HARNESSING RISK TRANSFER TO SUPPORT IMMEDIATE POST-DISASTER NEEDS OF LOW- AND MODERATE-INCOME HOUSEHOLDS

A meso-insurance pilot in New York City

Implementation Lessons for Community Organizations

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SBP

NYC Mayor's Office of Climate & Environmental Justice

Swiss Re Corporate Solutions

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One of the world's leading international nonprofit organizations, Environmental Defense Fund creates transformational solutions to the most serious environmental problems. To do so, EDF links science, economics, law and innovative private-sector partnerships. With more than 3 million members and offices in the United States, China, Mexico, Indonesia and the European Union, EDF's scientists, economists, attorneys and policy experts are working in 28 countries to turn our solutions into action.

About the Center for NYC Neighborhoods
The Center for NYC Neighborhoods promotes and protects affordable homeownership in New York so that middle- and working-class families are able to build strong, thriving communities. Established by public and private partners, the Center meets the diverse needs of homeowners throughout New York State by offering free, high-quality housing services.

About The NYC Mayor's Office of Climate & Environmental Justice (MOCEJ)
MOCEJ works to make our buildings efficient and resilient, ensure New York City's infrastructure is climate-ready, transform the City's streets and public realm into living, open spaces, and to make the City's energy clean and resilient. Through science-based analysis, policy and program development, and capacity building, and with a focus on equity and public health, MOCEJ leads the City's efforts to ensure that New York City is both reducing its emissions and preparing to adapt and protect New Yorkers from the intensifying impacts of climate change.

About SBP
SBP is a national social impact organization dedicated to shrinking the time between disaster and recovery by reducing risk, increasing preparedness and resilience, and improving disaster recovery systems, policies, and programs to better serve the needs of all Americans. Since its founding in 2006 in St. Bernard Parish, Louisiana in the wake of Hurricane Katrina, SBP has rebuilt homes for more than 4,000 families, with the help of 150,000 volunteers in 16 communities across the U.S. and the Bahamas.

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INTRODUCTION

Climate-related extreme events are worsening around the globe. These disasters can impose a substantial financial burden on households, businesses, and communities. Disaster costs can be wide-ranging and the recovery process can be long. Some disaster impacts require immediate access to funds, such as paying for evacuation or temporary lodging, removing water-damaged materials and clearing debris, higher commuting costs when transit is down, generators or fuel when power is lost, fixing needed appliances, or dealing with lost income when business is interrupted.

When households do not have access to the needed financial resources to cover such immediate expenses, they can be forced to adopt strategies that are costly for them in the short- and longer-run. This could include failing to pay bills, such as utilities, mortgages, or rent; forgoing important expenses, such as those for healthcare; selling possessions; or taking on additional work. The need to adopt such strategies is greater for low- and moderate income (LMI) households that are less likely to have immediate access to funds to cover the spike in expenses and possible drop in income that a severe disaster can impose. Most sources of assistance after a disaster, such as federal aid, traditional insurance payouts, or loans, can take months or even years to make their way to those in need, leaving households struggling in the immediate aftermath of such events. A lack of resources for household recovery can have spillover impacts on local businesses and community recovery.

This report shares lessons from the design and launch phases of a learning pilot that couples prametric risk transfer with an immediate post-flood assitance program for low- and moderate income households.

This report shares implementation lessons from a learning pilot in New York City designed to harness risk transfer to provide immediate and flexible post-flood assistance to under-resourced households. Risk transfer refers to tools such as insurance and other financial mechanisms that shift risk from households and businesses in order to provide them with financial protection against potentially large losses. The learning pilot discussed in this report was developed with the support of a Civic Innovations Challenge award from the National Science Foundation and Department of Homeland Security and brought together

multiple partners including the Environmental Defense Fund,[i] SBP, the Center for NYC Neighborhoods, the NYC Mayor's Office of Climate and Environmental Justice (MOCEJ), Guy Carpenter / MMC Securities,[ii] Swiss Re, and ICEYE.

As detailed in this report, the pilot uses a concept sometimes referred to as meso-insurance, group insurance, or community insurance, in which an intermediary helps to secure insurance coverage on behalf of a group. In this pilot program, the Center for NYC Neighborhoods (the Center) purchased a parametric risk transfer product to provide a fast payment to the Center in the event of a qualifying flood. If this occurs, the Center will use the funds to activate an emergency grant program that will provide cash assistance to LMI households suffering financial hardship from the flood. The pilot program is designed to provide faster funding to households than is currently available from other sources and to be more flexible to cover the broad range of costs households can face. The expectation is that such grants could help prevent households from falling into greater financial precarity immediately after the flood due to lack of needed resources for immediate response and recovery.

The first part of this report details the design decisions made to move from broad concept to implementation. It provides a detailed overview of the design and structure of both the risk transfer product and the assistance program. In the second half of the report, we turn to the lessons learned on pilot design and immediate implementation. As of the time of writing, the grant distribution program had not been triggered by a flood, so there had not been an evaluation of how effectively it operated in a disaster situation or of the impact of such grants on the post-flood well-being and financial resilience of households. We are able, however, to share lessons for community organizations and other non-profits that may wish to use risk transfer tools or establish post-disaster assistance programs for vulnerable residents in terms of getting started, placing the new program in a broader context, making use of private risk transfer, and standing up an assistance program. Some of the learnings may also transfer to local governments, if they wish to harness such solutions, although they operate with a somewhat varied set of both constraints and opportunities.

[i] Initially, the lead institution was the Wharton Risk Center at the University of Pennsylvania, but the Principal Investigator transferred to the Environmental Defense Fund during the project.

[ii] Marsh McLennan won the 2023 Insurance Insider Broking Innovation of the Year award for their work on community-based catastrophe insurance and this pilot.

MOVING FROM CONCEPT TO IMPLEMENTATION

The Challenge

This learning pilot was developed to help address the challenges some New York City (NYC) residents face in recovering from floods that are worsening with climate change. Flooding is the costliest natural disaster and, due to the combined effects of sea level rise, changing storm patterns, increased development, erosion, and in some places, subsidence, flood risk is growing in many places around the country [1, 2]. Sea-level rise has already led to an increased probability of coastal flooding, which will continue, and is projected to cause higher flood damages in the future [3-5]. Climate-induced intensification of rainfall is also projected to increase flooding in certain parts of the United States [6, 7] which could lead to greater flood damages in the coming years [8].

NYC faces growing coastal and inland flood risk. In response, since Hurricane Sandy (2012), NYC has invested heavily in coastal hazard mitigation and resilience planning. It is strengthening flood protection for buildings and infrastructure, taking steps to enhance the city's coastal defenses, and improving risk communication to residents about both current and future flood risks [9]. Recent storms, such as the remnants of Hurricane Ida in 2021, also highlight the substantial risk the city faces from heavy rainfall. Extreme precipitation events, which are increasing in the region [10], can overwhelm the city's stormwater and sewer system, leading to flooded roads, subways, and buildings. The city has thus enhanced its focus to address the impacts of stormwater flood risk, including expanding education, improving emergency response procedures, reducing stormwater flood impacts, and managing future stormwater flood risk. NYC's efforts include the development of a series

of public maps depicting stormwater flooding,[iii] the release of a Rainfall Ready Action Plan,[iv] and a Stormwater Resiliency Plan [11]. The project team's work on financial resilience was designed to complement existing efforts and resources.

Lower-income groups and households of color suffer disproportionately from disasters and recover less quickly than more privileged residents [12-14]. Wealth inequalities are already substantial and increasing in the U.S., with detrimental effects on educational attainment, physical health, and emotional well-being [15, 16]. Natural hazards can compound these inequities [17-19]. Without financial safety nets after a disaster, households can fall into greater financial precarity, potentially defaulting on loans, accumulating debt, and exhausting savings [20, 21]. For example, after suffering flood damage, delinquencies and bankruptcies are much more likely for households that are financially constrained or living in communities with limited financial services – both of which overlap significantly with race and ethnicity, as well as household wealth [18, 22].

Lower-income households and households of color suffer disproportionately from disasters and recover less quickly.

Most sources of disaster recovery funding can be quite delayed [23], yet households face expenses immediately after the occurrence of a disaster and in the following days and weeks; they may also experience a disruption in income [24]. Expenses could range from the need to pay for temporary housing to higher commuting costs to being unable to pay bills when they have lost income that month. Federal assistance payments can take months or years to reach disaster victims, and even traditional indemnity insurance payments can be burdensome to obtain and slow to reach households with active policies. For instance, during Hurricane Sandy there were reported disputes between lenders (who must sign off on insurance claims for those with mortgages) and households around access to funds, as well as challenges in getting insurance to pay the full costs of damage [25]. Higher-income households are less impacted by delays, drawing on liquid savings or using tools like credit cards they can then easily pay off [26]. Low- and moderate-income (LMI) households, however, do not have sufficient savings and have limited access to credit [27], causing them to struggle post-flood. They may be forced to engage in coping measures that are costly for the household, such as deferring needed expenses, perhaps those for medical care or food, failing to pay bills on time, taking on extra work, or selling personal belongings [13, 24, 28, 29].

NYC, with over 8 million residents, is the largest municipal economy in the United States. In 2021, one in four adults in NYC faced material hardship and economic disadvantages were significantly more common among people of color [30]. The likelihood of experiencing flooding is greater for low- and moderate-income residents [31] and residents of NYC's floodplain tend to be working- and middle-class homeowners [32]. Currently these households and communities are not able to easily access the needed disaster recovery funds after an event and there are very few policies or programs designed specifically to help build financial resilience to natural hazards LMI households. While NYC is unique in many respects, such as its size, the challenges it faces with post-flood recovery, particularly

[iii] Maps available online here: https://experience.arcgis.com/experience/6f4cc60710dc433585790cd2b4b5dd0e.

[iv] See: https://www.nyc.gov/site/dep/whats-new/rainfall-ready-nyc.page.

for its most vulnerable residents, are faced by many cities and communities across the country.

Scope of the Pilot

This project began to improve the post-flood financial resilience of LMI households in New York City. One pilot project, of course, cannot solve the many gaps in financial recovery from the range of floods NYC may experience. Given the myriad challenges that arise after disasters, a broader set of tailored solutions are needed for different subgroups of the population, since different groups will have different post-disaster needs and varying capabilities and resources. In order to narrow the scope of the pilot, we considered the needs of several subgroups of the NYC population: owners versus renters, those subject to mandatory flood insurance purchase versus those who are not, households versus microenterprises and small businesses, and those facing coastal surge flooding versus rainfall flooding.

The project team first made the decision to narrow the perils considered and focus specifically on rainfall-related flooding. This is a growing risk in NYC and one for which residents are often less prepared. Current flood maps produced by the Federal Emergency Management Agency do not account for rainfall-related flooding risk in their designation of high-risk areas. As such, rainfall-related flooding often occurs outside this boundary, where flood risk is not disclosed to residents and there is no requirement to purchase flood insurance. This makes many residents in these locations unaware of their flood risk and unaware of the availability of flood insurance and thus without financial protection post-flood.

The team next made the decision to focus exclusively on the immediate post-flood financial needs of LMI households. For many of these households at risk from rainfall-related flooding, they are unlikely to suffer complete property damage. In addition, the budget for the pilot was not sufficient to provide full indemnity coverage to a significant number of households, nor would there be sustained funding for such a program. In stakeholder interviews, the project team heard many times about the difficulties of delayed resources and that this challenge was particularly severe for LMI households and not well-addressed by existing programs. We thus worked to fill this gap.

Theory of Change

Our theory of change – the explanations and assumptions underpinning why we believe the pilot would improve financial resiliency – is that if lower-income households can receive fast and flexible dollars after a flood, they will be better able to cover the spike in household expenses (and/or dip in income) they experience, thus preventing them from spiraling into worsening financial precarity and improving their overall recovery. Our theory of change is further articulated in more detail through our logic model, discussed below, after we provide more details on the structure of the pilot.

In the first phase of our effort, we considered many different options for meeting this objective of providing fast and flexible dollars to those in need, from fully private sector approaches to fully public sector approaches. We focused attention on models from the emerging discussions around inclusive insurance. Inclusive insurance is defined as any program or policy that makes insurance coverage available to those previously locked out of the insurance market [33]. In the end, we evaluated six policy proposals. The initial six included parametric microinsurance, premium reductions for low-cost flood mitigation, a local flood insurance affordability program, community assistance tied to a high-deductible NFIP policy, community based insurance, and right-sizing insurance through one-on-one consultations. All of these ideas may be helpful for other contexts and communities. More details on them can be found in a summary primer of the options [34].

Parametric risk transfer pays based on a measure of the hazard, referred to as the trigger. It can provide fast and flexible dollars after a diaster.

We then undertook an intensive evaluation process of the six options involving more than 30 semi-structured expert interviews, exploratory analyses, stakeholder engagement, and consultations with our advisory board. This engagement process also led to the creation of several hybrid options, which were also evaluated. Through these discussions, each proposal was assessed using the following criteria: effectiveness, feasibility, cost, sustainability over time, administrative burden, partner willingness, and interaction with existing city policies. We also had to evaluate them against the terms and limitations of the grant, which included a fixed budget and a one-year timeline to show progress on implementation.

Many of the models we evaluated faced challenges that would prevent them from being viable for this project. We first had to eliminate any with launch costs that exceeded our budget or that would take multiple years to develop, given the tight timeline of our grant. We then eliminated others that would require partners we could not identify, the need for ongoing public sector subsidies, which were not available, or that would require regulatory

changes that would be difficult to undertake at all or in our timeframe. Identification of these concerns helped us narrow in on the specific design that was ultimately piloted

Concept Overview

As our objective was to get fast and flexible dollars to those suffering immediate economic impacts from floods, our pilot makes use of parametric insurance. Parametric insurance refers to a type of insurance that instead of paying a claim equal to the assessed loss or repair cost (subject to policy terms), instead pays a defined dollar amount based on an agreed measure of the magnitude of the disaster. This metric is referred to as the trigger, such as the measured height of flood waters or wind speed in a certain location [35]. While standard indemnity insurance typically requires a time-consuming, and sometimes contentious, loss adjustment process, with a parametric policy, the payout can be made immediately when the designated trigger is reached. Parametric insurance thus provides several important benefits. First, the ease in determining whether a claim payment needs to be made ensures that payouts are made much faster, often in a matter of days. Second, parametric insurance also provides important flexibility to the insured. The funds can be used for any immediate disaster-related needs; the insurer is agnostic as to how the funds are spent. Third, parametric approaches can be more transparent and inspire greater trust in the product since the trigger is clear and the payment defined in advance. While not a replacement for indemnity property policies (such as standard homeowners' or flood insurance), parametric approaches are an important tool when speed and flexibility are paramount.

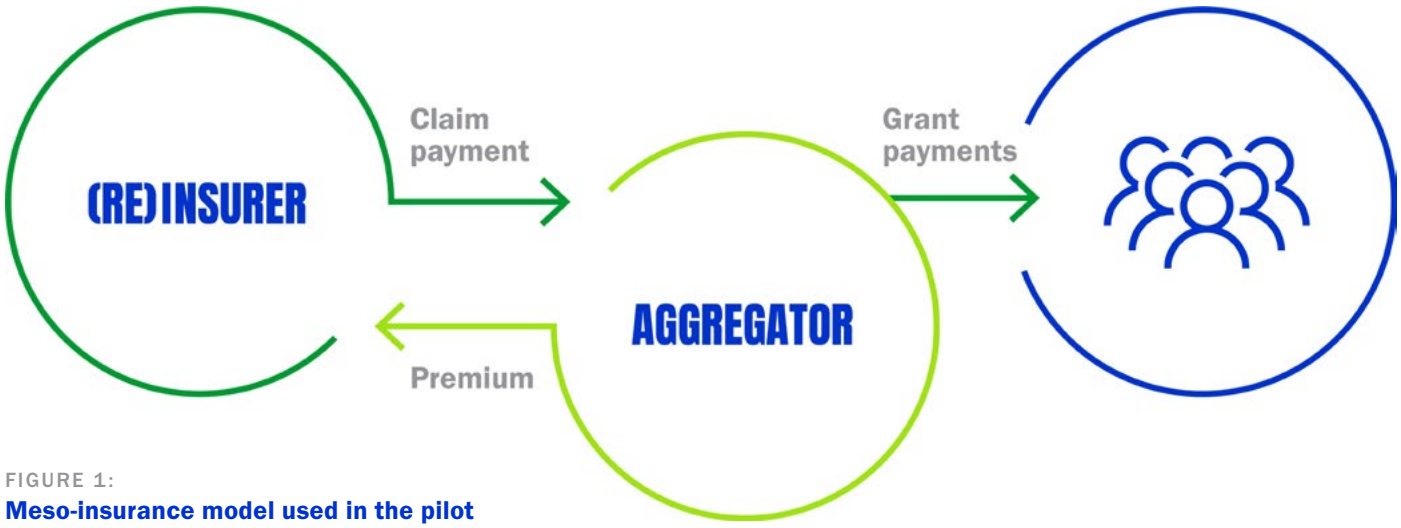


FIGURE 1:
Meso-insurance model used in the pilot

Our concept harnesses a parametric approach that is sometimes referred to as group insurance, meso-insurance, or an aggregator model. All these terms—we will use "meso-insurance" here—refer to a situation in which an intermediary (sometimes called a risk aggregator), harnesses risk transfer on behalf of a group of beneficiaries. This could take a number of different forms. In one approach, the aggregator purchases insurance on behalf of a group, but the policies are held individually with an insurer. This is akin to group health insurance; the intermediary institution negotiates terms with the insurance company and provides full or partial payment, but the contracts are individually held with the insurance firm. A second model has the aggregator coupling insurance to other products or programs it offers. An example could be a Community Development Finance Institution (CDFI) attaching insurance to loans it makes to LMI borrowers to protect both them and the CDFI from disaster-driven defaults [37]. A third approach has the aggregator as the policyholder who then uses the insurance payout to distribute funds to those in need.

This third approach is the one adopted in this pilot (see Figure 1): the Center for NYC Neighborhoods purchased a parametric risk transfer product and would use the funds to assist LMI households with post-flood financial needs. This approach was chosen for two key reasons. First, there were not private providers ready to write microinsurance for flooding in NYC or identified partners willing to require insurance as a part of any service or program. Second, using an intermediary that pays the premium reduces financial burdens on LMI residents. It can also reduce the burden of having to encourage individual households to enroll and the intermediary can direct funds to those in greatest need post-disaster. For our pilot, the intermediary organization is the Center, but the intermediary could be any non-profit, community group, employer, local government, or any other entity looking to provide financial protection to a specific group. Our team explored the local government being the intermediary, as well, but found that NYC faced numerous barriers to purchasing a risk transfer product itself and in standing up a direct-to-household assistance program that could not be addressed in the timeframe of the grant.

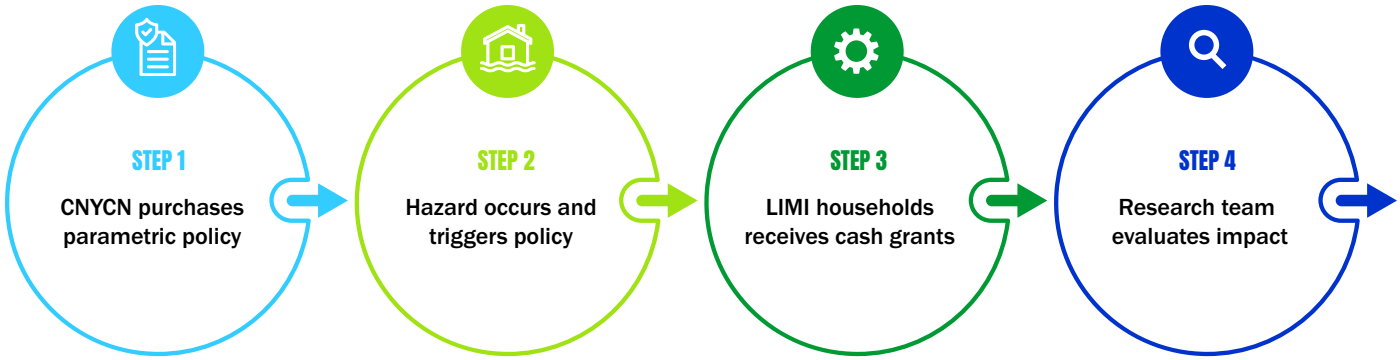


FIGURE 2:
Steps in Parametric Risk Transfer Pilot

The Center for NYC Neighborhoods purchased the parametric flood policy from Swiss Re, working with Guy Carpenter and its affiliate, MMC Securities LLC.[v] If the policy is triggered by a qualifying flood, the Center would receive a payout and use those funds to make emergency grants to LMI households identified as experiencing financial hardship from the flood. Even within this specific meso-insurance approach, there are still a number of different design choices that could be made – both on the design of the risk transfer instrument and the design of the assistance program. We discuss these design choices in the sections below.

Due to limitations in funding for the premium, which came from the NSF grant, and because this was a small pilot designed to test concepts, and all organizations faced capacity constraints, four neighborhoods were identified in defining the trigger for the payout of the parametric product (discussed further below). We chose the four pilot locations by overlaying the city's stormwater flood maps with residential units and income levels in order to identify places of high flood risk where there were also many residential homes and a concentration of LMI residents.[vi] While the trigger was designed around these four neighborhoods, it does not restrict the geographic area where the CNYCN program could issue payments.

Completing the full design phase, including the necessary analytics and structuring work discussed further below, took over a year with the core project team to finalize. The ultimate program—the result of that effort—is summarized in Figure 2. First, the Center purchases the risk transfer product, then a qualifying flood could occur triggering payout. If that happens, the Center would activate their assistance program and send grants to households in need, and finally, the project team would evaluate the program.

[v] MMC Securities LLC is a US registered broker-dealer and member FINRA/NFA/SIPC.

[vi] The city provides maps for several scenarios. For this analysis, our team used the "extreme" stormwater scenario, which is noted to have a 1% annual occurrence (100-year flood). For locations without specific stormwater flood maps, similar information could be obtained by local researchers or groups such as the First Street Foundation.

Logic Model

A theory of change explains how a particular program or intervention is linked causally to a set of outcomes. As noted, our theory of change is that fast and flexible dollars to meet immediate needs post-flood will help prevent LMI households from facing greater financial stress and thus improve their recovery. This theory of change is depicted in our logic model shown in Figure 3. A logic model is a visual representation of the relationships between elements in a system that indicates how a program or initiative creates change.

The logic model creates a map of the inputs used to create the pilot project to the long-term outcomes the project aims to influence. The inputs refer to the tangible costs that went into the pilot creation. This includes people time, developing and collecting necessary data, conducting supporting analytics, as well as structuring and executing the risk transfer solution. These inputs supported two key activities, shown in green: creating the Flood Recovery Fund program (the assistance program) at the Center and the design of the novel parametric risk transfer product. The outputs are the tangible results of those activities. For this program, that includes the payout of the risk transfer policy and households receiving cash grants through the Center's new assistance program.

These outputs may then lead to a set of behavior changes for households that have to do with being in a better financial position post-flood. This would include things such as being able to make necessary payments, for example, for their rent/mortgage and utilities and being able to pay for needed short-term disaster-related expenses without having to forgo other important expenditures. These changes will then lead to increased financial and housing security in the medium-term and, in the longer-run, improved recovery and wellbeing. Of course, there are many determinants of recovery; the outcomes listed in the logic model are influenced by many other factors beyond our small pilot. As such, isolating the impact of the specific program of interest on outcomes can be difficult in evaluation research and will be tackled by the research team if the program is activated. We now provide more detail on the various aspects of the pilot.

Features of the Assistance Program

There are essentially two distinct pieces of this pilot: the use of risk transfer to fund an assistance program and the assistance program itself. We first discuss the features of the latter. The Center was able to draw on prior experience when designing the grant assistance portion of this pilot. After Hurricane Sandy, the Center successfully implemented post-disaster emergency grants through a program referred to as the Neighborhood Recovery Fund, which received post-disaster philanthropic contributions [38]. For our learning pilot, the Center launched a similar Flood Recovery Fund, which will make payments to households for emergency needs after a triggering flood. The Center has established a separate bank account for this fund to accept any risk transfer payouts. Notably, this account could also accept philanthropic donations to supplement any financing from risk transfer and thereby expand the Center's ability to provide recovery assistance.

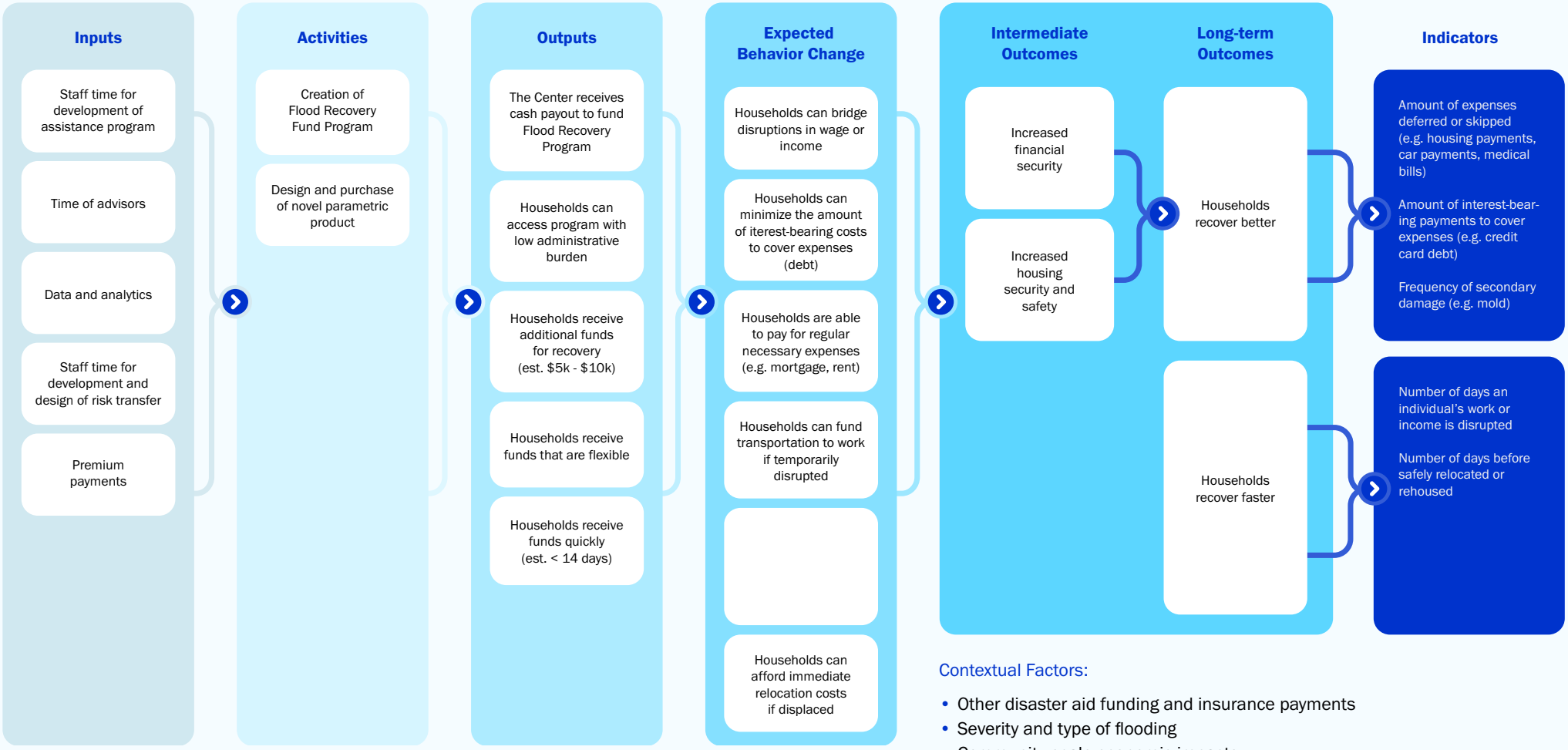
FIGURE 3

CIVIC INCLUSIVE INSURANCE PILOT: LOGIC MODEL

Problem: Low-to-moderate income households in NYC lack the financial resources to recover quickly or fully from extreme flooding events.

Program Goal: Increase the speed and quality of flood recovery for low-to-moderate income households by providing immediate and flexible funds to cover unexpected costs using parametric insurance.

Population: Low-to-moderate income households in New York City (household income less than or equal to 165% area median income).



Contextual Factors:

- Other disaster aid funding and insurance payments
- Severity and type of flooding
- Community-scale economic impacts

To ensure that payouts would be made expeditiously after a flood, the Center has developed all the procedures, resources, and application materials for the program in advance. After consultation with partners, the Center chose a program activation strategy that makes use of their network of housing advisors ("network partners") from local community-based organizations already working with the Center. After a triggering flood, the Center will make the intake form available on **floodhelpNY.org** (a flood resiliency website developed in partnership by the Center, MOCEJ, and the NYS Governor's Office of Storm Recovery) and alert all network partners. The Center will accept applications either through the website or directly from network partners. Case managers will review the intake forms and obtain any necessary documentation from households. After confirming eligibility, they will issue approval and denial notices.

To be eligible for a grant, the Center established the following criteria: the request must be related to a 1-4 family residential structure in New York City, the applicant must be the owner, the property must be their primary residence, the applicant must have experienced financial hardship as a result of the flood, and their total household income must be at or below 165% of Area Median Income for NYC. These eligibility criteria were developed based on similar Center programs, which have been refined over time and adhere to their mission to promote and protect affordable homeownership. Other organizations with different missions might choose varying eligibility criteria.

The Center took many steps to minimize the paperwork burden to apply. Applicants will need to complete an intake form, provide proof of identification, complete a "use of funds" questionnaire outlining their financial need, sign a financial attestation form, sign an income attestation form, sign a primary residence attestation form, and provide the name of the individual(s) on the home deed (ownership will be verified by the delivery team). The use of attestation forms and staff verifying home ownership were used to ease the process and minimize the time spent on paperwork and documentation.

Trigger Design

We now turn to discussion of the parametric risk transfer instrument. All parametric products have a trigger, which is the measurement that determines when payments are released. Products could have a single trigger or multiple triggers that must all be met before payment is made. To preserve trust in the product, an ideal trigger(s) would use objective data produced by independent third parties that is publicly accessible and fully transparent. To preserve the benefit of speed, the trigger should also be able to be rapidly calculated during or immediately after the disaster. Finally, triggers should be highly correlated with the policyholder's economic loss to make sure that adequate funding is available when needed. Critically, they also need to be accepted by risk transfer partners – brokers and (re)insurers. Trigger innovation, then, must involve these stakeholders.

The project team wanted the risk transfer solution to provide a payout during extreme rainfall-related flooding. Triggers for this type of event are relatively new. More commonly used triggers have been focused on the wind or storm surge from hurricanes. For example, wind speed has been a common trigger, but this does not correlate well with inland flooding. As another example, the NYC Metropolitan Transportation Authority has been using parametric catastrophe bonds since 2013, focused in part on coastal storm surges. As such, they have used the recorded height of waters at certain gauges as a trigger. Again, since our focus was inland flooding, this solution did not work for our pilot, and so the team investigated other options. For the pilot, we considered three possibilities: (1) measures of total precipitation from gauges, (2) on-the-ground flood depth sensors, and (3) satellite imagery data.

We first considered using existing public federal data on total precipitation, collected by the National Oceanic and Atmospheric Administration's network of rain gauges. While measures of precipitation are an objective and fast trigger, the rain gauges currently installed in NYC with publicly available data are at the airports and in Central Park and the team was concerned the measurements at these locations did not capture the risk in the pilot residential neighborhoods well enough. If precipitation data is more locally collected, however, it may be useful to explore in other applications of parametric flood policies.

We next turned to on-the-ground sensors. In theory, this would be an ideal trigger since sensors could measure flood depths in the exact locations of concern. Unfortunately, we found that existing technologies were unable to scale in the pilot neighborhoods fast enough to fully cover the potential flood risk within the time frame of the project. One possible data provider was FloodNet, a partnership between the city and local researchers, which has developed low-cost, real-time flood sensors that can be installed across the city, including on Department of Transportation infrastructure to measure flood depths on NYC roads. The information is made publicly available to communities, who are also involved in the site selection and installation process. For MOCEJ and the Center, using depths as measured by FloodNet would have been ideal, supporting a local research effort and minimizing the risk that a rain gauge did not always capture flooding in the pilot neighborhoods. While this technology is promising, concerns about the resilience of the sensors to severe weather, lack of redundancy, and the lack of research around how well the sensors correlated with

existing risk models prevented this option as being selected for the pilot. In addition, it would have required installation of sensors in many new locations not currently being pursued by FloodNet and there were limited funds available for more widespread deployment to the pilot neighborhoods. Since they only indicate flooding at one small point, there are also still open questions of the density of the needed sensor network and optimal sensor placement to catch the type of damaging floods of concern to the pilot. FloodNet is also considering installing rain gauges in some neighborhoods; the team hopes that a combination of the gauge and sensor readings could be used in the future as the sole trigger.

Finally, the team looked at satellite imagery data to measure floods, but there were several challenges. Optical imagery collected at the time of peak flooding is often blocked by clouds limiting the viability of detecting all inundated areas. Synthetic Aperture Radar (SAR), however, can "see through" clouds to measure conditions on the earth's surface. While this has been done globally to measure large riverine and coastal floods, it is not yet capable of measuring flash flooding in dense urban environments – NYC being one of the most densely populated cities in the country – that peaks and recedes quickly. We found that while technology currently exists to overcome historic difficulties with using areal imagery, especially for longer duration events, it could not solely be relied on due to the ephemeral nature of flooding in our pilot neighborhoods and the difficulty of radar capture in urban environments.

Without a clear easy trigger, the team ultimately turned to a blended solution to more accurately capture flooding severity from extreme rain. This involved a Swiss Re partnership with ICEYE, a remote sensing data provider that has a focus on floods and other natural hazards. Following an extreme rainfall event that causes flooding, ICEYE will create a flood footprint of the event (the spatial extent of flooding) by blending information from SAR, ground sensors (including FloodNet, if available), and a search of social media for photos and videos containing observed flooding. ICEYE has typically worked at larger geographies, such as a state or region, or even country. This project was focused on small neighborhoods, which required combining multiple sources of data to ensure an accurate estimate of any flooding. The ICEYE flood footprint will be overlaid on a grid representing inhabited areas in the pilot neighborhoods. As the severity of flooding increases, a greater number of grid points would fall within the footprint leading to an increase in the payout.

This trigger has the benefit of being more closely aligned with rainfall-related flooding in the pilot neighborhoods. It is not without its drawbacks, however. Unlike other perils that can be well-captured by metrics that are constantly monitored, such as hurricane wind speeds published by the National Hurricane Center, this trigger relies on a more active monitoring process. Because the construction of a flood footprint is a non-trivial process, there must be a formal request to ICEYE from the Center to determine if sufficient flooding occurred to generate the flood footprint. ICEYE will then construct the flood footprint, which must be completed within a specified time period. That the trigger is not something continually monitored and that the trigger requires analyses could both slow down payment and possibly increase the costs of the product. Swiss Re pays a fee to ICEYE from the risk transfer premium to support the needed ICEYE assessments. When a trigger measurement is paid for by the risk bearing entity, however, it is not entirely an

independent measurement, creating a concern about financial conflict. Further, since all data sources and methodologies used to create the flood footprint, including SAR and the ICEYE methodology of combining sources, are not public, there is less transparency than other trigger designs, which is important for trust in a product. ICEYE will, however, be making their analyses freely available to the city in real-time as they are undertaken. As of writing, there are no measurements that can meet all the criteria for an ideal trigger related to rainfall flooding in dense locations. More work is needed to develop and refine triggers that can be easy, independent, and cost-effective for rainfall-related flooding. Organizations will need to work closely with their broker and risk transfer partners to ensure any trigger is the best fit for their application.

One final concern about parametric products that we addressed in the design is the case where a significant event occurs (and causes damage) but is not sufficient to trigger the policy. A design in which a damaging flood could occur with no payout would lead to frustration for the beneficiaries and amplify distrust between the risk transfer market and the community. As such, the trigger is designed to scale payment based on the severity of the event where there would be a small recovery during relatively small events and a larger recovery with more severe events. To determine the desired payout levels, Guy Carpenter used catastrophe models to estimate the frequency of different sized flood events in the pilot neighborhoods. Additionally, they benchmarked catastrophe models with independent estimates of significant historic floods to determine hypothetical recovery if the risk transfer program was in place at the time of the event. The team also discussed the tradeoff between a more cost-effective solution which would trigger at a lower-probability and the desire, as a pilot, to test and prove the concept with a higher frequency event. The cost of risk transfer is higher when there is a higher likelihood of recovery, so there is a tradeoff between recovery frequency and final cost of the program. Working with Guy Carpenter, the team ultimately landed on a 10-step trigger that increases in increments of $100,000 up to a maximum payout of $1.1 million.

Regulatory Considerations

This type of meso-insurance model, and parametric risk transfer, are both fairly new to the U.S. insurance market and did not fit neatly into the rubrics of existing insurance regulations. Insurance in the United States is typically classified by state regulators into certain lines of business and must adhere to regulations for that line of coverage. There is no “meso-insurance” or “parametric insurance” class, which forced us to attempt fitting our model into other categories, such as property insurance or liability insurance; for this particular model, neither was a clear fit. There are two specific difficulties our model faced in the U.S. regulatory environment: insurance needs to indemnify the policyholder and the policyholder must have an insurable interest.

Let’s start with the first. Insurance is defined as reimbursing for a loss. This is known as indemnification and it means that a policyholder cannot profit from insurance – if they could, it would be a speculative financial instrument and not insurance. This is why most property insurance pays the costs to repair or replace damage and requires substantial documentation to make sure this is done exactly. Some observers do not believe that a

parametric policy – which pays a set amount based on a measure of the hazard regardless of measurement of loss – can be classified as insurance because, in theory (depending on the design), the policyholder could receive a payout larger than their loss.

Several approaches have been taken by different U.S. regulators to overcome this challenge, often involving what is referred to as "proof of loss." This is essentially an additional trigger on a parametric policy that requires some proof that the insured has suffered an economic loss. For microinsurance policies – those where the payout is small – some jurisdictions have allowed for innovative means of meeting this requirement. In California, Oregon, and Washington, for example, Jumpstart offers small parametric insurance policies for earthquakes where payouts are made based on measurements of ground-shaking. Regulators in these states have allowed a simple proof-of-loss method where the company texts policyholders and asks them if they have suffered any economic loss as a result of the quake. If they attest that they have, the funds are released. In Puerto Rico, the regulator adopted guidance for microinsurance policies that waives proof-of-loss entirely, under the recognition that if there was a triggering catastrophe, there is no way households would not have suffered loss at the level of payouts.

Our model, however, is distinguished from micro-insurance because it involves a sizable maximum payout of almost $1.1 million, and the Center, not the individual household, is the payee under the contract. While our triggers and payout amounts were designed to prevent any profit-making, we also solved for this issue by including in the contract a "claw back provision," whereby the Center would need to return any funds that were not used as emergency grant payouts. This could be verified with sound record keeping by the Center as to total grant payouts through the program. Such a contract provision would guarantee that the product only provides indemnification.

The second regulatory challenge for this new model is the requirement that policyholders must have an insurable interest – that is, a financial stake in, or deriving value from, what is insured. This is to prevent, to take an extreme example, someone taking out insurance on their neighbor's house and then burning it down to collect the insurance payout. While it may appear at first glance that the Center is taking out insurance on behalf of the residents, the Center is not making any promises to households or providing any guarantee of payment. Rather, it is using risk transfer as a financing tool for an emergency assistance program. In this way, the insurance would be on behalf of its own program. As such, the insurable interest is the Center making sure it does not have a deficit in its assistance fund. The challenge, though, is that there is nothing obligating the Center to make these assistance payments and thus it has no liability or obligation, as currently arranged. While there may be various means of establishing an insurable interest on the part of a non-governmental-organization acting as an aggregator for a group of homeowners, those potential avenues conflicted with other practical considerations for the implementation and administration of this particular program. Note that it may be easier for a municipal or state government to show it has an insurable interest in using a risk transfer instrument for recovery of its citizens, since without the extra funding the local government may face negative economic impacts or larger fiscal strain on budgets. Additionally, governments have an interest in the tax revenues tied to property values. This area of insurance law and

regulation is one that has not yet been resolved in a manner that can consistently inform the development of parametric products.

Despite the team's expectation that it should be possible for our model to meet definitions of insurance, given the novelty of the pilot, the team quickly realized that resolving these issues to the satisfaction of the regulator would take a substantial effort by all parties. The project team decided that such regulatory engagement warranted a time frame and legal resources well beyond those available for our small pilot, particularly since the regulator's assessment of our proposed product would set precedent. As such, without the comfort of official, expressed regulatory approval of the initially-conceived parametric insurance product, we ultimately executed this product as a derivative. This has been true for similar models around the world, which are often implemented as financial products. This was thus not a new approach and provided an expeditious path forward.

The approach, though, does have some drawbacks in the U.S. setting. First, insurance regulation is a more appropriate framework for this model where there is not intent to ever profit. The Commodity Futures Trading Commission (CFTC), which regulates financial derivatives, has concerns about speculative investing that do not apply to our model. And insurance regulators, which focus on issues of consumer protection and insurer solvency, are much more appropriate governance concerns for our model. Also, only "Eligible Contract Participants," as defined under U.S. commodities laws (essentially, sophisticated buyers), are legally allowed to purchase bi-lateral (that is, between parties rather than on an exchange) derivatives. While the Center qualifies as an Eligible Contract Participant, many smaller community organizations and non-profits would not, closing off this model to many. Second, the insurance regulatory regime seems more appropriate for our model because it principally focuses on consumer protection and insurer solvency and, therefore, discourages speculation. In contrast, speculation is key for properly functioning detritivores markets and, as such, not discouraged by U.S. commodities laws. Rather, the CFTC seeks to balance consumer protection with risks that are inherent where speculation is involved. The project team hopes that in the coming years, regulators and other stakeholders can work together to find approaches for expanding the use of parametric and meso-insurance models when useful for closing existing gaps in financial protection for disasters.

WHAT HAVE WE LEARNED?

Given the novelty of the meso-insurance design, a detailed evaluation of the project is warranted to inform future replication, scaling, or modification. A robust evaluation of a pilot typically requires several component studies, beginning with an evaluability assessment of the pilot against the original need (or the program's theory of change) and leading into a rigorous study of the pilot's implementation such as that described in this document [39]. For us, the most important analysis will be an evaluation of the program's outcomes and its impacts on households after a triggering flood event. The study of those specific outcomes – such as changes in household savings, expenditure disruptions, or other financial consequences after a flood – is currently being designed. While the Center purchased a one-year risk transfer product in early 2023, it has not been triggered. As such, certain necessary studies of program impact have not yet been possible.

We have, however, completed design and launched the program and thus can document and analyze those processes and their implementation. It is these lessons that we share in this report – essentially the link between the inputs and the activities. Based on records of the pilot process to-date, we can also begin to qualitatively assess whether the selection, implementation, and inputs can be replicated across different geographies and scales. This section thus provides the initial lessons learned for other non-profits or community organizations that may wish to use risk transfer products to support an assistance program or to cover other economic impacts of a disaster. Please note, not all of the lessons will be applicable to all entities – in particular, while this concept could be used by a local government, they will have a distinct set of implementation challenges and opportunities such that some of the below learnings from a non-profit may be less applicable.

Should the risk transfer product be triggered, and the flood assistance program activated, broader evaluation would be possible. This would include first a look at the operation of the assistance program and how well it met target outputs. That is, an evaluation of the link between the "activities" column and the "outputs" column as depicted in our logic model in Figure 3. This would involve a survey of program operators and program participants to document whether the goals were achieved (e.g., ease and extent of program participation,

the number of households served and the funding they received, satisfaction with service delivery). This would also include a look at how the risk transfer product operated: was the payment process smooth and fast? Was the amount well-matched to the need? Did it perform as anticipated?

The second component of a post-flood program evaluation would be measuring the program's effect on the "long-term outcomes" listed in the logic model. This would require a research strategy with a large enough sample and an ability to track households for up to a year after the program. Additionally, as noted earlier, it would require methods that can help isolate the impact of the program on the potential indicators listed in the logic model, such as the amount of deferred expenses. This type of study will be necessary to determine if the approach of fast and flexible dollars does indeed improve post-disaster outcomes for households.

1 Getting Started

Learn about private risk transfer markets

The very first step for a non-profit considering the use of risk transfer to fill existing disaster recovery gaps, is to learn about how risk transfer works and the dynamics and processes of the risk transfer market. This includes obtaining an understanding of the players and their roles, such as brokers, insurers, and reinsurers; the difference between insurance and other risk transfer instruments; how insurance is priced; and how the claims process works. It also includes exploring examples globally of risk transfer approaches that were designed to meet similar goals as those being considered by the organization. In this pilot, the Center worked first with the Wharton Risk Center (now dissolved), and then with EDF, on understanding and then navigating insurance markets and options.

Create a dedicated team

As soon as the decision is made to pursue this approach, a dedicated team should be created with a workplan, timeline, and standing schedule of engagement. This should include a core team with members of the implementing organization and any other key advisors or partners. For our pilot, approximately eight to twelve individuals were intensely involved at any one time from across the partners and for different tasks. The approach used in this pilot included a funding partner, the community organization, advisors from multiple sectors, an insurance broker, an insurance/reinsurance provider, and a data provider. With so many necessary partners, a small core team that keeps the project organized and on track is necessary.

The implementing organization should also determine roles within their organization early in the process. It often requires having project champions who can elevate the project and obtain the endorsement of senior management. Creating a new program from scratch can extend over an enormous amount of time – up to a year – even if an organization already has a program or department responsible for deploying services. It can also take a

substantial amount of time from all team members. For example, the core project team for this pilot held monthly team-wide calls along with (on average) biweekly task calls and, for certain points in time, were in at least weekly contact with each other. For a small number of team members, the work amounted to approximately twenty percent or more of their employed hours though large stretches of project development.

It can sometimes be difficult to get attention and priority for disaster-specific programs in non-disaster times. Be prepared to have to push for attention to the needed program creation process. Support from leadership including the appropriate resource and staffing allocations will be essential.

2 Place Your Approach in the Broader Context

Clearly define the gap your program will fill

One risk transfer solution cannot fill every disaster recovery gap. As such, any effort must begin with a detailed assessment of the current financial needs of diverse community members. This can be done through an examination of current disaster assistance programs, what they pay, and under what conditions, as well as a look at take-up rates for different insurance products [36]. It also should be done through investigations of local recovery from prior disasters. Talk to different groups that assisted in recovery from prior events and ask what challenges they witnessed and what gaps they noticed. Emergency management offices, for example, likely have staff, data, and reporting to shed light on populations and specific needs that tend to be underserved post-disaster.

The team will then need to determine what specific gap, for which specific peril(s), and which specific population(s) they are seeking to fill. This includes consideration of what populations the project will serve (the demographics and financial condition of the households), what housing or building types will be the focus, and which hazards will be considered. As stated already, for this pilot, the aim was to provide fast and flexible dollars to LMI owners or renters to cover immediate needs after a severe rainfall-related flood event. In our work examining financial recovery gaps, the team learned that very few households at risk of rainfall-related flooding had flood insurance. The team also identified gaps in timing of post-disaster resources and that the first days and weeks after a flood can be a critical time that is under-resourced by existing programs.

Explicitly design for integration with other programs

Once the need, peril, and population are identified, then the design team must consider how the solution will interact with other existing programs, at both a federal and local level. Federally, this involves consideration of federal disaster assistance and, if a focus on flooding, the National Flood Insurance Program (NFIP). For us, the two programs of concern were the NFIP and FEMA's Individual Assistance (IA) grant program.

While the NFIP makes flood insurance available to all residents of participating communities, our pilot is focused on a population that either did not have flood insurance,

did not need a full indemnity policy, or could not afford flood insurance. The city and other local partners had observed after prior floods that households located in inland areas outside of the FEMA-mapped 100-year floodplain (the Special Flood Hazard Area, SFHA) were more likely to be uninsured against flooding since in these areas they were not informed of the risk or required to insure. Some of these households simply could not afford an NFIP policy, even if they were aware they were at risk. The average annual cost of an NFIP policy outside of the SHFA in New York City was $683 in between 2020 and 2022. For others, rainfall-related flooding resulted in costs that would not be well-covered by an NFIP policy, such as evacuation expenses, backup power, or covering lost income. Finally, indemnity insurance payouts can often take weeks, if not many months, to reach policyholders, leaving LMI residents struggling with the immediate expenses that begin the day of the disaster. The Center's assistance program was designed to complement the NFIP and to meet different needs than an NFIP policy—not as a replacement for it.

The team also considered the role of FEMA's IA program. This is a grant program that is only made available after a President issues a disaster declaration. Rainfall-related flooding can be localized and not widespread enough to activate a disaster declaration, such that these funds might not be available at all. The design team for this pilot wanted to be sure that the Center grant program could still pay when there was localized need, even if not widespread enough to trigger activation of IA by the President.

Still, as the city experienced after the severe flooding related to Ida in 2021, if severe enough, a declaration could be issued. For cases where IA is offered, the concern of the project team was ensuring that residents would still be eligible for the FEMA assistance. IA grants are typically a few thousand dollars and designed to cover needs not funded by other sources. IA grants will not pay for losses that could be covered by insurance – this is referred to as "duplication of benefits." Many stakeholders raised concerns in the design phase that the targeted population of the pilot needed access to as many post-disaster resources as possible and so grants from the Center must not disqualify them from IA (if available) under duplication of benefits rules.

To do this, the Center drew on their experience after Hurricane Sandy and spoke with other groups experienced in helping households navigate disaster recovery to develop guidance on what economic costs were ineligible for IA and could be covered by the Center grants. This could then be stated explicitly in award letters to ensure recipients remain eligible for IA. For example, the Center's grant could be stated as being for mortgage payments, which would leave the recipient eligible to receive a FEMA IA repair award. That said, IA can be very time-consuming and difficult for households to navigate and prior research has found that the payouts can be regressive, favoring higher-income and whiter areas [22, 40, 41]. Some advisors thus noted that if the Center grants were easier, faster, and contained greater sums for people, they could still improve household recovery, even if disqualifying them from some IA.

Beyond federal programs, though, it is also important for the design team to consider how the program will interact with local programs. This was achieved in this pilot through advisory support from the NYC Mayor's Office of Climate and Environmental Justice. Staff

from MOCEJ were able to connect the team to other local offices and highlight ways in which the pilot could be complementary to other city efforts and not duplicative. As discussed earlier, New York City has many programs to help educate residents about climate risks to help reduce flood risks over time, and to build household-level financial resilience. This pilot, focused on the financial recovery from floods, was naturally complementary to these efforts.

3 Purchasing the Risk Transfer Product

Iterate and negotiate

Be prepared to iterate and negotiate to make sure the final risk transfer product meets your specific needs. This could include considering more options for the trigger design, examining a wider range of modeling and analytics, shopping for the best risk transfer price, and carefully reviewing contract language to ensure it meets expectations. The design details of the risk transfer instrument will determine whether it meets the needs of your program and is a value add – be sure it is structured to your needs.

Get board approval early

For non-profits, new programs or new financing typically require approval by their board of directors. Given the novelty of these approaches, involve the Board of Directors early and throughout the process and be sure to provide significant lead time before negotiation of the risk transfer contract. For many community and non-profit organizations, risk transfer will be a new topic for many board members and they are likely to have many questions about how it works and how it advances the mission of the organization. Inviting experts to present to the board to explain concepts can be a helpful starting point. The board can then be engaged in design choices throughout the development process.

When testing something new, it must also be explained to the board that part of piloting is to learn and that failure can be expected. These small pilots are to “learn by doing” and even if the program fails to operate as expected, the learnings are critical for future program design and development. This is a very different mindset than is typical when in considering new programs and might require an ongoing dialogue.

This early engagement will make board members prepared for any final approvals that are needed. For example, for the particular design of this pilot, the Center had to open a bank account dedicated to this new program. This was not possible to do without board approval and so could not be left until the last minute without jeopardizing signing the final contract. It is important to keep in mind that in some cases board approval can take months, so it is necessary to plan ahead and include time for this. The pricing and structure of risk transfer instruments changes over time, so it is important that a delay in board approval does not require a renegotiation of pricing and terms.

In this pilot, the Center’s Board of Directors expressed several concerns that needed to be addressed before final approval. The first was focused on the fact that the risk transfer product had to be a derivative due to regulatory limitations (discussed above) and was not

actually an insurance product. Some board members had trouble connecting the financial product to the work of protecting LMI homeowners. A few board members had deep experience with the 2008 financial crisis and considered derivatives risky and had negative perceptions about their use. To assuage concerns, the Center staff brought in experts to contextualize how this type of insurance-like derivative could not be used for speculative profit-making and functioned equivalently to insurance.

The next set of questions and concerns centered around the efficacy, logistics, and reputational risks of the Center taking out a risk transfer product on behalf of LMI residents. The Board raised concerns that even though the Center could never profit off the parametric product, these tools are generally not well-understood and the Center did not want anyone raising a misperception that the Center could somehow profit from a program designed to help disadvantaged households. The board also raised concerns about purchasing a product from global, for-profit companies that are part of "big finance." They were concerned about the Center being seen as potentially enriching a sector that has been known for its predatory behavior in the past. The board, understandably, wanted a deep discussion on whether purchasing a product such as this was truly mission-aligned for the organization.

Ease the contracting process

Early in the process, identify who in the organization is needed for contract review and approval. Contracting can take time and the necessary people should be involved from the start. These people might include general counsel, finance team members, and possibly the CEO. Community organizations should request to see all of the legal contracts at one time to have a complete understanding of their liabilities and to ensure an efficient review and approval process. Community organizations should request answers to these questions: How many documents and contracts will we be reviewing? What are they? What is the timeline for getting them done? With answers to those questions, it is much easier to establish a negotiation and revisions timeline.

4 Standing up the Assistance Program

Learn from others

It can be helpful to seek guidance and advice from other groups around the country that are focused on similar objectives. Many local organizations have established programs to help those they serve recover from disasters. The recovery gaps identified by these groups are often similar around the country, making many programmatic ideas transferable. Lessons from others can not only speed the program design and creation process, but also help make success more likely by avoiding mistakes that others have made. Reach out and connect with these other organizations to share tips and lessons learned.

Consider partners, engagement, and participation formats

There are dozens of choices to make about an assistance program, even after the population, needs, and hazards have been identified. Who will staff the program? How will households be notified? How will assistance requests be collected, reviewed, and executed?

What information is needed for review? Who will make determinations and how? All of these questions will need to be addressed by the non-profit team, with particular attention to the necessary resources for not just program design and launch, but activation in the event of a disaster. This may require identifying key partners and their roles and documenting these clearly in advance. Some of the functions may be done by those external to the organization through partnership agreements. This could range from hiring a consultant for certain aspects of the program to agreements with other community organizations in a better position to provide a particular service.

Build in time for technology development

If technology is needed to launch the program, start the build-out as soon as possible. Building a website and application portal and connecting that to internal databases of the organization is a workstream that – depending on the particular organization – could take a significant amount of time and resources. Some hurdles can arise including the need to procure additional platforms and services, verifying copy and language, onboarding new developers to help with the sites, and testing for platform glitches and malfunctioning. This may also be an area of low internal capacity for some organizations, requiring more thought and effort and likely requiring the need to hire additional contractors to support the technology development.

Discuss fraud prevention approaches related to assistance provision

Discuss how to incorporate fraud prevention into the application intake process. While the use of a parametric derivative to fund an assistance program does not require documentation of recipient loss for contract compliance, mission-driven non-profits still have an obligation to vet applicants to ensure funds go to those impacted and in need following the policy being triggered. For an organization that does not typically engage in assistance provision, sending funds to households without serious economic need could result in a reputational risk for the organization. To avoid these concerns, the organization must determine how the need/loss will be verified quickly to avoid a slow distribution of assistance. This will require a conversation with organizational leadership about program objectives and mission alignment.

Consider program budget and resourcing

Creating a new program will require dedicated time from all partners in design and launch, as well as ongoing staff time to support the program once it is in operation. Once established, most of the program needs will be post-flood; this may require the capacity of the organization to re-task people to the program when activated by a disaster. Before embarking on the program design, the organization should ensure sustained funding for this needed staff time. For an assistance program financed through an insurance purchase as in this pilot, the organization will also need annual premium payments and annual brokerage fees. The size of these payments will depend on the details of the risk transfer product, including payout levels and how frequency payouts are estimated to be made. Organizations will need to consider the source of these needed annual funds. Potential sources include government or foundation grants, philanthropic donations, or other sources of existing revenue.

CONCLUSION

This report distills lessons learned from the design and launch phases of a NYC-based pilot to provide immediate assistance to LMI households struggling with post-flood financial needs unmet by other programs. The pilot harnesses parametric risk transfer to finance an assistance program run by the Center for NYC Neighborhoods. After completing the early phases of the pilot, the project team was able to identify key findings for other non-profits or community organizations interested in replicating aspects of the new program. This pilot was in one location, designed in part by terms set by our grant funding, with a specific set of partners and potential service recipients. Other groups will face a different set of opportunities and constraints, but the lessons from our launch may nonetheless prove useful as other groups consider replication.

The two pieces of this pilot – the use of parametric risk transfer and the creation of a post-disaster assistance flood for lower-income households – could be replicated independently or together. Parametric risk transfer can be undertaken at all scales from microinsurance (as has recently been launched in Puerto Rico) up to use by governments to support various aspects of post-disaster rebuilding and recovery. While a risk transfer product could fund an assistance program, such a program could also be funded directly by public or philanthropic dollars, as well, as has been done in other locations around the country in various forms. Linking the two, however, provides a guaranteed source of funding at the moment of greatest need instead of having to rely on the chasing of charitable dollars or government assistance that can be slow to arrive and poorly matched to needs.

If the pilot is continued in subsequent years and is activated by a severe flood, additional monitoring and evaluation will need to be undertaken to address open questions about operation, efficacy, and impact of both the parametric product and the assistance program:

- Did the parametric product execute easily and fast and as expected?
- Was it the right amount of funds for the need?
- What risks are most cost-effective for risk transfer?

- Did the grant assistance program run smoothly?
- How much do households need after floods of different levels of severity?
- How quickly do they need funds?
- Do fast and flexible dollars improve their recovery outcomes?

The team has already flagged two key issues that require continued discussion and refinement for sustainability of the program and any expansion or replication. The first is specifically related to the use of risk transfer: finding a stable source of funding for premiums. It is notoriously difficult to motivate the purchase of insurance. No one likes to purchase something they hope to never use, people generally hate to think about bad things happening, and people are often unaware of the risks they face and the role insurance plays in management of those risks, all of which lead to chronic under-preparedness. For community organizations and other non-profits, greater use of risk transfer will also require a shift in disaster philanthropy: donors will need to understand that in paying the cost of a premium, their dollars will be leveraged many times over in post-disaster payouts. But right now, many donors prefer to donate to disaster relief when needed rather than to ongoing disaster preparation. Some organizations might find ways to embed insurance premiums into budgets, but that will likely take more demonstrations of success and efficacy in the aftermath of a disaster to motivate such commitments. It is likely there will be more charitable dollars and possibly government grants to support piloting, but those dollars may be less available to financially support a long-term program. Long-term funding is needed since paying a premium for one year or hoping to time insurance purchase to when a disaster occurs does not work – coverage must be maintained over the longer-term.

The second key open issue is determining the most efficacious, cost-effective, and sustainable institution and approach to support the immediate, post-disaster needs of LMI households. Community organizations and local nonprofits may be in the best position to identify populations that require assistance and document their specific needs, as well as have the trust and partners to have a wide reach. Most rely, though, on donations. These could be secured after a disaster to fund an assistance program, but organizations would prefer not to spend time courting donors in the immediate aftermath of a disaster; they would prefer to be on the ground helping. Risk transfer could thus play an important role in smoothing their financing and ensuring funds when needed. On the other hand, disasters are growing in frequency and severity nationally and we risk having people fall between the cracks if we must rely on local organizations, which may have limited capacity and resources, to reach everyone in need. There is thus a strong incentive to work to improve the federal assistance programs to make them better able to meet immediate needs and expand their reach to the most vulnerable.

REFERENCES

1. AECOM (2013). *The Impact of Climate Change and Population Growth on the National Flood Insurance Program through 2100*. Prepared for Federal Insurance and Mitigation Administration, Federal Emergency Management Agency.
2. Wing, O. E. J., Bates, P. D., Smith, A. M., Sampson, C. C., Johnson, K. A., Fargione, J., & Morefiled, P. (2018). Estimates of present and future flood risk in the conterminous United States. *Environmental Research Letters*, 13(034023).
3. Sweet, W. V., & Park, J. (2014). From the extreme to the mean: Acceleration and tipping points of coastal inundation from sea level rise. *Earth's Future*, 2(12), 579–600.
4. Neumann, J. E., Emanuel, K., Ravela, S., Ludwig, L., Kirshen, P., Bosma, K., & Martinich, J. (2015). Joint effects of storm surge and sea-level rise on US Coasts: New economic estimates of impacts, adaptation, and benefits of mitigation policy. *Climatic Change*, 129(1–2), 337–349.
5. Garner, A. J., Mann, M. E., Emanuel, K. A., Kopp, R. E., Lin, N., Alley, R. B., Horton, B. P., DeConto, R. M., Donnelly, J. P., & Pollard, D. (2017). Impact of climate change on New York City's coastal flood hazard: Increasing flood heights from the preindustrial to 2300 CE. *Proceedings of the National Academy of Sciences*, 114(45), 11861–11866. **https://doi.org/10.1073/pnas.1703568114**
6. Mallakpour, I., & Villarini, G. (2015). The changing nature of flooding across the central United States. *Nature Climate Change*, 5(March), 250–254.
7. Prein, A. F., Rasmussen, R. M., Ikeda, K., Liu, C., Clark, M. P., & Holland, G. J. (2016). The future intensification of hourly precipitation extremes. *Nature Climate Change*, 7, 48. **https://doi.org/10.1038/nclimate3168**
8. Wobus, C., Lawson, M., Jones, R., Smith, J., & Martinich, J. (2013). Estimating monetary damages from flooding in the United States under a changing climate. *Journal of Flood Risk Management*, 7(3), 217–229.
9. NYC Emergency Management (2019). *NYC's Risk Landscape: A Guide to Hazard Mitigation*. New York City Emergency Management. **https://www1.nyc.gov/assets/em/downloads/pdf/hazard_mitigation/risklandscape2.0_2019_r2_digital_lowres.pdf**
10. USGCRP (2018). *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*. U.S. Global Change Research Program.
11. Mayor's Office of Resiliency (2021). *New York City Stormwater Resiliency Plan: Helping New Yorkers Understand and Manage Vulnerabilities from Extreme Rain*. The City of New York.
12. Hallegatte, S., Vogt-Schilb, A., Rozenberg, J., Bangalore, M., & Beaudet, C. (2020). From Poverty to Disaster and Back: A Review of the Literature. *Economics of Disasters and Climate Change*, 4(1), 223–247. **https://doi.org/10.1007/s41885-020-00060-5**
13. Hamel, L., Wu, B., Brodie, M., Sim, S.-C., & Marks, E. (2018). *One Year After the Storm: Texas Gulf Coast Residents' Views and Experiences with Hurricane Harvey Recovery*. The Kaiser Family Foundation and the Episcopal Health Foundation.
14. Markhvida, M., Walsh, B., Hallegatte, S., & Baker, J. (2020). Quantification of disaster impacts through household well-being losses. *Nature Sustainability*, 3(7), Article 7. **https://doi.org/10.1038/s41893-020-0508-7**
15. Keister, L. A. (n.d.). The One Percent. *Annual Review of Sociology*, 40, 347–367.
16. Shapiro, T. M. (2017). *Toxic inequality: How America's wealth gap destroys mobility, deepens the racial divide, and threatens our future*. Basic Books.
17. Howell, J., & Elliott, J. R. (2018). Damages Done: The Longitudinal Impacts of Natural Hazards on Wealth Inequality in the United States. *Social Problems*, 072018, 1–20.

18. Ratcliffe, C., Congdon, W., Teles, D., Stanczyk, A., & Martín, C. (2020). From Bad to Worse: Natural Disasters and Financial Health. *Journal of Housing Research*, 29(sup1), S25–S53.

19. Rhodes, A., & Besbris, M. (2022). *Soaking the Middle Class: Suburban Inequality and Recovery from Disaster*. Russell Sage Foundation.

20. Fothergill, A., & Peek, L. A. (2004). Poverty and Disasters in the United States: A Review of Recent Sociological Findings. *Natural Hazards*, 32(1), 89–110.

21. Pastor, M., Bullard, R. D., Boyce, J. K., Fothergill, A., Morello-Frosch, R., & Wright, B. (2006). *In the Wake of the Storm: Environment, Disaster, and Race after Katrina*. Russel Sage Foundation.

22. Billings, S. B., Gallagher, E. A., & Ricketts, L. (2022). Let the Rich be Flooded: The Distribution of Financial Aid and Distress after Hurricane Harvey. *Journal of Financial Economics*, 146(2), 797–819.

23. Martín, C., Gilbert, B., Teles, D., & Theodos, B. (2019). Housing Recovery and CDBG-DR: A Review of the Timing and Factors Associated with Housing Activities in HUD's Community Development Block Grant for Disaster Recovery Program. *U.S. Department of Housing and Urban Development*, 117.

24. You, X., & Kousky, C. (2023). Improving Household and Community Disaster Recovery: Evidence on the Role of Insurance. *SSRN Scholarly Paper* 4365715. **https://doi.org/10.2139/ssrn.4365715**

25. Paganini, Z. (2019). Underwater: Resilience, racialized housing, and the national flood insurance program in Canarsie, Brooklyn. *Geoforum*, 104, 25–35.

26. del Valle, A., Scharlemann, T., & Shore, S. (2022). Household Financial Decision-Making After Natural Disasters: Evidence from Hurricane Harvey. *Finance and Economics Discussion Series*. Board of Governors of the Federal Reserve System. **https://doi.org/10.17016/FEDS.2022.015**

27. Spader, J., & Turnham, J. (2014). CDBG Disaster Recovery Assistance and Homeowners' Rebuilding Outcomes Following Hurricanes Katrina and Rita. *Housing Policy Debate*, 24(1), 213–237.

28. Farrell, D., & Greig, F. (2018). *Weathering the Storm: The Financial Impacts of Hurricanes Harvey and Irma on One Million Households*. JPMorgan Chase & Co. Institute.

29. Sweeney, K., Wiley, H., & Kousky, C. (2022). *The Challenge of Financial Recovery from Disasters: The Case of Florida Homeowners after Hurricane Michael*. Wharton Risk Management and Decision Processes Center, University of Pennsylvania.

30. Poverty Tracker Research Group at Columbia University (2023). *The State of Poverty and Disadvantage in New York City, Volume 5*. Robin Hood.

31. Lieberman-Cribben, W., Gillezeau, C., Schwartz, R. M., & Taioli, E. (2020). Unequal social vulnerability to Hurricane Sandy flood exposure. *Journal of Exposure Science & Environmental Epidemiology*, 31, 804-809.

32. The Center for NYC Neighborhoods (2014). *Rising Tides, Rising Costs*. Center for NYC Neighborhoods. **https://cnycn.org/wp-content/uploads/2014/09/Rising-Tides-Rising-Costs-2014_compressed.pdf**

33. Kousky, C., & French, K. (2022). *Inclusive Insurance for Climate-Related Disasters: A Roadmap for the United States*. Ceres.

34. Kousky, C., & Wiley, H. (2021). *Improving the Post-Flood Financial Resilience of Lower-Income Households through Insurance*. Wharton Risk Management and Decision Processes Center, University of Pennsylvania.

35. Kousky, C., & Sengupta, R. (2022). *Parametric Insurance for Disasters*. Initiative of Climate Risk and Resilience Law and Environmental Defense Fund. **https://www.icrrl.org/wp-content/blogs.dir/102/files/2022/09/Parametric-Insurance-22.pdf**

36. Kousky, C., French, K., & You, X. (2023). *Addressing Financial Recovery Gaps for South Carolina Households: Models for Inclusive Disaster Insurance*. Environmental Defense Fund. **https://www.edf.org/sites/default/files/documents/%5BFinal%203%5D%20EDF_SC-Inclusive-Insurance-2023%20%281%29.pdf**

37. You, X., Kousky, C., Wiley, H., & Skees, J. (2022). *Linking Inclusive Finance with Inclusive Insurance in the United States Through Community Development Financial Institutions*. Environmental Defense Fund. **https://www.edf.org/sites/default/files/documents/%5BFinal%5D%20EDF_CFDI-Report_2022.pdf**

38. The Center for NYC Neighborhoods (2014). *Final Report to Goldman Sachs Gives*. Center for NYC Neighborhoods. **https://cnycn.org/final-report-goldman-sachs-gives-april-2014/**

39. Rossi, P. H., Lipsey, M. W., & Henry, G. T. (2018). *Evaluation: A systematic approach*. SAGE Publications.

40. Drakes, O., Tate, E., Rainey, J., & Brody, S. (2021). Social vulnerability and short-term disaster assistance in the United States. *International Journal of Disaster Risk Reduction*, 53. **https://doi.org/10.1016/j.ijdrr.2020.102010**

41. Wilson, B., Tate, E., & Emrich, C. T. (2021). Flood Recovery Outcomes and Disaster Assistance Barriers for Vulnerable Populations. *Frontiers in Water*, 3(7 December).