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AWARD AMOUNT:
\$47,500

JENNIFER M. FIRST
University of Missouri

MICHAEL SUNDE
University of Missouri

KRISTINA KINTZIGER
University of Nebraska Medical Center

KELSEY ELLIS
University of Tennessee, Knoxville

SARAH ELIZABETH SCALES
University of Nebraska Medical Center

MEGAN WADDLE
University of Missouri

JORDAN FAZIO
University of Tennessee, Knoxville

J. BRIAN HOUSTON
University of Missouri

RESEARCH BRIEF SERIES

HEALTH AND EXTREME WEATHER

This research brief is part of an award program designed to address gaps in knowledge related to extreme weather disasters—such as wildfires, floods, extreme heat, and severe storms—that pose significant health risks, particularly for populations already experiencing health challenges.

EXAMINING HURRICANE HELENE FLOODING VULNERABILITIES AND HEALTH DISPARITIES IN SOUTHERN APPALACHIA

OVERVIEW

In September 2024, the remnants of Hurricane Helene brought catastrophic rainfall and devastating inland flooding to communities across North Carolina, South Carolina, Georgia, Tennessee, and Virginia. This southern Appalachian region experienced the highest concentration of fatalities—with more than 120 deaths—as well as prolonged power outages, communication failures, and severe disruptions to transportation, health care, and access to food and water.

In response to the scale and complexity of these impacts, we designed a mixed methods study to examine the spatial, physical, social, and health impacts of Hurricane Helene-related flooding in this region. Drawing on county-level geospatial analysis (n = 22 counties), a community-based survey with residents (n = 700), and workshops with public health and emergency response professionals (n = 20), this study aimed to assess patterns of flood exposure and social vulnerability, identify the physical and mental health impacts of the disaster, as well as the factors influencing these outcomes, and capture perspectives from local officials on community needs and opportunities to improve flood-related health disparities in the region.

KEY FINDINGS

- Our geospatial analysis identified communities with compounded risk, including physical impacts from flooding but also high social vulnerability, population density, and long-term infrastructure disruption.



North Carolina residents clean out storm-damaged homes, September 2024.

Photo credit: Shutterstock.com

- Common post-flood health symptoms reported in survey responses included headaches, respiratory and skin irritations, and gastrointestinal issues. Many reported exposure to contaminants like debris, floodwater, visible mold, and sewage, which were significant risk factors.
- Mental health assessments indicated that 35.2% of survey respondents showed moderate to severe PTSD symptoms, while 27.5% had moderate to severe depression symptoms. Higher social resources, including support from family, friends, and community, had a protective effect.

- Workshop participants described both effective logistical strategies and persistent challenges in coordinating volunteers, donations, and resources during the aftermath of Hurricane Helene. Volunteer resource centers, informal collaboration among agencies, and real-time site coordination proved effective response strategies.
- Participants praised social media and community radio for disseminating emergency information in some communities. However, a lack of centralized and interoperable systems, the absence of redundancy, and general technology limitations contributed to communication failures.
- Participants emphasized disproportionate impacts on vulnerable populations, including the deaf and hard of hearing, older adults, foster children, and veterans with PTSD. Rural and geographically isolated communities also faced unique challenges.
- Burnout, trauma, and a lack of behavioral health support for first responders emerged as an urgent concern in workshops. Some noted that behavioral health needs were often under-prioritized and resources under-utilized.
- Areas of improvement for preparedness and recovery infrastructure, including better coordination and clarity of roles; development of permanent resource hubs; proactive, equity-focused distribution of supplies; stronger 211 services; local data integration; and pre-event relationship-building with rural communities, were frequently mentioned.



Hurricane Helene damage in Green Mountain, North Carolina, October 2024.

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RESEARCH IMPLICATIONS

- Federal, state, and local emergency management policies should prioritize pre-disaster investments in under-resourced communities, particularly in rural and socioeconomically disadvantaged areas. These investments should include not only physical infrastructure, but also the social infrastructure to support and sustain localized adaptation and recovery.
- There's a pressing need for continued investment in medical and social resources for recovery, as they proved to be essential protective factors against adverse physical and mental health outcomes. Strengthening health and social service infrastructure should be a foundation of flood resilience-building efforts. As hurricane and climate-induced flooding events become more frequent and severe, sustained investment in critical infrastructure (e.g., communication, transportation, utilities, housing, healthcare, and social services) within at-risk communities is essential to reduce long-term recovery costs and promote population health.

AUDIENCE

This research is relevant for researchers interested in using convergent approaches that integrate health, social, and geospatial data, as well as federal, state, and local policymakers working on public health, community development, and emergency management policies to improve outcomes during extreme weather disasters.

Full Report: First, J. M., Sunde, M., Kintziger, K., Ellis, K., Scales, S., Waddle, M., Fazio, J., & Houston, J. B. (2026). Examining Hurricane Helene Flooding Vulnerabilities and Health Disparities in Southern Appalachia. (Natural Hazards Center Health and Extreme Weather Report Series, Report 11). Natural Hazards Center, University of Colorado Boulder. hazards.colorado.edu/health-and-extreme-weather-research/examining-hurricane-helene-flooding-vulnerabilities-and-health-disparities-in-southern-appalachia



The Health and Extreme Weather Research Award Program is funded by the National Institutes of Health (NIH) through supplemental support to the National Science Foundation (NSF Award #1635593 and NSF Award #2536173). Opinions, findings, conclusions, or recommendations produced by this program are those of the author(s) and do not necessarily reflect the views of the NIH, NSF, or Natural Hazards Center.



University of Colorado Boulder

Natural Hazards Center
Institute of Behavioral Science | University of Colorado Boulder

1440 15th Street | Boulder, CO 80309-0483 USA

hazctr@colorado.edu | (303) 492-6818