with other organizations like the Red Cross and local emergency management, collegiality among staff/leaders, direction from FEMA/HUD, work with other PHAs]*

- . How do you think PHAs in general should collaborate with other government and community organizations on disaster risk management?

7. **[External Policies and Incentives]** Can you tell me about the policies or regulations at the national, state, or local level that influence your organization's ability to work on disaster risk management? *[Prompt: Examples include financing programs for rehabilitation or development of affordable rental housing, etc]*

- . How do you think these policies and regulations influence implementation of disaster risk management more generally at PHAs?

8. **[Readiness for Implementation / External Policies and Incentives]** Can you tell me more about any resources your PHA needs in order to implement disaster risk management strategies? *[Prompt: Financial (past federal/non-federal disaster aid), staff, community support, disaster planning aids/technical assistance, resources for residential preparedness]*

- . *[Follow-up question]* Where does your PHA receive funding from? Are there any requirements for receiving that funding, such as having a disaster plan in place?

*[Prompt: Is funding consistent or does it fluctuate?]*

- b. What resources do you think PHAs in general need to support their disaster risk management?

**9. [Structural Characteristics]** Can you tell me more about how your PHA's organizational structure or characteristics influence your PHA's ability to implement disaster risk management strategies? *[Prompt: executive director/structure, social architecture, age, maturity, size, physical layout, funding sources/money]*

- . How do you think organizational structure or characteristics influence implementation of disaster risk management strategies more generally at PHAs?

**10. [Implementation Climate]** In light of other competing priorities, to what extent does your organization prioritize implementation of disaster risk management? *[Prompt: highest priority, not a priority at all]*

**11. [Readiness for Implementation]** Are there any other factors that influence your organization's work on disaster risk management? *[Prompt: hazard risk/past disasters; resources (funding, staff); needs of residents/residential vulnerability]*

- . Moving forward in disaster risk management for PHAs, what types of external changes would be helpful for your organization? How do you think PHAs should have a seat at the table in disaster risk management?

12. Do you have any additional comments or anything else you would like to share with me today regarding the topics we discussed?

This conversation has been very informative. Those are all the questions we have for you today.

Would you mind if we contacted you if we have additional follow-up questions?

We'll be sending you a summary of your interview for your feedback within two weeks by email, so that you can review and check our interpretation for accuracy and completeness. If you have any remaining questions that come up, you can contact me by email.

Thank you!

## APPENDIX D

### Codebook for qualitative interviews

Category	Code	Subcode	Definition
External factors	Outer Setting		Describes the setting in which the PHA exists. There may be multiple Outer Settings and/or multiple levels within the Outer Setting (e.g., community, state).
RQ2.1- What external and internal factors influence PHA preparedness, response, and recovery strategy implementation?		Critical Incidents	Describes large-scale and/or unanticipated events that can influence implementation and/or delivery of PHA disaster risk management strategies. May include pandemics, weather-related disasters, technological disasters, or political disruptions.
		Local Conditions	Describes economic, environmental, and/or political conditions external to the organization (e.g., PHA, housing non-profit, federal organization) that influence their implementation and/or delivery of PHA disaster risk management strategies. This can include externalities at the national, state, and/or local level.
		Partnerships and Connections	Describes linkages between the organization (e.g., PHA, housing non-profit, federal organization) and external entities (e.g., community partnerships, collaboratives, technical assistance organizations) that may influence implementation and/or delivery of PHA disaster risk management strategies. This may include unproductive relationships as well.
		Policies and Laws	Describes externally promulgated (governmental or other external entity) policies, regulations, rules, codes, mandates, recommendations, guidelines, directives, or accreditation requirements, and/or alignment of implementation and/or delivery of PHA disaster risk management strategies with these policies and laws. Can include policy recommendations for the future.
		Financing	Describes reimbursement, grants, and donations that influence implementation and/or delivery of PHA disaster risk management strategies. It also includes overall funding constraints regionally or nationally, distinct from local economic conditions (see local conditions).
		External Pressure	Describes any external pressure that influences implementation and/or delivery of PHA disaster risk management strategies. This encompasses federal, state, or social/community-level pressure.

Internal Factors	Inner Setting		Describes the setting in which PHA disaster risk management strategies are implemented (e.g., PHA, housing non-profit, federal organization).
		Structural Characteristics	Describes structural characteristics of the organization (e.g., PHA, housing non-profit, federal organization) itself, the housing units that they oversee, or the housing programs they run that influence implementation and/or delivery of PHA disaster risk management strategies. Can include physical infrastructure (layout and configuration of space and other material features), information technology infrastructure (technological systems for tele-communication, electronic documentation, and data storage, management, reporting, and analysis), and work infrastructure (organization of tasks and responsibilities within and between individuals and teams).
		Communications	Describes approaches that the organization (e.g., PHA, housing non-profit, federal organization) uses to communicate information within their organization that influence implementation and/or delivery of PHA disaster risk management strategies. Does not include any communication with clients.
		Culture	Describes the shared values, beliefs, and norms across the setting in which PHA disaster risk management strategies are implemented (e.g., PHA, housing non-profit, federal organization) that influence implementation and/or delivery of PHA disaster risk management strategies.
		Available Resources	Describes the resources that influence implementation and/or delivery of PHA disaster risk management strategies within and across the setting in which PHA disaster risk management strategies are implemented (e.g., PHA, housing non-profit, federal organization). This may include funding, staffing, physical space, and/or materials (e.g., vouchers) and equipment.
		Access to Knowledge and Information	Describes the internal guidance and/or training that influences implementation and/or delivery of PHA disaster risk management strategies within and across the setting in which PHA disaster risk management strategies are implemented (e.g., PHA, housing non-profit, federal organization).
	Recommendations		Describes any recommendations given by an organization (e.g., PHA, housing non-profit, federal organization) to influence implementation and/or delivery of PHA disaster risk management strategies. This may include explicit recommendations by the interviewee or recommendations inferred by the interviewer.

## APPENDIX E

Examples of identified PHA DRM strategies implemented by types of agencies, organized by themes

	<b>Disaster Preparedness Measures</b>	<b>Partnership Building</b>	<b>Disaster Recovery Strategies</b>	<b>Prioritization of PHA Residents &amp; Staff</b>
<b>PHAs</b>	<p>Perform building renovations and buy insurance for units</p> <p>Run DRM tabletop exercises</p> <p>Implement disaster plans</p> <p>Create internal disaster task forces to discuss plans and lessons learned</p> <p>Establish a permanent DRM role</p>	<p>Collaborate with local and state organizations for resources and training</p> <p>Share lessons learned and disaster plans with other PHAs</p>	<p>Provide Section 8 vouchers to displaced residents and PHAs in neighboring states</p> <p>Create after action reviews with lessons learned</p> <p>Educate staff on applying for post-disaster aid</p>	<p>Implement policies to ensure that staff are safe in a disaster</p> <p>Incorporate equity and inclusivity into planning</p> <p>Maintain residential statistics, such as health issues and location</p> <p>Alleviate residential challenges by adding mobility chairs, backup power, cash supplies</p> <p>Ensure that executive director is supportive of DRM</p>
<b>Local governmental &amp; non-governmental agencies</b>	<p>Include a PHA seat in local emergency management committee</p> <p>Provide preparedness grants to PHAs</p>	<p>Provide resources to PHAs (e.g., buses for evacuation, DRM training, vaccinations)</p> <p>Create cross-agency disaster task forces</p>		
<b>State government agencies</b>	<p>Require PHAs to make infrastructure improvements during post-disaster reconstruction</p>	<p>Provide donations to PHAs for DRM supplies</p>	<p>Identify and organize available units for displaced residents</p>	
<b>Federal government agencies</b>	<p>Transition PHAs to Section 8/MTW</p>	<p>Engage with PHAs regularly to ensure that they are kept informed</p> <p>Provide hazard-specific trainings to PHAs</p> <p>Incentivize PHAs to implement DRM with technical assistance</p>	<p>Convert housing assistance payments for destroyed units to vouchers</p> <p>Set up and work at disaster recovery centers to identify displaced households</p>	

## APPENDIX F

### Survey Tool

1. Your participation is voluntary and you can end the survey at any time. There are minimal risks to participating in this research study and no known benefits. Your name, contact information, or organization will not be associated with any data that is stored in a data repository. All data will be aggregated and we will not publish individual responses.

Do you consent to participate in this survey?

[Yes] [No] (If “No” discontinue survey)

2. What is your PHA’s name?  
[Fill in the blank]
3. Is your PHA engaged in any disaster risk management activities? This includes any disaster mitigation, preparedness, response, or recovery activities.  
[Yes] [No] [Don’t know]
4. [If “Yes” to #3]: Is your PHA currently engaged in any of the following disaster risk management activities?
  1. Emergency/disaster plans in place [Yes] [No] [Don’t know]
  2. PHA staff or department dedicated to risk/emergency management [Yes] [No] [Don’t know]
  3. Dedicated funding for emergencies/disasters [Yes] [No] [Don’t know]
  4. Other [Fill in the blank]

4. [If “Yes” to 4.1] Please check which of the following emergency or disaster plans that your PHA has in place

- Emergency Operations Plan
- Business Continuity Plan
- Hazard-specific Plan(s)
- Other [Fill in the blank]

5. [For all responses to #3]: Please answer the following questions about your PHA’s engagement in disaster risk management activities:

- Is your PHA at risk of experiencing impacts from disasters/hazards? [Yes] [No] [Don’t know]
- Is your PHA currently recovering from a past disaster? [Yes] [No] [Don’t know]

- Does your PHA have partnerships (e.g., local, state, federal) that support disaster risk management? [Yes] [No] [Don't know]
- Does your PHA experience barriers or challenges when working with external partners on disaster risk management? [Yes] [No] [Don't know]
- Do local/state/federal direction or mandates for disaster risk management hinder your PHA's engagement in disaster risk management? [Yes] [No] [Don't know]
- Does your PHA have authority to implement disaster risk management strategies? [Yes] [No] [Don't know]
- Does your PHA have a disaster risk management department and/or role? [Yes] [No] [Don't know]
- Does your PHA prioritize engagement in disaster risk management? [Yes] [No] [Don't know]
- Does your PHA have adequate financial resources/funding available to engage in disaster risk management? [Yes] [No] [Don't know]
- Does your PHA have adequate staff/technical capacity to engage in disaster risk management? [Yes] [No] [Don't know]

## APPENDIX G

Although “Do not know” responses were not included in the statistical analysis, they are included in the table below to provide an overview of survey respondents’ knowledge around implementation of the six PHA DRM strategies measured in this study. Most “Do not know” responses were concentrated among three DRM strategies: having adequate staff and/or technical capacity to engage in DRM (25%); having adequate financial resources to engage in DRM (37%); and having partnerships in place to support DRM (23%).

“Do not know” response count, organized by DRM implementation strategies (n= 282)

	<b>Dedicated disaster funding</b>	<b>Disaster plan(s) in place</b>	<b>Adequate staff and/or technical capacity</b>	<b>Adequate financial resources</b>	<b>DRM department and/or role</b>	<b>Partnerships</b>
<b>Total</b>	5.0%	1.1%	24.8%	37.2%	8.9%	23.0%
<b>PHA Size</b>						
Extra Large (5,000+)	1.4	0	0.7	1.8	0	0.7
Large (1,000-4,999)	1.8	0	6.4	7.1	1.1	3.2
Medium High (300-999)	1.4	0	5.7	7.8	3.2	2.5
Medium Low (100-299)	0.35	0.35	6.7	9.6	2.5	7.1
Small (50-99)	0	0.7	2.5	5.0	1.4	2.8
Very Small (0-49)	0	0	2.8	6.0	0.7	6.7
<b>MTW Status</b>						
MTW Status	0.35	0	0.35	0.7	0	0.35
No MTW Status	4.6	1.1	24.5	36.5	8.9	22.7
<b>OMB Urban Classification</b>						
Rural	0.35	0.7	7.1	13.1	2.5	9.2
Micropolitan	0.35	0	3.9	6.4	1.4	4.3

Metropolitan	4.3	0.35	13.8	17.7	5.0	9.6
<b>Political Affiliation</b>						
Republican	1.8	0.35	15.2	20.6	4.3	10.3
Democratic	3.2	0.7	9.6	16.7	4.6	12.8
<b>Perceived Hazard Risk</b>						
Yes	2.8	0.7	9.9	16.7	4.6	5.0
No	1.8	0	8.9	12.1	1.8	11.3
Do not know	0.35	0.35	6.0	8.5	2.5	6.7

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## APPENDIX H

### Status of six DRM strategies by PHA size, MTW status, OMB Urban Classification, Political Affiliation, and Perceived Hazard Risk, including “Yes” and “No” responses

Status of PHA dedicated disaster funding by PHA size, MTW status, OMB Urban Classification, Political Affiliation, and Perceived Hazard Risk (n= 196)

	Dedicated disaster funding n (%)	No dedicated disaster funding n (%)	p-value
<b>Total</b>	35 (17.9%)	161 (82.1%)	
<b>PHA Size</b>			<b>0.05*</b>
Extra Large (5,000+)	8 (4.1)	11 (5.6)	
Large (1,000-4,999)	9 (4.6)	43 (21.9)	
Medium High (300-999)	6 (3.1)	54 (27.6)	
Medium Low (100-299)	7 (3.6)	25 (12.8)	
Small (50-99)	4 (2.0)	16 (8.2)	
Very Small (0-49)	1 (0.51)	12 (6.1)	
<b>MTW Status</b>			<b>0.005***</b>
MTW Status	6 (3.1)	5 (2.6)	
No MTW Status	29 (14.8)	156 (79.6)	
<b>OMB Urban Classification</b>			0.40
Rural	3 (1.5)	24 (12.2)	
Micropolitan	4 (2.0)	29 (14.8)	
Metropolitan	28 (14.3)	108 (55.1)	
<b>Political Affiliation</b>			0.85
Republican	16 (8.2)	77 (39.3)	
Democratic	19 (9.7)	84 (42.9)	
<b>Perceived Hazard Risk</b>			1.0
Yes	27 (13.8)	122 (62.2)	

No 8 (4.1) 39 (19.9)

\*Significant at p<0.1  
 \*\*\*Significant at p<0.05

Status of PHA disaster plan implementation by PHA size, MTW status, OMB Urban Classification, Political Affiliation, and Perceived Hazard Risk (n= 207)

	Disaster plan(s) in place n (%)	No disaster plan(s) in place n (%)	p-value
<b>Total</b>	182 (87.9%)	25 (12.1%)	
<b>PHA Size</b>			0.74
Extra Large (5,000+)	20 (9.7)	3 (1.4)	
Large (1,000-4,999)	47 (22.7)	9 (4.3)	
Medium High (300-999)	59 (28.5)	5 (2.4)	
Medium Low (100-299)	29 (14.0)	4 (1.9)	
Small (50-99)	15 (7.2)	3 (1.4)	
Very Small (0-49)	12 (5.8)	1 (0.48)	
<b>MTW Status</b>			1.0
MTW Status	11 (5.3)	1 (0.48)	
No MTW Status	171 (82.6)	24 (11.6)	
<b>OMB Urban Classification</b>			0.22
Rural	20 (9.7)	6 (2.9)	
Micropolitan	31 (15.0)	3 (1.4)	
Metropolitan	131 (63.3)	16 (7.7)	
<b>Political Affiliation</b>			0.53
Republican	87 (42.0)	10 (4.8)	
Democratic	95 (45.9)	15 (7.2)	
<b>Perceived Hazard Risk</b>			0.81
Yes	137 (66.2)	18 (8.7)	

No	45 (21.7)	7 (3.4)
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\*Significant at p<0.1

\*\*\*Significant at p<0.05

Status of adequate PHA staff and/or technical capacity for engagement in DRM by PHA size, MTW status, OMB Urban Classification, Political Affiliation, and Perceived Hazard Risk (n=429)

	Adequate staff and/or technical capacity n (%)	No adequate staff and/or technical capacity n (%)	p-value
<b>Total</b>	137 (31.9%)	292 (68.1%)	
<b>PHA Size</b>			0.22
Extra Large (5,000+)	8 (1.9)	19 (4.4)	
Large (1,000-4,999)	29 (6.8)	58 (13.5)	
Medium High (300-999)	43 (10.0)	67 (15.6)	
Medium Low (100-299)	26 (6.1)	70 (16.3)	
Small (50-99)	19 (4.4)	34 (7.9)	
Very Small (0-49)	12 (2.8)	44 (10.3)	
<b>MTW Status</b>			0.34
MTW Status	5 (1.2)	6 (1.4)	
No MTW Status	132 (30.8)	286 (66.7)	
<b>OMB Urban Classification</b>			0.51
Rural	27 (6.3)	71 (16.5)	
Micropolitan	26 (6.1)	58 (13.5)	
Metropolitan	84 (19.6)	163 (38.0)	
<b>Political Affiliation</b>			1.0
Republican	67 (15.6)	144 (33.6)	

Democratic	70 (16.3)	148 (34.5)	
<b>Perceived Hazard Risk</b>			0.60
Yes	80 (18.6)	162 (37.8)	
No	57 (13.3)	130 (30.3)	

\*Significant at p<0.1

\*\*\*Significant at p<0.05

Status of adequate PHA financial resources available for engagement in DRM by PHA size, MTW status, OMB Urban Classification, Political Affiliation, and Perceived Hazard Risk (n=401)

	Adequate financial resources n (%)	No adequate financial resources n (%)	p-value
<b>Total</b>	149 (37.2%)	252 (62.8%)	
<b>PHA Size</b>			0.52
Extra Large (5,000+)	8 (2.0)	16 (4.0)	
Large (1,000-4,999)	28 (7.0)	55 (13.7)	
Medium High (300-999)	37 (9.2)	68 (17.0)	
Medium Low (100-299)	38 (9.5)	50 (12.5)	
Small (50-99)	16 (4.0)	36 (9.0)	
Very Small (0-49)	22 (5.5)	27 (6.7)	
<b>MTW Status</b>			0.18
MTW Status	6 (1.5)	4 (1.0)	
No MTW Status	143 (35.7)	248 (61.8)	
<b>OMB Urban Classification</b>			0.88
Rural	33 (8.2)	53 (13.2)	
Micropolitan	27 (6.7)	51 (12.7)	
Metropolitan	89 (22.2)	148 (36.9)	
<b>Political Affiliation</b>			0.53

Republican	77 (19.2)	121 (30.2)	
Democratic	72 (18.0)	131 (32.7)	
<b>Perceived Hazard Risk</b>			0.35
Yes	78 (19.4)	145 (36.2)	
No	71 (17.7)	107 (26.7)	

\*Significant at p<0.1  
 \*\*\*Significant at p<0.05

Status of PHA DRM department and/or role in place by PHA size, MTW status, OMB Urban Classification, Political Affiliation, and Perceived Hazard Risk (n= 464)

	DRM department and/or role n (%)	No DRM department and/or role n (%)	<i>p</i> -value
<b>Total</b>	99 (21.3%)	365 (78.7%)	
<b>PHA Size</b>			<b>6.8e-05***</b>
Extra Large (5,000+)	14 (3.0)	15 (3.2)	
Large (1,000- 4,999)	25 (5.4)	73 (15.7)	
Medium High (300-999)	29 (6.2)	89 (19.2)	
Medium Low (100-299)	20 (4.3)	83 (17.9)	
Small (50-99)	8 (1.7)	47 (10.1)	
Very Small (0-49)	3 (0.65)	58 (12.5)	
<b>MTW Status</b>			<b>7.7e-04***</b>
MTW Status	8 (1.7)	4 (0.86)	
No MTW Status	91 (19.6)	361 (76.1)	
<b>OMB Urban Classification</b>			<b>6.9e-04***</b>
Rural	12 (2.6)	95 (20.5)	
Micropolitan	14 (3.0)	76 (16.4)	

Metropolitan	73 (15.7)	194 (41.8)	
<b>Political Affiliation</b>			0.37
Republican	46 (9.9)	190 (40.9)	
Democratic	53 (11.4)	175 (37.7)	
<b>Perceived Hazard Risk</b>			<b>5.9e-04***</b>
Yes	70 (15.1)	187 (40.3)	
No	29 (6.2)	178 (38.4)	

\*Significant at p<0.1

\*\*\*Significant at p<0.05

Status of PHA partnerships in place that support DRM by PHA size, MTW status, OMB Urban Classification, Political Affiliation, and Perceived Hazard Risk (n= 436)

	Partnerships n (%)	No partnerships n (%)	p-value
<b>Total</b>	288 (66.1%)	148 (33.9%)	
<b>PHA Size</b>			<b>1.5e-04***</b>
Extra Large (5,000+)	23 (5.3)	4 (0.92)	
Large (1,000- 4,999)	73 (16.7)	20 (4.6)	
Medium High (300-999)	80 (18.3)	39 (8.9)	
Medium Low (100-299)	58 (13.3)	37 (8.5)	
Small (50-99)	34 (7.8)	20 (4.6)	
Very Small (0-49)	20 (4.6)	28 (6.4)	
<b>MTW Status</b>			0.76
MTW Status	8 (1.8)	3 (0.69)	
No MTW Status	280 (64.2)	145 (33.3)	
<b>OMB Urban Classification</b>			<b>3.2e-05***</b>

Rural	45 (10.3)	47 (10.8)	
Micropolitan	51 (11.7)	34 (7.8)	
Metropolitan	192 (44.0)	67 (15.4)	
<b>Political Affiliation</b>			<b>0.01***</b>
Republican	137 (31.4)	89 (20.4)	
Democratic	151 (34.6)	59 (13.5)	
<b>Perceived Hazard Risk</b>			<b>4.2e-07***</b>
Yes	194 (44.5)	62 (14.2)	
No	94 (21.6)	86 (19.7)	

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\*Significant at  $p < 0.1$

\*\*\*Significant at  $p < 0.05$