The Impacts of Extreme Weather Disasters on the Implementation of Head Start Services

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With the increasing frequency and intensity of extreme weather disasters,[1] it is essential for Office of Head Start staff and Early Head Start/Head Start (EHS/HS) program leaders to prepare for and respond effectively to these challenges. This brief presents data on the number and percentage of EHS/HS sites located in extreme weather affected areas from 2012 to 2017, along with estimates of the impacts of these disasters on EHS/HS enrollment and service delivery.

Key Findings

- Between March 1, 2012, and February 28, 2017, more than 4 in 10 (43%) EHS/HS sites were located in communities that experienced an extreme weather disaster. These extreme weather-affected EHS and HS sites had the capacity to serve more than half a million children.
- EHS/HS sites located in communities that experienced an extreme weather disaster were more likely to temporarily or permanently close in the year following the disaster.
- EHS/HS programs that remained open after an extreme weather disaster served more children in the following year but provided a lower percentage of those children with developmental screenings.
- EHS/HS programs did not experience greater difficulties in hiring teachers in the year following an extreme weather disaster.

This brief is based on a comprehensive approach to document how extreme weather disasters disrupt the delivery of EHS/HS services to children and their families. The SRI study team integrated multiple years of data from the Head Start Program Information Report (PIR) and Head Start Service Location datasets with contemporary records from Federal Emergency Management Agency (FEMA) disaster declarations and community demographic information from the U.S. Census Bureau's American Community Survey (ACS). We linked the FEMA and PIR data using Federal Information Processing Standards (FIPS) county codes for areas affected by extreme weather disasters that received federal disaster relief funding. We then used regression analyses to estimate the impacts of these weather disasters on the implementation of Head Start services.

The remainder of this brief provides background on these issues, describes the site-level and program-level findings in more detail, and suggests implications of the findings. See the Appendix for more information about the research methods, including the data sources, sample, and analyses.

Sites refers to the center or home-based facilities in which EHS/HS services were provided. Site information was drawn from the Head Start Service Location datasets.

Programs refers to the organizations that administered EHS/HS services. In some cases, programs included multiple sites. Program information was drawn from the Head Start PIR.

Extreme weather is increasingly common and impacts children's health and learning

Extreme weather disasters, such as tornadoes, hurricanes, floods, and wildfires, can have devastating consequences for communities, resulting in property damage, disruptions to public and private services, and loss of life.[2] The frequency of these events in the United States has increased, with a 44% rise in average annual weather-related disasters between 2005 and 2014 compared with pre-2000[3] levels. The severity of these events is also increasing, resulting in greater destruction and displacement.[4]

Young children are particularly vulnerable to the physical and mental health consequences of extreme weather disasters.[5] Children are more susceptible than adults to disease, infection, and malnutrition as a result of exposure to polluted air and water, shortages of healthy food, and displacement from their homes.[6] Further, a study of children who had experienced Hurricane Andrew found that nearly half reported symptoms of post-traumatic stress disorder following the event.[7] Other studies point to high rates of depression and anxiety among young children who experience extreme weather disasters.[8]

Extreme weather disasters can also negatively impact children's learning. International studies of children affected by disasters such as the 2010 Chilean earthquake and the 2009 Black Saturday bushfires in Australia found lower scores on assessments of language, preliteracy, and numeracy.[9] Other studies show a decline in the standardized test scores of school-age children and in young children's executive function skills, such as concentration and emotion regulation following extreme weather disasters.[10]

For nearly 60 years, Head Start programs have supported the development of young children from low-income households across the United States, and Early Head Start programs have done so since 1995. EHS/HS programs deliver early childhood services in center- and home-based settings, including health and wellness services such as nutritious meals, dental care, and screenings for developmental, sensory, or behavioral disabilities. Children are eligible for Head Start if they reside in households with incomes that meet U.S. Department of Health and Human Services poverty guidelines or are unhoused or in foster care. EHS/HS programs also reserve 10% of enrollment slots for children with disabilities. They also provide services for children's caregivers, including parenting education, job training, mental health services, and connections to food and housing assistance. For more information on EHS/HS programs, visit https://www.acf.hhs.gov/ohs.

The negative impact on children's learning may result from reduced access to services due to extreme weather disasters. School and early care facilities may be destroyed, teachers may be absent or unavailable, and children may be relocated to other districts, creating disruptions in access to educational services.[11] The extended housing instability, food insecurity, parental job loss, and social disconnection caused by extreme weather disasters can lead to significant emotional trauma for students.[12] Lost school time in early childhood due to extreme weather disasters is correlated with lower graduation rates, academic performance, and attendance over time.[13]

Consistent access to services can mitigate the impacts for children and families

Consistent access to high-quality educational, health, and support services has been shown to mitigate these impacts for children and families.[14] EHS/HS programs provide these services to approximately one million young children and their families each year.[15] Evidence indicates that participation in EHS and HS yields benefits for children and families. Although the mechanism and duration of effects have been debated,[16] evidence overwhelmingly indicates that access to EHS/HS services provides children with meaningful improvements in the development of key academic and behavioral skills.[17] Thus, it is essential for Office of Head Start staff and EHS/HS program leaders, as well as other state and federal agencies responsible for disaster preparedness and response, to ensure that EHS/HS programs are able to continue providing services following a disaster.

Early Education and Care, Inc. Head Start program in Panama City, FL. October 2018, following Hurricane Michael.

Photo by Kristen Hopp. Used with permission.

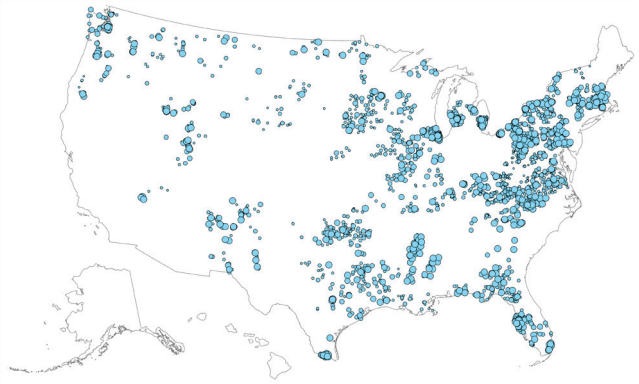
Site-Level Findings

Over a 5-year period, approximately 43% of EHS/HS sites were located in communities that experienced an extreme weather disaster

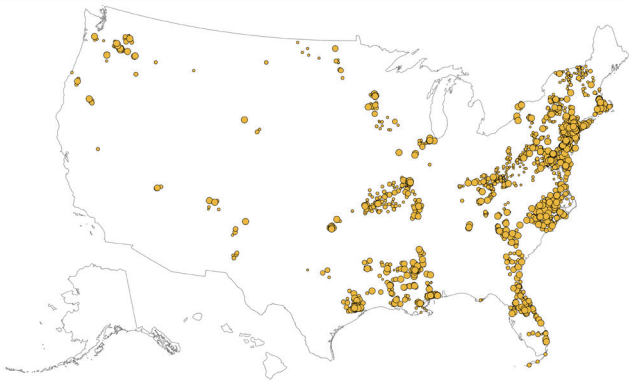
Between March 1, 2012, and February 28, 2017, a total of 8,130 EHS/HS sites were located in communities that were designated as federal disaster areas due to extreme weather (wildfires, storms, tornadoes, or floods). Of this total number of sites, 3,690 were affected by multiple extreme weather disasters—667 by three or more disasters. The maps below illustrate the locations of EHS/HS sites in communities that were and were not affected by disasters during this period.

Locations of EHS/HS sites in communities that did and did not experience an extreme weather disaster, March 2012 through February 2017

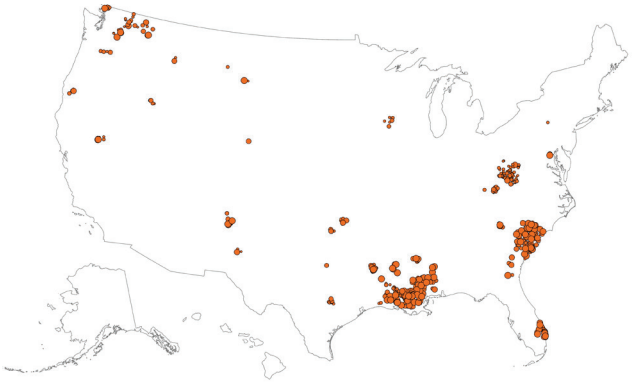
EHS/HS homes and centers that were in a community that **experienced 1 extreme weather disaster** between March 2012 and February 2017 (n = 4,440 or 23% of sites)



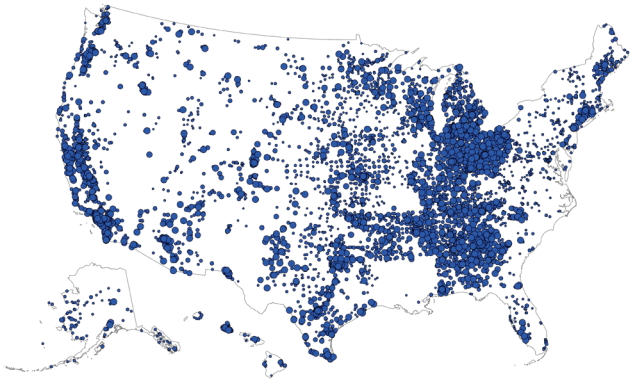
EHS/HS homes and centers that were in a community that experienced **2 extreme weather disasters** between March 2012 and February 2017 (n = 3,023 or 16% of sites)



EHS/HS homes and centers that were in a community that experienced **3 or more extreme weather disasters** between March 2012 and February 2017 (n = 667 or 4% of sites)



EHS/HS homes and centers that were in a community that **did not experience an extreme weather disaster** between March 2012 and February 2017 (n = 10,802 or 57% of sites)



Note: Each circle represents an EHS/HS site. Circle sizes reflect the total average number of enrollment slots (the number of children who could be served at the site) across years during the focal period.

EHS/HS sites situated in weather-impacted communities had capacity to serve more than half a million children in the 5 years from March 2012 through February 2017. The most common disaster was storms, which affected 276,322 EHS/HS enrollment slots, followed by floods, which impacted 193,934 slots. The year 2012–2013 saw the largest number of slots affected by an extreme weather disaster (218,620), the majority of which were related to Hurricane Sandy.

Enrollment slots in EHS/HS sites in communities that experienced an extreme weather disaster by year and disaster type

Year*	All extreme weather disasters combined	Wildfire	Storm**	Tornado	Flood
2012–2013	218,620	11,031	207,278	0	1,302
2013–2014	69,083	4,789	0	8,813	57,360
2014–2015	25,768	5,499	0	625	19,644
2015–2016	51,619	9,066	0	0	42,600
2016–2017	156,717	12,115	69,044	7,824	72,028
Total	**521,807**	**42,500**	**276,322**	**17,262**	**193,934**

** Each year extends from March 1 to February 28/29 of the following year. ** Storm category includes coastal storms, hurricanes, and tropical storms.*

EHS/HS sites in communities affected by an extreme weather disaster were more likely than sites in unaffected communities to close temporarily or permanently in the year following the disaster

Based on analyses of data files from the Head Start Service Location (HSSL) datasets from 2013, 2014, and 2015, EHS/HS sites located in communities that experienced an extreme weather disaster were more likely not to be included in the data file the following year, compared with sites in communities unaffected by an extreme weather disaster. A site may drop out of the HSSL data file because the site permanently or temporarily closed (e.g., as a result of an extreme weather disaster), the site moved to a new location to better meet the needs of the community, the site location was not updated following a transition in grants, or there was a data entry error.

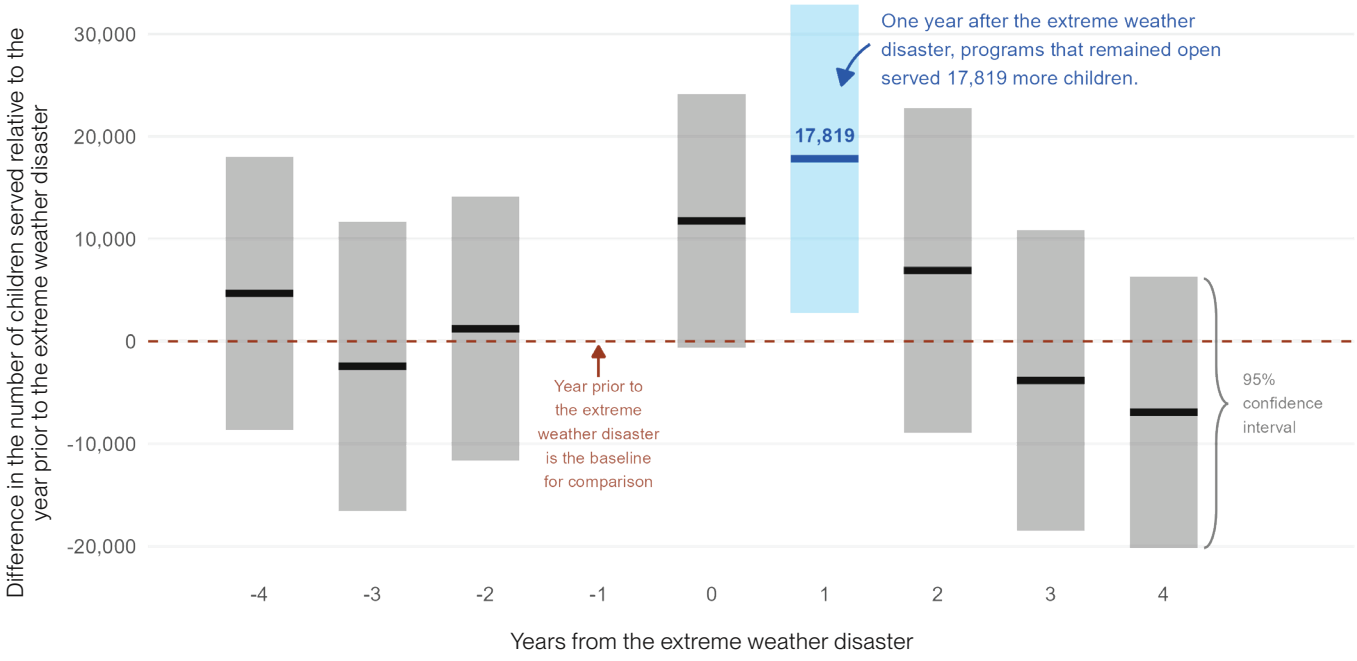
Specifically, 11% of EHS/HS sites in communities that experienced an extreme weather disaster in 2013 were absent from the 2014 HSSL data file, significantly higher than the 9% dropout rate for sites that did not experience an extreme weather disaster. This trend continued: 16% of sites impacted by a weather disaster in 2014 were absent from the 2015 data file, while only 15% of sites unaffected by a weather disaster were absent the following year. These differences in the probability of a site being included in the HSSL data file were statistically significant ($p < .01$).

Program-Level Findings

Among the EHS/HS programs that remained consistently open across 2012–2017, those in disaster-affected communities served more children in the year following the disaster

EHS/HS programs in communities affected by an extreme weather disaster served more children in the year following the disaster than in the year prior. The graph below illustrates the estimated impact of an extreme weather disaster on the number of children served, both before the disaster occurred and in the years following the disaster, relative to the year prior to the disaster. The analysis shows no changes in the number of children served before the disaster, indicating there are no pre-disaster systematic differences in the number of children served between programs that do and do not experience an extreme weather disasters. While the number of children served increases in the year of the disaster, this increase is not statistically significant. However, in the year following the disaster, those programs that remained open **served 3.5% more children** compared with the year prior to the disaster. This difference is statistically significant ($p < .05$) and translates into all of the EHS/HS programs in disaster-affected communities serving an average of 17,819 more children in the year following the extreme weather disaster across this five year period.

Impact of extreme weather disasters on the number of children served by EHS/HS programs in affected communities



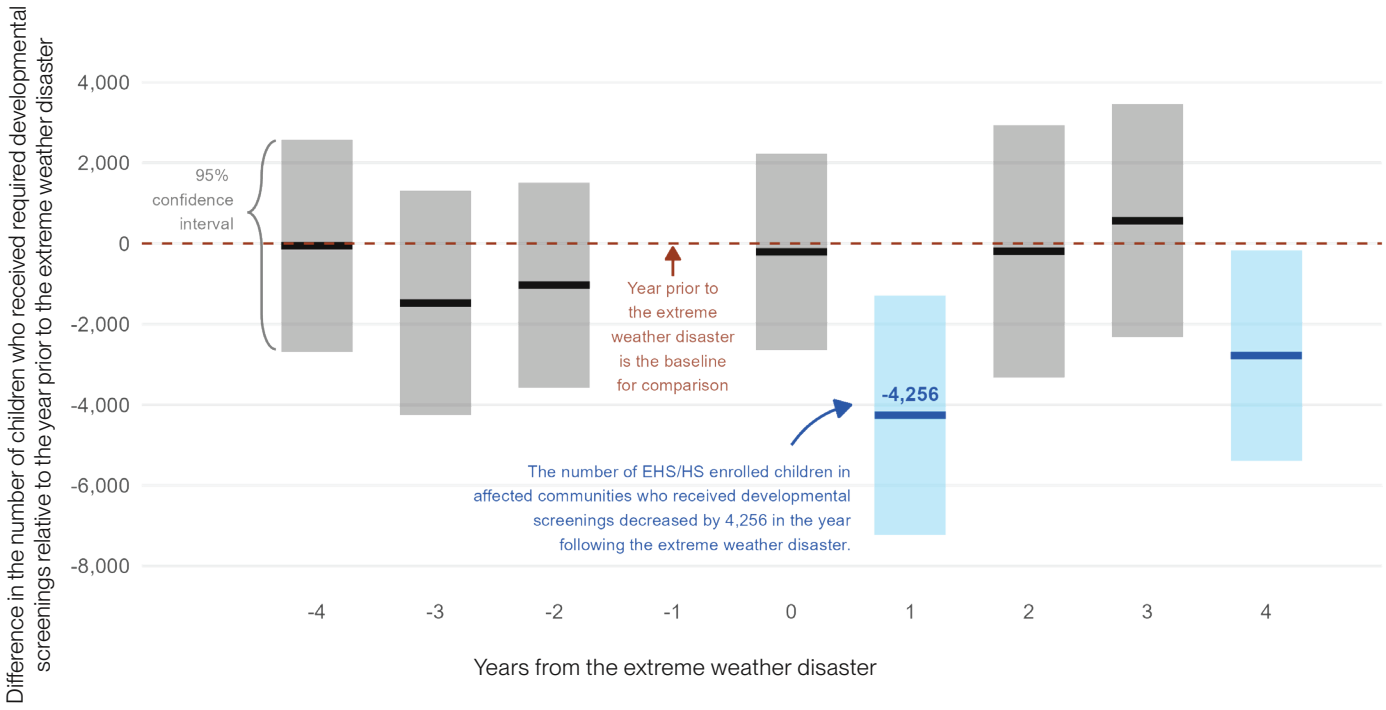
Note: Estimates colored blue are significant at $p < 0.05$. Estimates in grey are not statistically significant.

Although it may seem counterintuitive that EHS/HS programs would serve more children in the year following an extreme weather disaster, this finding must be understood in the context of the findings presented above indicating that programs in affected communities were more likely to close in the year following such a disaster. The increase in the number of children served is observed only among those programs that remained open. The programs that persevered may have adapted to increased demand or may have been better equipped to support the needs of their communities after the extreme weather disaster, ultimately allowing them to serve more children despite the challenges posed by the disaster.

Among the EHS/HS programs that remained consistently open from March 2012 to February 2017, the percentage of children who received developmental screenings decreased in the year following an extreme weather disaster

The percentage of children receiving developmental screenings in EHS/HS programs affected by an extreme weather disaster significantly declined in the year following the disaster. The analysis assessed the impact of an extreme weather disaster on the percentage of children receiving developmental screenings, both before the disaster occurs and in the years following the disaster, relative to the year prior to the disaster. There were no changes in the percentage of children receiving screenings before the disaster, indicating there are no pre-disaster systematic differences in percent of children receiving a developmental screening between programs that do and do not experience an extreme weather disasters. However, in the year following the disaster, the **percentage of children receiving developmental screenings decreased by about 2.7 percentage points**, a difference that is statistically significant ($p < .01$). This 2.7 percentage-point decrease amounts to approximately 4,256 EHS/HS children who would have received a developmental screening if not for the extreme weather disaster.

Impact of extreme weather disasters on the percentage of EHS /HS enrolled children in affected communities who received developmental screenings



Note: Estimates colored blue are significant at p <0.05. Estimates in grey are not statistically significant.

These findings suggest that EHS/HS programs may struggle to provide or report the full range of services in a timely manner during the year following an extreme weather disaster. While this study cannot determine the exact mechanisms behind this reduction in the percentage of children receiving developmental screenings, the reduction may be due to the weather disaster's disruptions to other public services. Additionally, it may be a consequence of programs enrolling a greater number of children in the year following the disaster. With more children to serve, programs may have had difficulty maintaining the same level of comprehensive services, including providing timely developmental screenings, for all enrolled children.

EHS/HS programs did not experience greater difficulties in hiring teachers in the year following an extreme weather disaster

We do not see evidence that EHS/HS programs faced increased challenges in hiring teachers in the year following an extreme weather disaster. The analysis assessed the estimated impact of any extreme weather disaster on the number of teacher vacancies both before the event occured and in the years following the disaster, relative to the year prior to the disaster. The results show no pre-disaster systematic differences in teacher vacancies between programs that did and did not experience an extreme weather disaster. Further, there were no significant impacts on teacher vacancies in the year of the disaster or in the subsequent years.

Recommendations

The findings illustrate that extreme weather disasters pose significant challenges for EHS/HS programs. With more than 40% of EHS/HS sites located in disaster-affected areas over a 5-year period, and many facing temporary or permanent closure, the programs that oversee these sites struggled to maintain the full range of EHS/HS services while attempting to meet increased demand. This highlights the need for targeted support to ensure continuity of care for vulnerable children and families in the aftermath of extreme weather disasters.

Based on these findings, we propose two potential actions that the Office of Head Start (OHS) could take to better support EHS/HS programs in responding to extreme weather events.

Increase technical assistance for robust disaster planning. OHS could provide more technical assistance to help EHS/HS programs create robust disaster plans. These plans should include strategies for maintaining comprehensive services, such as developmental screenings, even when enrollment increases in the wake of a disaster. Plans should also address how to best support the mental health needs of children, families, and staff impacted by trauma. OHS could develop templates and best practices to guide programs in creating tailored disaster plans that account for the specific risks and resources in their communities. Providing training on plan implementation and facilitating peer learning opportunities could further strengthen program preparedness and resilience in the face of future extreme weather disasters.

Coordinate with FEMA and prioritize EHS/HS services. To ensure the timely resumption of EHS/HS services following a disaster, OHS could coordinate with FEMA to designate these programs as essential services, similar to policing, firefighting, and medical care. This designation could help prioritize the repair of damaged EHS/HS facilities and the restoration of services for vulnerable children and families. OHS could work with FEMA to develop streamlined processes for EHS/HS programs to access disaster relief funds and technical support to get facilities operational again as quickly as possible. Prioritizing the return of EHS/HS services would help mitigate the disruption to children's learning and development and provide critical support to families in the recovery process.

By implementing these strategies, OHS can help ensure that EHS/HS programs are better prepared to withstand and recover from extreme weather disasters, minimizing disruptions to the critical services that support the healthy development and school readiness of our nation's most vulnerable children.

Appendix: Research Methods

Data Sources

This study drew on four sets of data: site-level data extracted from the Head Start Service Location (HSSL) datasets, data from the Head Start Program Information Report (PIR), records from Federal Emergency Management Agency (FEMA) disaster declarations, and community demographic information from the American Community Survey (ACS). All data except the site-level data are publicly available.

Head Start Service Location

Site-level data were extracted from the HSSL at four points in time: November 27, 2013; December 9, 2014; December 22, 2015; and October 12, 2019. These data include physical addresses for each center, grant number, program name, program number, and total slots. A program may have multiple sites in multiple counties, so program addresses do not necessarily capture a program's exposure to an extreme weather disaster occurring in a given county. We used site-level data to determine a program's exposure to an extreme weather disaster, based on the share of a program's total slots that were in a disaster-affected county. (Note that counties are called "communities" throughout the main body of this brief, for readability.) From year to year, more than 90% of sites were consistently present in the HSSL data file. We therefore assumed that site locations in fall 2013 captured site locations for the year from March 1, 2012, through February 28, 2013, and that site locations in fall 2015 captured site locations in the year from March 1, 2016 through February 28, 2017.

Head Start Program Information Report

The PIR data provided information on the study outcome variables as well as information on program characteristics used as covariates in the analyses. Prepared and submitted by each Early Head Start (EHS) and Head Start (HS) grantee, the PIR provides annual information on the performance of grantees, including program demographics, enrollment, program design and management, child and family outcomes, and staff qualifications and professional development.

We analyzed PIR data from the 2011/2012 school year to the 2016/2017 school year. We specified this range of data because (1) it provided sufficient time to observe the duration of impacts, (2) it gave us enough observations for a sufficiently powered study, (3) the variables of interest were sufficiently and consistently specified to support longitudinal analyses, (4) it provided the most recent period when longitudinal data are reported, and (5) it coincided with availability of site-level data. Note that this range does not include the period during which the COVID-19 pandemic affected the provision of EHS/HS services nationwide.

FEMA Disaster Declarations

The records of FEMA disaster declarations provided information on the timing, location, type, and severity of declared disasters in the United States. Compiled by FEMA, these records contain information on disasters caused by a range of events, including storms (coastal storms, hurricanes, or tropical storms), earthquakes, wildfires, tornadoes, and floods. The information includes the date and location of each disaster, the type of disaster, the affected population, the amount of damage, and the type of assistance FEMA provided.

For this study, we analyzed FEMA records from 2012 through 2017, as these years coincide with years for which site-level data are available. Although the majority (81%) of FEMA disaster declarations are weather-related, FEMA also responds to major events that are not weather-related, such as the September 11 terrorist attacks (2001), Deepwater Horizon oil spill (2010), and COVID-19 pandemic (2020).

American Community Survey

The American Community Survey (ACS) provides demographic and socioeconomic information on the U.S. population. We used this information as covariates in our analyses. The ACS collects data on a wide range of topics, including age, sex, race, ethnicity, education, income, employment, and housing, making it a valuable resource for researchers and policymakers who need current information on the characteristics of communities and populations. The ACS produces estimates for all geographic areas in the United States, including states, counties, cities, and smaller geographic units such as census tracts and block groups. ACS annual estimates provide yearly updates on demographic and socioeconomic characteristics for these geographic areas. We used the ACS annual estimates from 2012 to 2017 to coincide with the years for which site-level data are provided.

Sample

This study examined EHS/HS programs active during March 2012–February 2017. We limited our analyses to these years because site-level data—needed to determine the exposure of each center to an extreme weather disaster—were only available for those years. We focused on EHS/HS programs rather than EHS/HS grantees to more closely observe the geographic communities of the children, teachers, and families who may have been affected by an extreme weather disaster.

Measures

Dependent Variables

The dependent variable information came from the PIR. This included three measures:

Number of children served. EHS/HS programs report on the total number of children in each of six 1-year age categories (from under 1 year to 5 years). We summed the number of children across all ages the programs reported serving each year.

Percentage of newly enrolled children who received developmental screenings. The Head Start Act requires all children to receive developmental, sensory, and behavioral screenings within 45 days of entering a program, to determine if further evaluation is needed. Children who were enrolled in EHS/HS in the previous year and received screening must be rescreened when they return to Head Start the next year. The PIR provides information on (1) the number of all newly enrolled children since the previous year's PIR was reported and (2) the number of all newly enrolled children who completed required screenings within 45 days. We used this information to calculate the percentage of newly enrolled children who received screenings within 45 days.

Number of unfilled teacher vacancies. EHS/HS programs report information on the roles and qualifications of program staff on the payroll at any time since the previous year's PIR data were reported. This information includes EHS/HS staff, contracted staff, and substitutes but does not include consultants, volunteers, or student interns. In this section of the PIR, programs report on the number of classroom teacher vacancies that have remained unfilled for 3 months or longer.

Independent Variable

Independent variable information came from the FEMA disaster declaration records.

Extreme weather disaster. We classified a weather disaster as extreme if it resulted in a federal disaster declaration. FEMA disaster declaration records include information on the type of disaster, the amount of federal support (individual assistance, public assistance, and/or hazard mitigation assistance), and the counties that received the support. Note that although EHS/HS programs can access this support directly, the FEMA records do not provide sufficient detail to determine when resources are provided to those programs. The community information is provided via Federal Information Processing Standards (FIPS) codes. We characterized a county as experiencing an extreme weather disaster if it received any type of federal disaster declaration support following a storm (coastal storm, hurricane, or tropical storm), wildfire, tornado, or flood. We excluded disasters such as earthquakes that are not weather-related.

Covariates

We drew the following covariate information from the PIR and the ACS data.

EHS/HS program size. The PIR provides information on the overall enrollment of EHS/HS programs. We followed Office of Head Start protocols and classified programs as *extra small* (< 100 children), *small* (101–300 children), *medium* (301–600 children), *large* (601–1,000 children), or *extra large* (> 1,000 children).

EHS/HS region. The federal government has established 12 regional offices to oversee and support EHS/HS programs. Regions 1–10 are defined by geographic area. For example, Region 1 includes all EHS/HS programs in Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; and Region 2 includes all programs in New Jersey, New York, Puerto Rico, and the Virgin Islands. Region 11 supports EHS/HS programs targeted toward migrant and seasonal farmworker households across several states. Region 12 supports programs that serve children and families in American Indian and Alaska Native communities. For our analyses, we classified programs as being in Regions 1–10, Region 11, or Region 12.

Urbanicity. We drew information on the urbanicity of communities from the ACS. The ACS divides urban areas into three categories based on population size and density: urbanized areas (densely populated areas with 50,000 or more people), urban clusters (densely populated areas with fewer than 50,000 people), and large rural areas (sparsely populated areas adjacent to urbanized areas with 20,000 or more people). Rural areas are divided into two categories: small rural areas (sparsely populated areas adjacent to urban clusters or large rural areas, with 2,500 to 19,999 people) and isolated rural areas (sparsely populated areas not adjacent to any urban area, with fewer than 2,500 people). The U.S. Census Bureau developed this system to classify all geographic areas in the United States.

Population measures. The ACS provides information on the number of individuals by age range and by demographic characteristics for a given geographic area. Geographic areas more prone to extreme weather disasters may experience long-term declines in populations, so failure to include these measures could bias estimates. We controlled for both the total number of individuals living in the geographic area and the number of individuals younger than age 5, and the number of individuals by racial category, by level of educational attainment, and by employment status.

Community median family income. The ACS provides estimates of the median household income for a given geographic area. It first determines the total income earned by all households in the area and then divides that number by the total number of households in the sample to estimate the average household income. The ACS identifies the median household income as the income level at which exactly half of the households in the sample have higher incomes and half have lower incomes.

Regression Analyses

To estimate the effects of extreme weather disasters on the number of children served, percentage of newly enrolled children who received developmental screenings, number of unfilled teacher vacancies, and number of families who received at least one family service in EHS/HS programs, and the duration of those effects, we estimated a disaster study model of the following form:

$$y_{it} = \sum_{k=-10}^{10} \delta_k T_{itk} + X_{it}\beta + c_i + \gamma_t + \epsilon_{it}$$

In this model, y_{it} is the outcome measure for program *i* in year *t*; X_{it} is a vector of time-varying local area characteristics, including, for example, the total population and number of children younger than age 5 living in a given geographic area at time *t*; c_i is a program fixed effect; and y_t is a year fixed effect. For $k<0$, T_{itk} s a fractional treatment variable indicating the share of center *i*'s slots that will be affected by an extreme weather disaster in k years. For $k>0$, T_{itk} is a fractional treatment variable indicating the share of center *i*'s slots that were affected *k* years ago. For programs affected by an extreme weather disaster, we looked at total slots across sites associated with that program to determine the value of the treatment variable. For example, if a program has one site in an affected county and another site in an unaffected county, the fractional treatment is 0.50. T_{itk} takes on the value of this fraction if in year *t* program *i* experienced an extreme weather disaster *k* years ago. We restricted the analysis to samples with non-missing outcome data.

Under the assumption that the EHS/HS programs not experiencing an extreme weather disaster capture the counterfactual trends that would be observed in all programs in the absence of extreme weather disasters, this model estimates the causal effect of extreme weather disasters. This assumption is likely valid due to the random timing of extreme weather disasters.

The coefficient δ_k for $k=1$ in the above model captures the impact of the extreme weather disaster on outcomes of interest in the year following the disaster. To capture the duration of the impact, we tested the null hypothesis that $\delta_k=0$ for each $k\geq1$ to identify the first year in which the program returns to its baseline level for each outcome of interest. We also estimated modified versions of the above equation.

Footnotes

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