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The influence of risk perception on disaster recovery: A case study of new Jersey families impacted by hurricane sandy

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Abstract

Introduction: Risk perceptions of extreme weather events have been explored extensively through the lens of emergency preparation, but the influence of pre-storm risk perceptions on resilience and recovery trajectories are understudied. The objective of this qualitative analysis is to explore 1) the factors which shape residents' perception of risk prior to an event, and 2) how these factors contribute to 'sensemaking,' after the storm to influence experiences of recovery.

Methods: Eight focus groups and ten in-depth interviews (N = 38) from the Hurricane Sandy Child Impact Study were analyzed using grounded theory. The sample comprised of New Jersey residents who experienced housing damage or displacement during Hurricane Sandy. Verbatim transcripts were coded using iterative phases of open, axial, and selective coding.

Results: Grounded theory analysis identified three major themes: 1) Local ecological knowledge and place-based intergenerational memory shaped respondents' initial risk perceptions, their framing of the event, and its consequences; 2) Unclear institutional decision-making complicated recovery planning and actions; 3) Inaccurate pre-storm risk perceptions led to traumatic memories and decreased self-efficacy in managing recovery. This mismatch in perception and outcome led participants to feel that they had been ill-informed before and during the storm and created skepticism of government recommendations and services during the recovery phase.

Conclusions: Local ecological knowledge and intergenerational memory are critical factors that shape pre-storm risk perception and can subsequently influence trust in officials, service utilization, and perceptions of recovery. Themes identified in this analysis suggest the need for future longitudinal research to investigate the extent to which pre-storm risk perception is predictive of post-disaster recovery and resilience.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Kathleen A. Lynch: Conceptualization, Formal analysis, Methodology, Software, Validation, Writing - original draft, Writing - review & editing, Data curation. **David M. Abramson:** Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing - original draft, Writing - review & editing. **Alexis A. Merdjanoff:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Writing - original draft, Writing - review & editing.

Keywords

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1. Introduction

Anthropogenic climate change threatens an increase in the frequency and severity of extreme weather events, making the study of risk perception—understanding how individuals and communities identify and anticipate future threats to health and well-being—a critical component of disaster mitigation. From a constructivist perspective, risk perception can be conceptualized as a process of *sensemaking*, one which is informed by the social and physical environment, past experience, and trustworthiness of sources [1-3]. In other words, one's sense of risk is constructed through the perceived legitimacy of information, a continuous process of meaningmaking within a specific social context [1,3]. In disaster research, this perspective has been used to understand pre-event prevention behavior, such as individual evacuation decisions [4,5] and organizational climate adaptation strategies [6,7]; the mechanisms through which we navigate and "sense" the challenges ahead [8]. However, as Weick and colleagues [9] argue, sensemaking is also an "ongoing retrospective development," (pg. 409) as much a process of looking backward as anticipating the future. Thus, while the study of risk-*as*-sensemaking may tell us valuable information about future-oriented attitudes (and subsequent preparedness behaviors), it may also provide insight into how individuals process and attribute their pre-event experiences to post-event scenarios, shaping their recovery experiences.

A constructivist, risk-*as*-sensemaking framework—where perception is influenced by our experience and knowledge of the local environment—suggests that disaster risk perception may be informed by resident place attachment [10]. Place attachment, the emotional and affective bond between the people and places they reside, encompasses both one's sense of identity and memories tied to a place [11] and one's perceived ability of a place to provide for their needs [12]. Recent research suggests that place attachment plays a prominent role in shaping sense of future environmental risks [13-15]. In certain contexts, strong place attachment can enhance pre-disaster preparedness, sensitizing individuals and communities to changes in their environment to foster preventative action, such as creating a wildfire emergency preparedness plan [16] or supporting coastal marshland restoration efforts [15].

However, place attachment may also undermine sense of risk, particularly when, in the words of Scannell and colleagues [10] "places appear to provide a false sense of security from disasters" (pg.162). This 'sense of security' does not necessarily stem from a *lack* of exposure to disaster, but perception of that place's ability to *endure* those exposures, both physically and socially. For instance, in an ethnographic study of post-Katrina New Orleans, DeVries (2011) writes how residents' repeated exposure to previous severe weather events (e.g., Hurricane Betsy) enhanced their sense of capacity to endure future storms, "tak [ing] the event not as a warning, but instead as evidence that the 'Big One' could be weathered as well" [17] (pg. 155). These feelings left residents ill-prepared, both psychologically and

materially, for Katrina's impact. Just as evidence from study of earthquake, flood, tornado, volcano, and other environmental hazards suggests that those who experience higher levels of casualty and damage from an event are more likely to adopt future risk-reducing behaviors [18], individuals who experience “near-miss” events may reduce their likelihood of future evacuation and event preparedness in that same locale, mistaking “good fortune as an indicator of resiliency” [19]: 440; [5]. Thus, risk-*as*-sensemaking—taking into account previous experiences and attachment to place—has the potential to play a key role in how residents perceive and respond to disaster.

Sensemaking is an ongoing process predicated on “retrospective development,” [3,9] suggesting that the extent to which individuals perceive risks prior to an event may also shape their experiences of recovery. Holding low pre-storm risk perceptions may impede individuals’ ability to “make sense of” the event, lowering resilience, conceptualized by Hobfoll and colleagues (2015) as the ability to access and mobilize key resources to support post-event recovery [20]. Given that risk perceptions may be shaped by sources we regard as trusted and believable [1,3] such as local representatives or emergency managers, a mismatch between pre-event risk perception and subsequent impacts may impede trust in those same sources during the recovery process. In other words, both the internal attributions (“I made the wrong decision”) and external attributions (“I was misinformed”) present in post-event sensemaking [21] may affect the extent to which individuals engage with recovery services, as internal attributions may lower self-efficacy, and external attributions may negatively impact institutional trust.

Given the dual temporality of risk perception—a process which draws on retrospective, experiential knowledge with the potential to shape future decisions—the question of risk-*as*-sensemaking becomes twofold: 1) To what extent are the aspects of sensemaking, including previous experiences of the environment and engagement with trusted sources, salient for informing disaster risk perception? and 2) How does this process shape experiences of disaster recovery?

1.1. Case study: Examining hurricane sandy risk perception and recovery experiences

Hurricane Sandy—the strongest and most destructive storm of the 2012 Atlantic hurricane season—provides a valuable case study for understanding the interplay between risk-*as*-sensemaking and its role in shaping disaster recovery experiences. Two days before Sandy reached the New Jersey shore on October 29th, coastal jurisdictions along the state—an area impacting approximately 240,000 individuals—were placed under mandatory evacuation orders by the Governor of New Jersey [22]. The following evening, the National Hurricane Center issued an advisory that Sandy would bring “life-threatening storm-surge flooding to the Mid-Atlantic Coast” [23]:5). Yet despite warnings about the storm's intensity from state and county-level political leaders, emergency managers, and local weather reports disseminated on television, the radio, and social media, many New Jersey residents did not evacuate [24]. According to the 2014 New Jersey Behavioral Risk Factor Survey, approximately 13% of the state's adult population evacuated their homes [22] and 72% of residents in mandatory evacuation zones chose to remain at home [25], suggesting that

many residents did not anticipate the catastrophic damage brought to coastal New Jersey by Sandy's wind and storm surge.

The unfolding of Hurricane Sandy for residents in the New York-New Jersey area also provides a useful context for understanding the role of "near-miss" phenomena in shaping risk perception [24,26,27]. After experiencing the "near miss" of Hurricane Irene in 2011, a storm forecast to make landfall as a Category 3 or higher storm but which ultimately resulted in only minor flooding, many residents attributed Sandy evacuation notices as an "overreaction," and took local government communications less seriously [26]:6). In a study of 1000 New Jersey residents post-Sandy, a significant proportion of participants questioned whether the storm would actually make landfall, and if it did, thought that the damage would be minimal [24]. This supports other research suggesting that many New Jersey residents had mis-assessed the risk posed by Sandy. A telephone survey of mid-Atlantic residents on storm perceptions 72 to 48 hours before Sandy's predicted landfall found that individuals perceived the greatest threat to be from hurricane-force winds and underestimated the threat from water [27]. For New Jersey residents, this may in part be attributed to the limited coastal flooding produced by Irene. Reinforcing these perceptions was the fact that Sandy's projected windspeeds met the threshold for the Category 1 Hurricane, less "severe" than Irene's Category 3 status. A qualitative analysis of tweets posted in the New York City area during Sandy found that risk perceptions were not continuously elevated even as the hurricane advanced, suggesting that other factors such as previous social and environmental cues had a larger influence on shaping notions of risk, rather than reports of storm strength and severity [28].

Beyond evacuation decisions, the case of Hurricane Sandy also allows us to examine the role of pre-storm risk perceptions on residents' "retrospective development" of events, and the consequences this may have on post-storm resilience and recovery trajectories. A recent analysis found that individuals who owned their home at the time of Sandy were more likely to have internal attributions of responsibility after the storm (i.e., harboring feelings of individual blame for negative consequences of the storm), and those who did not evacuate experienced "defensive attribution" assigning blame to external communications and systems [21]. The study also found that those who reported direct (e.g. lived in a location with an evacuation order, suffered any personal losses) or indirect experience with Sandy (e.g. know friends, family, or coworkers who suffered losses) held greater risk perceptions regarding a future storm [21].

1.2. Objective

This study uses Hurricane Sandy as a case study to examine the salience of risk perception, specifically risk-*as*-sensemaking, in the experience of disaster recovery. Using qualitative data collected from the Hurricane Sandy Child Impact Study (2017), the present analysis will explore: 1) the factors which shaped residents' perception of risk prior to the event, and 2) how these contributed to sensemaking after the storm to influence experiences of recovery. Given the potential mismatch between official communications and evacuation behavior, this study will pay particular attention to the ways in which perceptions of incorrect information shaped subsequent recovery behaviors and engagement with services.

Further, the emerging evidence that place attachments may mediate the relationship between environmental risk perception and preventive coping behaviors [10,14,29] suggests that understanding resident ecological memory and “primacy of experience” [17] may yield important insights into not only how communities recover after disaster, but how they may respond to future events.

2. Materials and methods

The present study is a grounded theory analysis [30] of eighteen focus groups and in-depth interviews conducted among New Jersey residents who experienced housing damage or displacement during Hurricane Sandy. The data were collected as part of the 2017 Child Impact Study funded by the New Jersey Department of Children and Families (DCF), a qualitative follow-up to The Sandy Child and Family Health (S-CAFH) study. S-CAFH is part of a portfolio of research conducted on behalf of the New Jersey State Department of Health to inform the agency's understanding of how a catastrophic event such as Hurricane Sandy can have short-term and long-term effects on children and families. (See Merdjanoff et al. [31] for additional detail on the sampling strategy for the overall S-CAFH study).

Focus group participants were recruited through broadcast email announcements, mass canvasing, local radio advertisements, and state-wide networks, to identify children and families who both had significant storm damage and mental health impacts from Sandy. Over 8000 unique emails were sent to DCF partners (i.e., Family Success Centers, domestic violence agencies, and counseling providers), other DCF affiliates, Shared Learning Collaborative participants, long-term recovery groups, over 900 Rutgers University MSW field placement agencies, the NJ Eagle Scout organization, and the listserv of the Climate Change Institute at Rutgers. In addition, the Mental Health Association of New Jersey distributed the email to all of its employees across the state. Social media efforts included posts on faculty and Rutgers University's Facebook pages, as well as banner placement on NJ.com. Canvassing teams distributed flyers directly and at post offices, libraries, community centers, and small businesses in Little Ferry, Moonachie, Union Beach, Keansburg, Keyport, Atlantic Highlands, Highlands, Sea Bright, Monmouth Beach, Oceanport, Long Branch, Asbury Park, and Red Bank. These recruitment efforts resulted in eight focus groups (range N = 3–7), geographically dispersed throughout the state. Focus groups were divided among parents, young adults, and teens.

Analysis of S-CAFH survey data revealed that children living in households which experienced minor damage had higher odds of emotional distress and sleeping problems than children living in homes with major damage [25]. Therefore, in addition to focus groups, the research team conducted ten in-depth interviews with parent-child dyads to explore families’ recovery experiences and contextualize these differences. The Institutional Review Board at New York University and Rutgers University approved the study. All participants completed verbal and/or written consent before participating in the study.

2.1. Measures

Both focus group and interview protocols followed a semi-structured interview guide to cover the same topics. The protocol focused on four themes centered on their exposure to

Sandy; consequences of exposure; response and recovery effort; and current recovery status. These themes were developed from S-CAFH survey findings on those highly affected by the storm in order to have respondents expand upon their perceptions and experiences of Sandy, and included broader questions along with several probes in order to obtain detailed experiences and perspectives.

All focus groups and interviews were conducted with trained members of the research team and lasted approximately 60 min. Focus groups and interviews were audio recorded and transcribed by a professional service.

2.2. Analysis

The authors used a grounded theory [30] approach to guide the analyses. Transcriptions were uploaded to Dedoose for qualitative coding and analysis. A subset of transcripts (n = 5) were independently open-coded to generate a list of initial codes. The codebook was refined through periodic consensus meetings and was used to code the remaining transcripts. A set of codes were developed specifically to capture dimensions of risk and recovery perceptions, including, “expectations of damage” “assessment/surprise by damage” “expectations of storm” “perceptions of risk” “preventative actions” “changed sense of place” “sense of the future” “evacuation decision (influences)” “frustration with decisions.” Following coding, team members completed a process of axial and selective coding, which involved a constant comparison of annotated code categories, analyzing code density, and re-reading all excerpts that fell within the most used codes to facilitate the identification of primary themes. In addition, the first author (KL) completed a secondary analysis of excerpts housed within selected pre-existing code categories (“memorable experience, evacuation”) that had been previously developed as part of the larger S-CAFH study, holding regular consensus discussions with the senior author (AM) on emergent themes. After all transcripts had been coded, the authors held consensus meetings to identify primary and divergent themes.

3. Results

A total of 38 participants participated in focus groups and interviews, drawn from highly impacted areas of New Jersey referred to by the study team as the ‘Disaster Footprint’ (see Ref. [31] for more information on the sampling approach used to create the disaster footprint). The ‘Disaster Footprint’ is a representative sample of the coastal residential areas within the nine most impacted New Jersey counties *directly* exposed to Hurricane Sandy (e.g., housing damage at the census block group level), an area which covers roughly 14% of New Jersey's geography represents approximately 12% of the state population. Focus group and interview participants resided in New Jersey coastal towns which sustained high levels of flooding and housing damage as a direct result of the event, including Hasbrouck Heights, Eatontown, and Toms River. The SCAFH Briefing Report (2015) contains demographic detail about residents of the ‘Disaster Footprint,’ who are majority non-Hispanic white (75.8%), middle-aged (55.7% between the ages of 36 and 64) and middleincome, with only 10% of residents living in households earning less than $20,000 per year [25]. Analysis of focus group and interview transcripts revealed several themes and sub-themes related

to the formation of hurricane risk perception, emotions experienced during Sandy and its immediate aftermath, and how this sensemaking influenced their perceptions of the recovery process. Explored in detail below, the following themes and sub-themes (Table 1) illuminate the ways in which New Jersey residents' risk perceptions prior to Sandy framed their perceptions and experiences of recovery in the subsequent weeks and years: 1) Local ecological knowledge and place-based intergenerational memory shaped respondents' initial risk perceptions, their framing of the event, and its consequences; 2) Unclear or ambiguous institutional decision-making complicated recovery planning and actions; and, 3) Inaccurate prestorm risk perceptions led to traumatic memories and decreased self-efficacy in managing recovery. As described below, official communication played a role in shaping resident risk perceptions, but these communications were filtered through both local ecological knowledge and place-based intergenerational memory of homeownership, two major components of sensemaking which shaped residents' sense of security.

3.1. Risk-as-sensemaking: Local ecological knowledge and place-based intergenerational memory shapes pre-storm risk perceptions

During focus groups and interviews, participants described low expectations of the storm's severity. While many anticipated minor inconveniences—such as basement flooding or brief electricity loss—many did not expect extensive property damage. This underestimation partly stemmed from recent environmental memory: in the preceding years, Atlantic hurricanes—such as Hurricanes Irene and Floyd— had reduced in windspeed and severity by the time of landfall in the Northeastern United States. As one participant described, recent hurricane experiences led to a sense that Sandy would progress similarly:

> [Hurricane] Floyd was, the water was licking at the front lawn, but it didn't come in, and neither did Irene the year before. So, some people had two feet in water for Irene, if they stepped down into their basement, and they repaired everything, and a year later, here comes Sandy, and this time they have all of their valuables in containers and they said ‘well, nothing will get ruined.’ Didn't realize that they'd become buoyant and turn over. And now all the water was leaking in. So, people lost pictures and all of that.
>
> (Hasbrouck Heights Focus Group 1)

As the above excerpt demonstrates, expectations of Sandy's impact on their home were informed by experiences with previous hurricanes in the region, influencing how residents prepared for the upcoming storm. By underestimating the potential for damage despite official communications, some residents felt that they had left their home and valued belongings vulnerable to the storm's effects. One mother recounted how she moved her and her son's belongings to areas she had assumed were safe from flooding:

> Because I have a split-level ranch, so we thought okay the water is going to keep in through the bottom level. We thought let’s get all the furniture up to the mid-level. We were all of us, my son’s bedroom is down there. We got everything out. We were like, ‘Let’s bring it up to the mid-level, it’s not going to hit up this high.’ Then all of a sudden, we all go to the top of the stairs and watch it come pouring in the

> window. I said, ‘Oh my God, there goes everything.’ The only floor that was saved was upstairs.
>
> (Toms River Focus Group 2)

In this case, the family had prepared for Sandy based on memories of how their home had weathered previous storms. To find that their assessment was incorrect, and damage had occurred despite preparations, lead to disheartening feelings that they “could have done more,” which persisted during recovery. Similar to the story above, homeowners’ risk perceptions were shaped by knowledge and confidence in the architecture and stability of their own home. Some participants described living in the neighborhood for generations, in homes that had weathered previous storms. This intergenerational memory of coastal homeownership facilitated confidence in their own pre-storm risk perceptions. When sharing their most vivid memory of Sandy, one participant described their shock that floodwaters had entered their home:

> When the water started seeping in the front door, and there was never water, and my parents owned the house from 1956. And there was never water, I bought that home from my siblings in 1982, so it was quite literally almost 30 years to the day of me purchasing with my ex-husband. And there was never any water and we weren’t expecting to get water that day. We were expecting to just have high wind. And that’s what we were anticipating.
>
> (Hasbrouck Heights Focus Group 1)

Another participant shared a similar sentiment, drawing upon local ecological memory and the intergenerational nature of neighborhood homeownership to predict storm severity.

> Whereas my husband was saying, “We’re going to get this much water.” I’m like, “Not possible, your grandparents lived here.” There’s no way. There’s never been a storm of this capacity. Listening to my father-in-law and he’s like, ‘NOAA [the National Oceanic and Atmospheric Administration] says it’s going to go out to sea.’ It didn’t, it made a 90° turn and hit us. We’re literally three minutes from the middle of Mantoloking Bridge, by boat. That’s why. We lived in a ranch bungalow and there was over five foot of water inside the house and it blew out the back wall.
>
> (Toms River Focus Group 1)

Recounting their anticipation and experience of Sandy's impacts, the excerpts above demonstrate the ways in which residents drew upon their own knowledge and intergenerational memory of the local environment and previous event experience to make sense of their risks.

3.1.1. Trusted sources: Mandatory evacuation zones influenced risk perceptions prior to sandy—

The above anecdote (‘NOAA says it's going to go out to sea’) points to another factor shaping risk perception: official communications from federal, state and local governments. Delineated evacuation zones in particular influenced New Jersey resident's perceptions of risk and safety. While some communities were in mandatory evacuation zones, others, such as Hasbrouck Heights, were not. In the following exchange,

participants spoke about how being outside the mandatory evacuation zone influenced their sense of safety prior to Sandy's landfall:

Moderator: Were either one of you in an area that was a mandatory evacuation zone?

Participant 1: No, no [we were not]. Yeah.

Participant 2: Actually, I thought we were safe, you know?

Risk perceptions were in part shaped by whether or not participants resided in a mandatory evacuation zone. As one young adult described, he evacuated with his mother to a relative's house to an area perceived to be safe: “Yeah, we actually evacuated to my grandmother's house that she doesn't technically live in a flood zone but it all flooded out in Sandy.” This young adult went on to describe experiences of feeling “trapped” in a flooded home crowded with relatives, expressing frustration that local authorities had not widened the mandatory evacuation zone.

> I wish that we hadn’t been at my grandmother’s house. I wish they made us leave town altogether. However, if they made us evacuate my grandmother’s house I think the [other] evacuation [location] was my middle school, and that got all flooded out, so I don’t think it would’ve been safe to be there either. I think they should’ve just made us leave entirely, which they didn’t [...] This whole town is just so close to the water I wish that somebody had said, “This whole town has to go.”
>
> (Hasbrouck Heights Focus Group 1)

As the above excerpts illustrate, risk perception during Sandy was shaped in part by communications from experts as “trusted sources” in conjunction with residents' own ecological knowledge and intergenerational memory of neighborhood storm responses.

3.2. Negative external attributions: Unclear institutional decision-making during sandy facilitated mistrust dining the recovery process

Risk perceptions of Sandy influenced participant's decision-making process during the storm. These decisions, influenced by local authorities or recent memory, led to feelings of guilt, anger, and regret as participants tried to make sense of their experience, which clouded the recovery process. Like the young adult above, many participants expressed frustration that they were not required to evacuate. As one participant shared, the choice to remain in her home not only put her family in danger of physical injury but led to traumas that persisted throughout the recovery process:

> I don't know why they didn't evacuate us. I remember we couldn't get out. My husband was sick. They had to swim in. They swam in and they put him in a kayak. They brought the kayak into the house to get him out. What's bothering me … I'm still not home, what's bothering me now is flash backs. If I go into the house, I have flash backs of what happened. That's really hard. It's hard. It's still going on.
>
> (Toms River Focus Group 1)

Given that communications from local authorities helped shape resident risk perceptions, negative experiences during Sandy led some participants to feel that they had received “bad

advice." This perception persisted into the recovery phase. One parent described how, years after Sandy, they still do not feel confident in the recommendations given by local or federal agencies.

> I still don't believe that I received the right information from the roofers, because if that's the case then five years later I wouldn't still be fighting the same problem. And like I said I've had roofers from FEMA and also from the insurance company […] like I said again, structurally I still feel like we were not given the proper information."
>
> (Hasbrouck Heights Focus Group 2)

In the same focus group, another participant echoed this sentiment of being "ill-advised" with a story of her interactions with the Federal Emergency Management Agency (FEMA) in the immediate aftermath of Sandy.

> I went to the FEMA people in the building, the one upstairs, and I was ill advised I believe right now, and soon thereafter, by one of the FEMA attorneys. And he's a Texas man who's been through flood after flood and said, "They're going to want to mitigate this, so it will never occur again. Don't use your flood money. Let it go into the grant." Never telling that the grant would take years to get going and get in place, and that we were overwhelmed with destruction.
>
> (Hasbrouck Heights Focus Group 2)

In this excerpt, a mismatch in expectations led to both miscommunication and mistrust. While the participant's lack of experience with destructive hurricanes made it difficult to fully assess their situation, it may have been difficult for FEMA officials to accurately assist in financial planning in areas where hurricane destruction is not a common occurrence. Hearing the story above, another participant responded:

> I think what was so debilitating in this area, even as I heard [Participant 1] speak, when she was talking about the guy from Texas with the accent. I remember in that week talking to all these people, the people who were trying to knit our wires back together. They were there for like over a week from Florida, and like offering those water bottles, right. I remember the FEMA person, you know. They were like again, from some place mid-West. Of course, they had seen all these things before, but here, and everybody was giving me like 'this calm down, it's gonna be okay, this what you need to do, blah blah blah.' And it sounds good, and I do believe they were giving good information, but it just was not something again that you could plan for, not anything that you can handle."

As this participant described, her unfamiliarity with the destructive hurricanes prior to Sandy made it difficult to process and accurately assess advice from government officials, especially given the perception that the mandatory evacuation zones for the New Jersey coastline had been calculated inaccurately. The sense that officials did not appropriately assess resident's needs pre-storm led some participants to feel vulnerable and fear being misled post-storm.

3.2.1. Negative internal attributions: low risk perceptions prior to sandy fostered negative emotions during the recovery process—

During recovery, participants described being overcome with a sense of personal guilt as a result of decisions made based on expectations that, similar to previous hurricanes like Irene, Sandy would pass relatively quickly with little destruction. Returning to homes damaged by the storm, participants spoke about how they "could have done more" to protect their loved one's belongings. As one mother described:

> "He [my son] always says, and I always hit at my heart, not my stomach, but my heart because when we were leaving the house, he said, 'Should I raise my stuff up or maybe bring it upstairs?' I'm like, 'Nothing's going to happen.' Of course, both my boys lost everything. That in particular is the thing that to this day still when he says something about ghost trap [a child's Ghostbusters toy], it's just like, 'Why didn't I just let him put his stuff upstairs?' So what if it was all over my bed. I was just being, 'Not on my bed.'"
>
> (Eatontown Focus Group 1)

Similarly, another parent described a friend's regret at not evacuating their family prior to the storm:

> "One of the parents … Child-parent teams that canceled today stayed during the storm. They were right around the corner. They had a four-year-old, a nine-year-old, and a 14-year-old and at one point during the storm, they were like, "What were we thinking?"
>
> (Little Ferry Focus Group).

In another exchange, a young adult described how their low risk expectations of Sandy led them to inadvertently put their pet in danger:

Interviewer: You mentioned your parrot was also at home during the storm. What happened there?

Participant: Well, we didn't think it was going to be that bad, so we left him. Then when we got there the next day, everything was destroyed, and he was inside. [I] put a heat lamp over him [and] he was okay.

(Young Adult Interview)

While the pet ultimately survived, this individual went on to describe that any flooding on the street after Sandy as a "triggering memory," impacting their sense of safety.

3.3. Retrospective development: low risk perceptions led to a sense that the storm came on "suddenly," forming traumatic memories that persisted during recovery

While sharing their most vivid memories of the storm, participants often spoke about their perception of how "suddenly" Sandy appeared. As one participant remembered:

> We didn't [evacuate] because there was no communication … I'll never forget the gurgling sound. "What is that?" As the water came up, 20 minutes [later] there was four feet of water in the house.
>
> (Toms River Focus Group 2)

Adding to this, participants spoke of how little time they had to make decisions, which was especially distressing if children were in the home. One parent remembered waking up her son in the middle of the night as water rushed in:

> And I said, "Brandon, Brandon, wake up, wake up, wake up." And he said, "Mommy what's wrong? What's wrong?" And I said, "I need you to get on those stairs, right away. Get on those stairs."
>
> And he said, "What's wrong? What's wrong?" And I said, "The water's coming in."
>
> (Hasbrouck Heights Focus Group 2)

In a different focus group, another parent shared their experience of evacuating his children amid the rapidly advancing storm:

> It's incredible if you think about it because it was like a tsunami because at 7:00 PM at night I was standing in the bay and there was no water. In two hours, it came back so it was my decks were floating away at 9:00 o'clock. That's when they knocked and my brother-in-law said, explicitly, "You have to get out of the house now, you have babies." Which they were eight and ten. When we left, we walked out, and we saw this tide water, but the house down the street was sparking with the power lines. [Pause]. We really thought that we were not going to live to see our kids the next day.
>
> (Toms River Focus Group 1)

These harrowing experiences during the storm, where residents had little to no prior lived experience with extreme weather events, fostered a changed sense of place among impacted families. Many spoke about a newfound lack of stability in a home where they had previously felt secure. As one parent said:

> Right, so there's automatically a thing with the water coming in. I am paranoid every time a heavy rain is coming, because I just don't know what's coming […] And I just feel like get me a new house, get me in a new area. I mean I don't know. Like I said the impact of the storm though, I still feel from that. Just my knowledge now of the area, and just how I see things is just kind of different, just structurally and environmentally.
>
> (Parent Interview)

In the aftermath of Sandy, participants were left with the disorienting task of sensemaking in a place now rendered unfamiliar.

3.3.1. Impacted resilience: low risk perceptions led to a sense that the storm came on "suddenly," decreasing self-efficacy in managing recovery—

The low

pre-storm risk perceptions contributed to a sense that Sandy arrived “suddenly,” which amplified the disorienting experience of the event. This feeling of “suddenness” left many families feeling unmoored and underprepared for the recovery process. The onslaught of changes in a compressed timeframe made it difficult for stressed homeowners to accurately assess or anticipate the scale of the damage, impacting their ability to formulate a plan and harness resources necessary for recovery. As one participant described

> "[Hindsight, of course 20/20. But just that, to say, okay I've got to get us into an apartment, and the apartment it was terrific and nice and they were going to do month to month, because I thought I'd be going home very quickly. I didn't know. And then of course as I saw that this was going to go on and on, they weren't even getting the grant up until I think it was '14, May of '14?
>
> I think it was '13, that was too quick, to get that on place. So, I think it was '14. So, then you have to hurry up and wait and say, oh, we can't do anything but I should have done this."
>
> (Eatontown Focus Group)

Living in an area with little previous exposure to or lived experience with climate-amplified disaster, parents felt distressed and unprepared for the aftermath. Many described needing to shift into “autopilot” to manage the recovery process. In focus groups, parents described “losing years” as they trained all their attention to recovery. For some, this led to a sense of guilt and a perception that they “were not doing enough” for their families, compounding their distress. As one mother described, in focusing on Sandy recovery, she felt that she had failed to help her child through difficulties in school:

> I'm still angry both at myself and the school because I was so involved like I said with his entire middle school that in eighth grade my son should have been in another program. If I would have been of sound mind and body, I would have realized that he wasn't on the right track in eighth grade to prep him for high school.
>
> (Toms River Focus Group 2)

For many parents, low risk perceptions prior to Sandy made recovery particularly stressful, because it meant that they had not formulated a plan for the aftermath of the storm. For some participants, this was particularly distressing because of prior successes in life—starting a career, raising a family, building a home—had been founded on their ability to plan ahead. In a focus group, one parent encapsulated this specific form of recovery distress with the following anecdote:

> It wasn't expected. I mean, I think for myself, even when I took the lead from corporate to go back to school and pursue a second career, it was all planned. It was planned. So, I always knew with having a kid, you have to have a plan. You can't just jump up and do whatever. You have to have it planned out. And it was not something that it was planned. Secondly, it wasn't something that you could control, for lack of a better word, because normally your kids can come to you and say like fix it. And you show up and you fix it. This was not one of those cases.
>
> (Hasbrouck Heights Focus Group 2)

The perception the Sandy was “sudden” led to a newfound lack of control in participant's lives, altering their sense of safety and self-assurance that persisted during recovery.

4. Discussion

From a sensemaking perspective, risk is informed by cues from the social and physical environment wherein “the action we take to mitigate risk is primarily based on our perception of the ‘realness’ of these events” [3]:750. The present study elucidates the socioenvironmental cues which render future threats ‘real’ among communities exposed to disaster. Examining New Jersey residents’ reflections on their experiences during Hurricane Sandy and its aftermath, it is apparent that while official communications (e.g., mandatory evacuation orders) played a role in shaping resident risk perceptions, the ‘realness’ of the impending event was filtered through residents' own knowledge and experience of place, including memories passed through generations of living in a coastal community *(“[it's] not possible, your grandparents lived here”).* Understanding how risk became refracted through resident “primacy of experience” [17] provides insight into how official risk communications became obfuscated before and during the storm, with implications for experiences of recovery.

The case examined here illustrates the dual temporality of risk perception, a process of sensemaking which calls for a continuous retrospective accounting of events to inform anticipations of the future. Hurricane Sandy highlights how disaster disrupts the ongoing process of sensemaking, where “we build upon those decisions that have proven successful in the past, thereby improving our ability to handle the uncertainty we face as it arises” [3]: 750, impeding post-event recovery. Situated in a geographic area of the United States with little previous social or ecological memory of climate change-amplified severe weather events, Sandy unsettled residents' own understanding of place. Lacking a lived experience of acute climate disaster, New Jersey residents were unable to build upon “decisions that have proven successful in the past,” rendering them unable to make “sense” of the event during the recovery phase. Navigating a familiar place now rendered strange (in the words of participants: *“my knowledge now of the area […] is just kind of different, just structurally and environmentally*”), residents were left with few socioenvironmental cues to handle an uncertain future. As climate change continues to amplify severe weather events around the globe, expanding the ‘disaster footprint’ into communities previously insulated from natural hazards, the case of Sandy may serve as a useful bellwether for anticipating the disaster resilience and recovery trajectories in as-yet impacted communities.

Residents impacted by Sandy not only had to overcome physical damage during recovery, but also the psychological disturbance that their sensemaking processes—their social identity and memory of place—had been altered by the storm. The themes of psychological disorientation present in the case of Hurricane Sandy echo those of the 1972 Buffalo Creek flood, a devastating event where “people continued to experience that same aching sense of disorientation for months and even years after the flood had passed [… where] people continue to feel that they are lost in ‘a strange and different place’” [32]; 158). While disrupted sense of place may partially explain the distress observed in the present study, Hurricane Sandy is distinct in that it fosters a newfound precarity. The residents of Buffalo

Creek lost faith in the ability of institutions to protect them [33]; the residents of coastal New Jersey heretofore did not see themselves as in need of protecting.

Examining risk perception in a locale previously insulated from climate disaster thus uniquely highlights the ways in which causal attributions become bound up in power, privilege, and blame [1,2,34] to harm the recovery experience. Impacting a region which is majority white, middle-aged, and socioeconomically middle class, Sandy created a demographically distinct "disaster footprint" compared to other global regions heavily impacted by climate change-amplified disasters. While these attributes may have provided residents with the social, economic, and political capital to harness the resources necessary for recovery [20,35], the present analysis reveals how their socioeconomic status and social position insulated them from perceiving environmental risks. Lacking lived experience with climate (and in many cases, economic) vulnerability, "good fortune was mistaken for resiliency"[19]. Thus, resident preevent formulation of risk impeded their post-event sensemaking, fostering both internal attributions that lowered self-efficacy *("I always saw myself as a planner but I didn't plan for this"*) and defensive external attributions that impeded engagement with services *("I don't think I received the right information")*. As the present analysis demonstrates, this mismatch in risk perception and event severity led participants to feel that they had been misinformed before and during the storm, an impression which morphed into skepticism of government recommendations during the recovery phase and a sense that officials did not understand what was best for their family. This sense may partially account for why there was an underutilization of services established by federal and state government to assist children and families after Sandy [25], and is also reflective of the social and political processing of risk [1], which suggests that sociopolitical factors such as status, power, and trust determine the perception and acceptance of risk [34]. Insulated from a lived experience of risk through heretofore geographic and demographic privilege, residents did not just feel that disaster "cannot happen to me" but that disaster services by extension "are not *for* me," impeding their ability to engage.

The ongoing, interactive and relational experience of sensemaking [3] demonstrated in this case study may explain the salience of "near misses" on disaster risk perception, suggesting that low levels of hazard exposure during experiences with previous events can reduce preparedness for future storms [5,18]. The themes reported here reveal that resident risk perceptions are shaped by their place attachments, informed by local ecological and social memory of how their neighborhood had weathered previous hurricanes. This experience of place was more fundamental to resident identity and perception of safety than official risk communications, shaping which recommendations were perceived as legitimate. In cases where risk communications aligned with pre-existing resident risk perceptions —for instance, if a home that had never flooded also resided outside the mandatory evacuation zone—residents were more likely to trust these recommendations, and these communications also served to confirm their own risk perceptions. When preparations proved to be insufficient, residents experienced a sense of sudden dislocation; because their own risk perceptions had aligned so well with officials', Sandy's destruction not only caught them unprepared but shook confidence in the government's, as well as their own, capacity for decision-making. In this way, the present study also supports and builds on Rickard and

colleagues' [21] analysis of Hurricane Sandy experiences, revealing how these “internal” and “external” attributions of responsibility also shape residents' experiences of recovery.

4.1. Future Directions

Building on the dominant approaches to the study of risk perception, this analysis examines the unique characteristics of the hazard, risk perceivers, and factors informing risk judgements [36] to provide evidence for the salience of risk perception on recovery experience, attending to the breakdowns in trust between residents and government sources. Looking forward, officials not only need to ensure accuracy of risk communication, but also be attuned to local context of resident lived experience and environmental memory. Even if experts perceive their own communications to be adequate and appropriate, their lack of alignment with resident's “primacy of experience” can facilitate a mismatch of expectations and distrust which spill over into recovery. An analysis published after Sandy found that FEMA flood maps significantly underestimate the percentage of US residents at risk of future flooding [37], which may account for the narrow mandatory evacuation zones created during Sandy. A report in November 2012 also found that mass media reporting on “Superstorm Sandy” created confusion about the nature of the storm, especially regarding whether residents should be concerned about water or high wind [23]. Reporting inaccuracies facilitate mistrust during recovery, which has implications for how residents may respond to the next storm. Given the strength of local identity and sense of place in shaping risk perceptions, officials may also consider acknowledging previous area storms in risk communications, highlighting how the coming event will be different. Perhaps if officials had acknowledged the ways that Sandy would be distinct from Irene, there would have been better alignment between official projections and resident perceptions of the coming storm. As the case of Sandy illustrates, recognizing risk perceptions prior to the storm is critical to facilitating positive perceptions during recovery. In light of the themes identified in this analysis, future longitudinal research is needed to quantitatively investigate the extent to which pre-storm risk perception is predictive of post-storm resilience.

4.2. Strengths and limitations

Through a constructivist paradigm of risk as a process of sensemaking, the present study elucidates potential pathways through which pre-storm risk perceptions can shape experiences of disaster recovery. The use of in-depth interviews and focus groups enabled interviewers to build trust and rapport with study participants, allowing space for detailed, nuanced accounts of the heightened emotions, memories, and regrets surrounding an extreme event. However, this study acknowledges several limitations. We have detailed demographic data for the overall SCAFH sample but lack demographic information about individuals who participated in the interviews and focus groups. While we aimed to sample communities across New Jersey's ‘Disaster Footprint’ (e.g., residential areas with direct exposure [31]), there may be selection bias in that individuals with strong views about their experiences during Hurricane Sandy were more likely to participate. Similarly, participation in the study required availability for a 60-min interview or focus group. Despite our efforts at flexible scheduling, residents with the highest burden may have been unable to participate. Finally, the qualitative data analyzed in this study captures participant attitudes at a single time point, five years after the event. While this enabled participants to reflect on their

recovery experiences, the timing of data collection may have impacted their recall of their pre-storm feelings and emotions.

5. Conclusions

Hurricane Sandy presents a unique case for understanding how development of disaster risk perceptions can shape experiences of disaster recovery through impeding post-event sensemaking. Expressing regret and anger at decisions made during the storm, residents were less confident navigating recovery, feeling that they could not fully trust either their own nor official decision-making. This trust is embedded in local socio-environmental histories too often taken for granted during the recovery process; the immediacy of attending to needs of the present moment post-event can elide the critical role of local history and the implications it has for future sensemaking. Yet, as this study demonstrates, the interplay of resident experience and official decision-making may precipitate an under-utilization of post-disaster services, ultimately hindering long-term recovery. This highlights an urgent need for concentrated efforts to repair and build trust between local communities, state offices of disaster mitigation and response, and federal disaster agencies.

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Data availability

The data that has been used is confidential.

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Table 1

Major themes and sub-themes.

Theme	Illustrative Quote
Theme 1: *Risk-as-Sensemaking: Local Ecological Knowledge and Place-based Intergenerational Memory Shapes Pre-Storm Risk Perceptions*	*"I think part of the problem with Sandy was people didn't really take it that seriously because of Hurricane Irene and other storms in the past. So I just remember sitting in class one day on that Friday before the storm happened and everyone was like, "Oh, did you hear about this storm that's going to pass?" People weren't even calling it a hurricane or anything."* (Seaside Heights Focus Group) *"I always remember we left for the hurricane before Sandy [Hurricane Irene], and then we stayed for Sandy. And I always remember we didn't know it was gonna come that far up, because it had never happened before."* (Little Ferry Focus Group)
Sub-theme 1: Trusted Sources: Mandatory evacuation zones influenced risk perceptions prior to Sandy	*"[Participant 1]: It's funny still to me that we weren't a mandatory evacuation and we got hit really hard. Our whole neighborhood.* *[Participant 2]:We really didn't think it was going to get hit the way that it did and I mean, we don't even live on water."* (Eatontown Focus Group)
Theme 2: *Negative External Attributions: Unclear institutional decision-making facilitated mistrust during the recovery process*	*"When you say ask for help? We could have had the government pay our mortgage. I didn't do that. We could have had them pay the electric bill. I didn't do that. I didn't feel like we were poverty stricken over it. I knew that we were insured and that we would be getting reimbursed, but there were those resources out there. I didn't apply for them because I thougfit it would be fraud In hindsight, thinking back, I probably should have."* (Parent Interview)
Sub-theme 2: Negative Internal Attributions: Low risk perceptions prior to Sandy fostered negative emotions during the recovery process	*"But I think it's everyone like, 'Oh, we should have taken it a little bit more serious. They said it was coming. ' You know what I mean. I think my dad blames himself or both my parents kind of blame … Like how they have that tinge of guilt like, 'All right, we could have put sandbags out and maybe would have helped control the damage a little bit.' "* (Seaside Heights Focus Group) *"I would have moved. I would have moved stuff in my house, just moved them to higher places. We left. This thing sticks with me and my sister. Our cat we left in our home because we didn't know how bad it was going to be […]We left it there. For a couple days it had no food or water. Thank God it's okay."* (Young Adult Interview)
Theme 3: *Retrospective Development:* Inaccurate risk perceptions led to traumatic memories	*"I remember the water, just the water everywhere. I remember that. I remember the fire started behind us. My house was covered in oil and water. We were stuck upstairs and the neighbor's oil tank leaked. I had oil all through my house. All I could think of was that I'm in oil, and now there's a fire. We called 911 and they said, 'Sorry ma'am, we can't help you. We can't get down there.' […] Then [I remember] my daughter screaming with the fire."* (Toms River Focus Group 1)
Sub-theme 3: Impacted Resilience: Sandy's "sudden" disruption made it difficult for residents to effectively manage recovery, decreasing self-efficacy	*"I was so on top of getting into the grant program, getting it done, getting it done, and it started to erode my sanity … [My therapist] sat there and said, 'well why are you upset? Do you believe that your house is who you are?' I said, yes, with a ten, now going on 12-year-old son, going from—not a large, but [a house with] three bedrooms, and a living room, and a yard and a barbecue, and a pool … And my daugfiter who comes out from Ohio with my granddaughter and her husband, and [now] we're in a one-bedroom apartment. I'm the one, I have the Christmases. I have the holidays. Yes, my house was everything. And they are not moving on any of the houses up here. I started to lose it at that point. "* (Hasbrouck Heights Focus Group 2)