

**COPING WITH COMPOUND CRISES:
EXTREME WEATHER, SOCIAL INJUSTICE,
AND A GLOBAL PANDEMIC**

HEARING
BEFORE THE
SUBCOMMITTEE ON ENVIRONMENT
OF THE
COMMITTEE ON SCIENCE, SPACE,
AND TECHNOLOGY
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**COPING WITH COMPOUND CRISES:
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AND A GLOBAL PANDEMIC**

WEDNESDAY, SEPTEMBER 30, 2020

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENVIRONMENT,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Subcommittee met, pursuant to notice, at 11:35 a.m., via Webex, Hon. Mikie Sherrill [Chairwoman of the Subcommittee] presiding.

**COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON ENVIRONMENT
U.S. HOUSE OF REPRESENTATIVES
HEARING CHARTER**

Coping with Compound Crises: Extreme Weather, Social Injustice, and a Global Pandemic

Wednesday, September 30, 2020
11:30 am ET
Cisco WebEx

PURPOSE

This hearing is an opportunity to discuss challenges in communicating and responding to disasters due to compounding stressors such as climate change and the COVID-19 pandemic. The hearing will touch upon the impacts of these stressors to environmental justice communities; the role of social and behavioral sciences in risk communication of science-based messages related to these compound stressors; the gaps in emergency management research to inform preparation and response; and the public and human health impacts of dealing with disasters during a global pandemic.

WITNESSES

- **Dr. Roxane Cohen Silver**, *Professor of Psychological Science, Medicine, and Public Health, University of California, Irvine*
- **Ms. Colette Pichon Battle (PEA-SHOWN Battle)**, *Founder and Executive Director, Gulf Coast Center for Law and Policy (GCCLP)*
- **Dr. Samantha Montano (MON-TAN-NO)**, *Assistant Professor of Emergency Management, Massachusetts Maritime Academy*

OVERARCHING QUESTIONS

- How can social and behavioral sciences inform us about how people respond to compound events, such as a pandemic and a natural disaster, in order to improve preparedness?
- What are the gaps in research on disaster planning, mitigation, and response? How can federal R&D funding fill those gaps?
- How do individuals perceive risk and respond to warnings and other crisis communications?
- How are vulnerable communities and populations disproportionately impacted by the dual threat of extreme weather and a pandemic?
- Are there lessons learned from our national response to COVID-19 that can be applied to climate change, or vice-versa?

BACKGROUND

As of July 8th, there have been ten weather and climate disasters in 2020 that have cost over \$1 billion dollars each in the United States.¹ From January to June, these events caused 80 deaths and nearly \$18 billion in damages.² This does not include any of the wildfires that continue to ravage the Western United States and Alaska, the Midwest derecho that obliterated cornfields

¹ <https://www.ncdc.noaa.gov/billions/>

² <https://www.nbcnews.com/science/environment/u-s-has-already-had-10-billion-dollar-disasters-year-n1233220>

across Iowa and other states, or the hurricanes that brought un-survivable levels of storm surge to the Gulf Coast. The United States is on pace to exceed the record of 16 billion-dollar disasters in a year, which has occurred twice before, in 2011 and 2017.³

This record year of weather and climate disasters comes as the United States is still grappling with the COVID-19 pandemic, with cases surging this summer in states at risk of extreme weather events.⁴ Typically, those in the path of hurricanes, wildfires, floods, and other disasters are evacuated to group shelters. However, these evacuations could lead to widespread transmission of COVID-19 depending on how the evacuation is executed.⁵ Accordingly, preparations for this year's disasters have looked different from those in years past. Emergency management officials have adapted to this new reality, rewriting emergency procedures to prevent the spread of COVID-19 in the wake of a disaster evacuation.⁶

Even with these new plans in place, there is no guarantee that when disaster strikes, they will be perfectly carried out. In the case of disasters that require evacuations, often these evacuations can be last minute and rushed. Strong winds pushed Oregon fires through dry trees and brush, causing "the blazes to explode in size and sending them rushing into towns and rural homes," and forcing people to flee with little warning.⁷ As tens of thousands have been forced to evacuate in the state, reports have surfaced of mask-less evacuees and challenges in enforcing social distancing rules.⁸ Already, at least one person has tested positive for COVID-19 at a wildfire shelter in Linn County, Oregon.⁹ Another two people tested positive in a temporary shelter in Seattle designed to protect those experiencing homelessness from poor air quality due to the fires.¹⁰ As Oregon evacuates its state prisons, inmates are relocated to other correctional facilities around the state, where they are at increased risk of contracting COVID-19 due to overcrowding.¹² As evacuations from wildfires continue across the West, public health and safety problems due to the compounding effects of the pandemic and wildfires will continue for emergency managers and evacuees alike.

Cascading Risks and Compound Events

Extreme Weather and the COVID-19 Pandemic

Compound weather and climate events are defined as comprising of "multiple distinguishable physical drivers and/or hazards and their risks."¹¹ They can be temporal (multiple storms in a row), spatial (simultaneous crop failures), or a concurrence of multiple variables (storm surge, flooding, and high winds from one storm).¹² The compound crises presented by extreme weather and climate events on top of the pandemic are presenting complex challenges for public health and disaster preparedness and response.

³ Ibid.

⁴ <https://www.washingtonpost.com/nation/2020/08/23/coronavirus-covid-updates/>

⁵ <https://www.medrxiv.org/content/10.1101/2020.08.07.20170555v1>

⁶ Ibid.

⁷ <https://apnews.com/2b305e6af052e6fe1d4bc247804ef569>

⁸ <https://www.usatoday.com/story/travel/hotels/2020/09/14/california-oregon-wildfires-hotels-shelter-evacuees-amid-covid-19/5790454002/>

⁹ <https://www.klcc.org/post/one-person-tests-positive-covid-19-linn-county-evacuation-center>

¹⁰ <https://www.seattletimes.com/seattle-news/2-people-test-positive-for-covid-19-after-staying-at-king-county-clean-air-shelter/>

¹¹ <https://www.nature.com/articles/s41558-020-0790-4>

¹² Ibid.

²¹ Ibid.

Environmental Justice: Inequities in Disaster Preparedness and Response

Research has demonstrated that climate hazards and COVID-19 “will exacerbate and be exacerbated by the unfolding economic crisis and long-standing socioeconomic and racial disparities...in ways that will put specific populations at heightened risks and compromise recovery.”²² Climate change has intensified these hazards, causing more frequent and severe weather events that harm vulnerable populations the most.²³

This Committee’s July 14, 2020 hearing on environmental justice, extreme heat, and COVID-19 found that extreme heat disproportionately impacts communities of color, low-income communities, those with pre-existing conditions, and other vulnerable populations, largely due to redlining and racist housing practices.²⁴ The Gulf Coast region has already faced numerous catastrophic hurricanes this season, in addition to being a COVID-19 hotspot in part as a result of a legacy of racial discrimination and lack of access to quality healthcare.²⁵ These communities face unique risks from the compounding nature of climate disasters and COVID-19. For those who are displaced by extreme weather events, many find themselves in situations that do not allow for social distancing and without access to proper healthcare. They face many immediate risks, such as contracting COVID-19, but there are also many long-term physical and mental health effects that require further study including the psychological impacts of being displaced, losing one’s home or a loved one from the disaster or the disease, the increased risk of contracting COVID-19, and more.

Disparities in preparedness and response is in and of itself a compounding risk for vulnerable communities facing a natural disaster or disease. Pre-COVID-19, these disparities already existed between communities of color and white communities. For example, Hurricane Katrina revealed the racial inequities that already existed in New Orleans and how the government’s failure to organize evacuation plans harmed communities of color and the poor leading up to the storm.²⁶ In the storm’s aftermath, the weak and slow Federal response compounded these existing inequalities that persist to this day. With the Federal Emergency Management Agency (FEMA) in charge of both coordinating the nation’s response to COVID-19 as well as any response to extreme weather and climate disasters, the already-overburdened agency’s resources are stretched even thinner, raising concerns over the allocation of those limited resources both pre and post-disaster.²⁷

Risk Communication

Media Exposure and Trusted Sources

Online media has largely overtaken local news reports and disaster reports from official sources as the main information source for people in a storm’s path.²⁸ Research on the public health

²² <https://www.nature.com/articles/s41558-020-0804-2>

²³ Phillips et al. 2020. “Compound climate risks in the COVID-19 pandemic.” Nature Climate Change.

<https://www.nature.com/articles/s41558-020-0804-2>

²⁴ <https://docs.house.gov/meetings/SY/SY00/20200714/110903/HHRG-116-SY00-20200714-SD002.pdf>

²⁵ <https://www.nature.com/articles/s41558-020-0804-2>

²⁶ <https://www.arcgis.com/apps/Cascade/index.html?appid=2106693b39454f0eb0abc5c2ddf9ce40>

²⁷ <https://www.nature.com/articles/s41558-020-0804-2>

²⁸ Thompson RR, Holman EA, Silver RC. Media Coverage, Forecasted Posttraumatic Stress Symptoms, and Psychological Responses Before and After an Approaching Hurricane [published correction appears in JAMA Netw Open. 2019 Jan 4;2(1):e190011]. *JAMA Netw Open*. 2019;2(1):e186228. Published 2019 Jan 4. doi:10.1001/jamanetworkopen.2018.6228

impacts of media exposure to various crises, from epidemics to terrorist attacks, has revealed that repeated media exposure “can lead to increased anxiety, heightened stress responses,” which can have long-term physical and mental health consequences.²⁹ Heightened stress can lead to disproportionate responses to the crisis at hand, such as panic buying of items like toilet paper and hand sanitizer, as we have seen with COVID-19.

The 24/7 media cycle can have a detrimental effect on people’s threat perception, causing increased distress, worry, and impaired functioning even if the risk is relatively low to them. This can create a “cycle of distress,” whereby people with the greatest concerns may watch more media coverage of the event or risk, which leads them to stress more.³⁰ When facts about risks are known and properly communicated to the public through the media, people generally form accurate perceptions of the given risk. However, without accurate and effective communication, people tend to form overestimated assessments of the threat, which leads to unnecessary stress and disproportionate behavioral responses.³¹ For example, the 2014 Ebola crisis was given unprecedented media attention in the United States even though there was a low risk of transmission of the disease.³² This media coverage of the Ebola crisis was found to be associated with “negative psychological outcomes, even among individuals at low risk for contracting the disease.”³³ These findings offer insight into the psychological impacts of COVID-19 media exposure, which is likely to be worsened by the fact that disease transmission risks are higher for COVID-19, and coverage of this crisis has persisted for longer than the Ebola crisis.

Gaps in Understanding

There remains much uncertainty about effective risk communication during a public health crisis especially around the use of social media.³⁴ Further research is needed to better understand social media as a source of risk communication, including how federal agencies can better leverage this medium to disseminate information. At present, emergency management agencies tend to underutilize social media as a communication source, thus further research could inform and advance their use of this tool.³⁵

Another area in need of additional research is risk communication and disaster planning with vulnerable communities. The elderly, people of color, the disabled, non-English speaking people, children, those with chronic medical diseases, and other vulnerable populations must be able to access information that is actionable to them to plan for a disaster. Many Americans lack the social and economic resources to protect themselves during disasters.³⁶ Some lack access to disaster information or seek it out from sources outside official governmental channels. Effective disaster communication and planning must ensure that all individuals have equal and sufficient access to information about how to best prepare given their circumstances.³⁷ Emergency

²⁹ Garfin, D. R., Silver, R. C., & Holman, E. A. (2020). The novel coronavirus (COVID-2019) outbreak: Amplification of public health consequences by media exposure. *Health Psychology*, 39(5), 355-357. <http://dx.doi.org/10.1037/hea0000875>

³⁰ Ibid.

³¹ Ibid.

³² <https://journals.sagepub.com/doi/full/10.1177/2167702617692030>

³³ <https://journals.sagepub.com/doi/full/10.1177/2167702617692030>

³⁴ Garfin, D. R., Silver, R. C., & Holman, E. A. (2020). The novel coronavirus (COVID-2019) outbreak: Amplification of public health consequences by media exposure. *Health Psychology*, 39(5), 355-357. <http://dx.doi.org/10.1037/hea0000875>

³⁵ Ibid.

³⁶ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1855003/>

³⁷ <https://aspe.hhs.gov/system/files/pdf/75866/emergfrA.pdf>

managers must take into account risk perception and communication when disseminating emergency information and organizing evacuations. Little is known about risk perception when it comes to vulnerable populations and emergency preparedness.³⁸ Previous disasters, such as Hurricane Katrina in 2005 and Hurricane Maria in 2017, emphasized that the needs of these groups continue to be inadequately understood and addressed by traditional emergency plans, and highlight that further research must be done to better equip these communities before, during, and after an emergency.

Social and Behavioral Science

Emergency Management Research

On September 26, 2019, this Committee held a hearing titled *Understanding, Forecasting, and Communicating Extreme Weather in a Changing Climate*, which discussed the challenges of communicating uncertainty and understanding the societal impacts of extreme weather.³⁹ The hearing explored the ongoing issue of communicating extreme weather forecasts for local, state, and federal officials, and underscored the need for more social and behavioral science research to understand how people interpret and respond to weather warnings.⁴⁰ This need has become even more urgent as the pandemic has added huge complexities in preparing for and responding to extreme weather.

Federal emergency response tends to prioritize evacuation from hurricane and wildfire zones, while state and local authorities are left to deal with preventing the spread of and containing any resulting increases COVID-19 cases. Better coordination is needed at every level of government “to prevent potential conflicts of strategy across agencies, sectors, and scales.”⁴¹ To improve this coordination, additional interdisciplinary, cross-sectoral risk assessments and research is needed in the emergency management domain. Assessments such as the National Climate Assessment tend to be siloed from public health and must consider spatial and temporal intersection of physical hazards and health or socioeconomic risk factors, interdependencies between sectors, and potential feedback mechanisms.⁴²

In addition, the United States’ conventional emergency response framework places an emphasis on disaster response as opposed to pre-disaster preparedness. To shift the modus operandi to be preventative, further research and resources are needed to bolster understanding of how the US emergency management apparatus can better prepare communities for individual and compounding disasters. This is especially poignant in the era of COVID-19, when emergency response agencies and first responders are particularly likely to find themselves deployed across multiple crises at the same time, putting them under unprecedented strain.

Climate Change and Health Research

Health impacts from the changing climate include increased sickness due to worsening extreme heat, increased vector-borne infectious diseases, and a range of diseases due to worsening air

³⁸ <https://aspe.hhs.gov/system/files/pdf/75866/emergfrA.pdf>

³⁹ <https://docs.house.gov/meetings/SY/SY00/20190926/109982/HHRG-116-SY00-20190926-SD001.pdf>

⁴⁰ Ibid.

⁴¹ Phillips, C.A., Caldas, A., Cleetus, R. *et al.* Compound climate risks in the COVID-19 pandemic. *Nat. Clim. Chang.* **10**, 586–588 (2020). <https://doi.org/10.1038/s41558-020-0804-2>

⁴² Ibid.

quality. Climate change poses the greatest threat to communities that have historically faced underinvestment and systemic inequality, such as communities of color and low-income communities.⁴³ These communities are already disproportionately exposed to extreme heat and other environmental hazards and lack resources to adapt to climate change. Other populations of concern are children, the elderly, people with chronic medical conditions, and vulnerable occupational groups, such as outdoor workers.⁴⁴ As the pandemic progresses, researchers are beginning to pose questions about how compound climate hazards intersect with the pandemic and associated public health response.⁴⁵

The COVID-19 Pandemic, Extreme Weather, And Mental Health

In addition to, and in connection with, associated physical harms, researchers have demonstrated that climate change also impacts mental health.⁴⁶ Survivors of natural disasters experience more harms to mental health, including increased post-traumatic stress disorder, depression, anxiety, substance abuse, and domestic violence.⁴⁷ Children in particular demonstrate strong psychological impacts from extreme events; childhood trauma can last into adulthood, and children's bodies are more vulnerable than adults' to the physical effects of heat. Children are also more reliant on social networks that are disrupted by climate-driven events.⁴⁸ Beyond climate-driven extreme weather events, evidence for climate anxiety, or anxiety associated with perception of climate change, is emerging in the literature.⁴⁹ It is important, however, to differentiate between adaptive and maladaptive responses. Anxiety can serve an adaptive function in response to real threats and is not necessarily pathological.⁵⁰

Similarly, as the pandemic unfolds, researchers are beginning to discuss and study the mental health implications of the pandemic.⁵¹ For example, populations experiencing financial impacts such as lower income and limited savings are experiencing greater depression during COVID-19.⁵² Experts have described the COVID-19 pandemic as a "perfect storm" for the mental health of young people in particular.⁵³ These researchers point to extended home confinement, grief, increased exposure to domestic violence, and the impact of social media as factors that may make adolescents vulnerable during the pandemic.⁵⁴ Researchers are also investigating mental health impacts from the pandemic on other vulnerable populations, such as communities of color and people in prisons and other types of detention.^{55,56} These discussions and early results in

⁴³ Chalupka, S., Anderko, L., & Pennea, E. (2020). Climate change, climate justice, and children's mental health: A generation at risk? *Environmental Justice*, 13(1), 10-14. doi:10.1089/env.2019.0034

⁴⁴ <https://health2016.globalchange.gov/populations-concern>

⁴⁵ Phillips, C.A., Caldas, A., Cleetus, R. et al. Compound climate risks in the COVID-19 pandemic. *Nat. Clim. Chang.* 10, 586–588 (2020). <https://doi.org/10.1038/s41558-020-0804-2>

⁴⁶ Clayton, S. (2020). Climate anxiety: Psychological responses to climate change. *Journal of Anxiety Disorders*, 74, 102263. Doi: <https://doi.org/10.1016/j.janxdis.2020.102263>

⁴⁷ Similarly, heat increases aggression and conflict, and increased suicide and hospitalization for mental health problems. Poor air quality is associated with cognitive impairment in the elderly, and behavioral changes in children.

⁴⁸ Ibid.

⁴⁹ Ibid.

⁵⁰ Ibid.

⁵¹ <https://academic.oup.com/aje/advance-article/doi/10.1093/aje/kwaa147/5874602>

⁵² <https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2770146?resultClick=1>

⁵³ Danese, A., & Smith, P. (2020). Debate: Recognising and responding to the mental health needs of young people in the era of COVID-19. *Child and Adolescent Mental Health*, 25(3), 169-170. doi:10.1111/camh.12414

⁵⁴ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7323662/>

⁵⁵ <https://pubmed.ncbi.nlm.nih.gov/32525370/>

⁵⁶ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7147918/>

how the current crisis affects mental health build upon an established body of evidence from previous epidemics, extreme weather events, and other crises.^{57,58,59,60,61} A few studies have looked at the impact of multiple, compounding societal crises on mental health, but more research needs to be done to understand how compound and cascading risks interact with psychological well-being.⁶²

Federal Funding and Research Gaps

The societal impacts of natural and man-made disasters are complex and can vary over the short and long-term, making it important to collect data both immediately after disasters and through sustained, long-term data collection. The NSF RAPID grant mechanism is a program that supports quick-response research. It focuses on proposals of up to \$200,000 on natural or anthropogenic disasters and similar unanticipated events and only requires internal merit review;⁶³ RAPID grants have been used previously to award research grants during the Zika and Ebola outbreaks.⁶⁴ NSF has several mechanisms that have been used to study social and behavioral dynamics in the years after disasters; however grant awards are typically not longer than four years. This research has also been funded through previous Disaster Supplemental Appropriations. Currently, NSF has a dedicated COVID-19 website that outlines funding opportunities related to the pandemic.⁶⁵ A recent literature review noted that there is more research on short-term social consequences of disasters, but few longitudinal studies, leaving a large gap in our understanding of how immediate impacts bear out long term, and clearly underscoring the need for additional research funding to support these studies.⁶⁶

A growing body of research discusses the health impacts of a changing climate, but significant gaps remain.⁶⁷ Part of the problem is that federal funding is negligible in this space. For example, just 0.17% of NIH's budget in 2008 went to climate-focused proposals. In addition to this, there are limited career opportunities for students interested in the intersection of climate change and health.⁶⁸ Established researchers in this field have called for increased funding and dedicated research programs to address the health risks of climate change, with increased

⁵⁷ <https://www.pnas.org/content/117/23/12595>

⁵⁸ An, R., Qiu, Y., Xiang, X., Ji, M., & Guan, C. (2019). Impact of Hurricane Katrina on mental health among US adults. *American Journal of Health Behavior*, 43(6), 1186-1199. doi:10.5993/AJHB.43.6.15

⁵⁹ Fullerton, C. S., Mash, H. B. H., Wang, L., Morganstein, J. C., & Ursano, R. J. (2019). Posttraumatic stress disorder and mental distress following the 2004 and 2005 Florida hurricanes. *Disaster Medicine and Public Health Preparedness*, 13(1), 44-52. doi:10.1017/dmp.2018.153

⁶⁰ Heid, A. R., Pruchno, R., Cartwright, F. P., & Wilson-Genderson, M. (2017). Exposure to hurricane sandy, neighborhood collective efficacy, and post-traumatic stress symptoms in older adults. *Aging & Mental Health*, 21(7), 742-750. doi:10.1080/13607863.2016.1154016

⁶¹ Raker, E. J., Lowe, S. R., Arcaya, M. C., Johnson, S. T., Rhodes, J., & Waters, M. C. (2019). Twelve years later: The long-term mental health consequences of Hurricane Katrina. *Social Science & Medicine*, 242, 112610. doi:10.1016/j.socscimed.2019.112610

⁶² Gargano, L. M., Li, J., Millien, L., Alper, H., & Brackbill, R. M. (2019). Exposure to multiple disasters: The long-term effect of hurricane sandy (October 29, 2012) on NYC survivors of the September 11, 2001 world trade center attack. *Psychiatry Research*, 273, 719-724. doi:10.1016/j.psychres.2019.01.090

⁶³ https://www.nsf.gov/pubs/policydocs/pappg19_1/pappg_2.jsp#11E1

⁶⁴ See NSF, "Dear Colleague Letter on the Coronavirus Disease 2019 (COVID-19)," NSF 20-052, April 3, 2020, <https://www.nsf.gov/pubs/2020/nsf20052/nsf20052.jsp>

⁶⁵ https://www.nsf.gov/news/special_reports/coronavirus/

⁶⁶ <https://www.annualreviews.org/doi/abs/10.1146/annurev-soc-121919-054827>

⁶⁷ <https://health2016.globalchange.gov/>

⁶⁸ <https://www.mdpi.com/1660-4601/17/4/1310/htm>

coordination and planning among agencies like EPA, NIH, CDC, NOAA, and NSF.⁶⁹ They estimate that over \$200 million annually dedicated to research on the health impacts of climate change is required to meet the current needs.

Researchers have also called for more long-term funding that encourages interdisciplinary approaches to the topics of natural disasters and other crises, including an integration of traditionally siloed fields like emergency management, public health, and economics.⁷⁰ In order to respond effectively to the pandemic, social and behavioral science research is needed to better understand current behavioral responses and inform decisions across the country that increase trust and encourage scientifically-informed action to mitigate risks.⁷⁰

Additional Reading

Dan Walton and Maarten van Aalst, September 2020. “Climate-related extreme weather events and COVID-19: A first look at the number of people affected by intersecting disasters.” <https://media.ifrc.org/ifrc/wp-content/uploads/sites/5/2020/09/Extreme-weather-events-and-COVID-19-V4.pdf>

⁶⁹ <https://ehp.niehs.nih.gov/doi/full/10.1289/ehp.0800088>

⁷⁰ <https://www.scientificamerican.com/article/what-happens-when-other-disasters-hit-during-a-pandemic/>

Chairwoman SHERRILL. All right. The hearing will now come to order.

Before I deliver my opening remarks, I want to announce a couple reminders to the Members about the conduct of this hearing. First, Members should keep their video feed on as long as they are present in the hearing. Members are responsible for their own microphones. Please also keep your microphones muted unless you are speaking. Finally, if Members have documents they wish to submit for the record, please email them to the Committee Clerk, whose email address was circulated prior to the hearing.

Without objection, the Chair is authorized to declare recess at any time.

Good morning, and welcome to this Environment Subcommittee hearing on “Coping with Compound Crises: Extreme Weather, Social Injustice, and a Global Pandemic.” I would also like to welcome our esteemed panel of witnesses and thank them for their participation. I’m thrilled to have two women at the top of their fields here with us today.

This hearing is very timely as this is National Preparedness Month, which is recognized every September to promote family and community disaster planning. This year’s theme is “Disasters Don’t Wait. Make Your Plan Today,” which is an especially important reminder as our country deals with the COVID-19 pandemic and devastating extreme weather events.

2020 has been a challenging year in so many ways: a record-breaking number of extreme weather events, a national reckoning with systemic racism, and a global pandemic. From January to July, there were 10 weather and climate disasters costing over \$1 billion each, and this number does not even include any of the devastating wildfires that continue to burn across the West Coast or the Midwest derecho that destroyed homes and cornfields across Iowa and other States, nor the extremely active Atlantic hurricane season that has wiped out entire towns and brought “unsurvivable” storm surge across the Gulf Coast region.

This season of climate and weather disasters compound the ongoing COVID-19 pandemic and continued social and environmental injustices. Many communities are grappling with multiple risks at once: the dueling threat of wildfire or hurricane evacuations during shelter-in-place orders, the legacy of historic redlining while trying to rebuild post-disaster, and farmers already reeling from the economic fallout due to the pandemic losing their crop to severe storms.

In my home State of New Jersey, where low-income families and small businesses have been particularly devastated, we are all hoping we don’t have another Hurricane Sandy during this abnormally active Atlantic hurricane season.

As climate change continues to cause more frequent and severe weather events, we must be ready to face multiple hazards at once. Whether it is several storms in a row, the everyday impacts of climate change on vulnerable populations, or an extreme weather event during a future pandemic, it is extremely important that we understand how these compound events interact with each other in order to better prepare for, communicate about, and respond to them.

There remains much uncertainty about the most effective risk communication methods during a public health crisis or extreme weather event, especially for vulnerable communities. Understanding how people perceive risk and respond to warnings, especially when faced with multiple threats, is essential to informing emergency planning and response. But the Federal Government lacks robust funding for emergency management research. We will hear today about how improved coordination and additional interdisciplinary research and risk assessments are needed to bolster our emergency management capabilities.

When disaster occurs, being able to collect data, particularly on social and behavioral responses, in a timely manner is crucial to understanding immediate impacts to communities. The National Science Foundation's Rapid (Rapid Response Research) funding mechanism provides funding for proposals with a severe urgency, including research on natural disasters or similar unanticipated events. This serves as a great model for other agencies to support research related to environmental and public health crises that require a Rapid funding mechanism.

As we enter an age where the impacts of disasters will continue to be exacerbated by stressors such as climate change and social injustice, it is imperative that Congress works to improve our country's response to these disasters. Investing in interdisciplinary and RAPID funding mechanisms for research into these topics, especially as we expect to see more compounding crises, will be vital to our success in mitigating the impact of these disasters.

I look forward to today's discussion with our witnesses to identify how this Committee can help address some of these critical research gaps. Thank you.

[The prepared statement of Chairwoman Sherrill follows:]

Good morning, and welcome to this Environment Subcommittee hearing on Coping with Compound Crises: Extreme Weather, Social Injustice, and a Global Pandemic. I would also like to welcome our esteemed panel of witnesses and thank them for their participation today.

This hearing is very timely as this is National Preparedness Month, which is recognized every September to promote family and community disaster planning. This year's theme is "Disasters Don't Wait. Make Your Plan Today" which is an especially important reminder as our country deals with the COVID-19 pandemic and devastating extreme weather events.

2020 has been a record year in a myriad of ways: a record-breaking number of extreme weather events, a national reckoning with systemic racism, and a global pandemic. From January to July, there were ten weather and climate disasters costing over \$1 billion dollars each—this number does not include any of the devastating wildfires that continue to burn across the West Coast, the Midwest derecho that destroyed homes and cornfields across Iowa and other states, nor the extremely active Atlantic hurricane season that has wiped out entire towns and brought "unsurvivable" storm surge across the Gulf Coast region.

This season of climate and weather disasters compound, or layer onto, the ongoing COVID-19 pandemic and continued social and environmental injustices. Many communities are grappling with multiple risks at once: the dueling threat of wildfire or hurricane evacuations during shelter-in-place orders; the legacy of historic redlining while trying to rebuild post-disaster; and farmers already reeling from the economic fallout due to the pandemic losing their crop to severe storms. In my home state of New Jersey, where low-income families and small businesses have been particularly devastated, we are all hoping we don't have another Hurricane Sandy during this abnormally active Atlantic hurricane season.

As climate change continues to cause more frequent and severe weather events, we must be ready to face multiple hazards at once. Whether it is several storms in a row, the everyday impacts of climate change on vulnerable populations, or an extreme weather event during a future pandemic, it is extremely important that we

understand how these compound events interact with each other in order to better prepare for, communicate about, and respond to them.

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As we enter an age where the impacts of disasters will continue to be exacerbated by stressors such as climate change and social injustice, it is imperative that Congress works to improve our country's response to these disasters. Investing in interdisciplinary and rapid funding mechanisms for research into these topics, especially as we expect to see more compounding crises, will be vital to our success in mitigating the impacts of these disasters. I look forward to today's discussion with our witnesses to identify how this Committee can help address some of these critical research gaps. Thank you.

Chairwoman SHERRILL. And I think somebody's microphone is on, if you could make sure you're on mute when not speaking. Thank you.

At this time I would like to enter into the record a letter from the Union of Concerned Scientists (UCS) expressing support for this hearing and emphasizing the importance of discussing the intersection of systemic racism, the climate crisis, and the pandemic. UCS's recent research has found that communities will increasingly face multiple crises at once as climate change progresses and that bold action is needed to limit these future impacts, especially for low-income communities of color.

We are honored to have the Full Committee Ranking Member Mr. Lucas with us today. The Chair now recognizes Ranking Member Lucas for an opening statement.

Mr. LUCAS. Thank you for holding today's hearing, Chairwoman Sherrill.

Today is the last day of September, which means we're 3/4 of the way through 2020. Today's hearing will focus on a number of factors which have combined to make this an especially difficult year for our country. Some of these challenges are new, and some have been ongoing. Unfortunately, extreme weather events are not new, although there's been a higher number of these events this year. We've seen an unusually active Atlantic hurricane season with 23 named storms to date and still two months to go. Communities along the Atlantic coast have been battered by strong winds, heavy rain, and severe flooding.

One of the many images future generations might remember of this year were by pictures of communities across the West bathed in orange due to the prevalence of wildfire across many Western States. More than 7.5 million acres have burned, which is well above the rolling 10-year average of wildfire damage. Entire communities in States like California and Oregon have literally burned to the ground.

Better forecasting and public warning of extreme weather events has long been a focus of this Committee, and I'm proud to have introduced "*The Weather Act of 2017*", which directed NOAA (National Oceanic and Atmospheric Administration) to address how we can better forecast the occurrences of extreme weather events and how we can help the public be better prepared in the occurrence of these events. We have made strides in these efforts, but we still have a long way to go.

A global pandemic has made forecasting even more challenging. We've heard from NOAA about the steps they've taken in order to ensure the continuity of operations to help warn Americans of impending extreme weather events. Unfortunately, a pandemic does not stop hurricanes, tornadoes, and flash floods. I think I speak for all of my colleagues here when I say how much we appreciate our forecasters for continuing this valuable work under challenging circumstances.

The Committee has heard from Federal agencies and research universities about the impact of COVID-19 on our country's research and development efforts. The message was clear: Our success depends on science. We must continue to move forward on scientific innovation and support our research enterprise.

I thank our witnesses for being here today. I look forward to hearing from our witnesses about what lessons we can learn from this year and how we can utilize our Federal research and development efforts to prepare for future events.

Thank you and I yield back, Madam Chair.

[The prepared statement of Mr. Lucas follows:]

Thank you for holding today's hearing, Chairwoman Sherrill. Today is the last day of September, which means we are three quarters of the way through 2020. Today's hearing will focus on a number of factors which have combined to make this an especially difficult year for our country. Some of these challenges are new, and some have been ongoing.

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I thank our witnesses for being here today. I look forward to hearing from our witnesses about what lessons we can learn from this year, and how we can utilize our federal research and development efforts to prepare for future events.

Thank you and I yield back.

Chairwoman SHERRILL. Thank you so much. We are also honored to have the Full Committee Chairwoman, Ms. Johnson, with us today. The Chair now recognizes the Chairwoman for an opening statement.

Chairwoman JOHNSON. Thank you very much, Chairwoman Sherrill, for holding this important hearing today. And good morning and thanks to all of our witnesses for being here today.

We are in an unprecedented moment in our Nation. We have previously discussed the intersection of COVID-19 pandemic and extreme heat on environmental justice communities. These last few months have laid bare how these communities are disproportionately impacted by the COVID-19 pandemic due to decades of social injustice. These same communities are often disproportionately impacted by extreme weather events that are exacerbated by climate change.

While we are working diligently across the globe to bring this pandemic under control, we cannot forget that we're just starting to address the impacts of climate change on our daily lives. These impacts are undeniable, and the increasing evidence of extreme weather events is a very visible example. In 2020 alone we've seen unsurvivable storm surges due to hurricanes in the Gulf Coast, the devastation of Iowa's corn crop due to the Midwest derecho, and the largest wildfire in California's history.

As communities across the country grapple with these intersecting crises, it is clear that these crises are impacting not only our citizens' physical well-being, but also our mental health. The ongoing stress and trauma due to the pandemic and for some communities outweighs the weather.

As the former Chief Psychiatric Nurse at the veterans' hospital, I've seen firsthand how trauma can affect mental health. The types of compounding crises we are currently seeing will have both short-term and long-term effects on our communities. It is important that we work to collect the data and conduct the research that is necessary to understand the impacts of this trauma.

I look forward to today's discussion with this panel of expert witnesses to better understand what research is needed for us to improve our preparation for, communications of, and response to compounding disasters.

Thank you, and I yield back.

[The prepared statement of Chairwoman Johnson follows:]

Thank you, Chairwoman Sherrill, for holding this important hearing today. Good morning and thanks to all our witnesses for being here. We are in an unprecedented moment in our nation. We have previously discussed the intersection of the COVID-19 pandemic and extreme heat on environmental justice communities.

These last few months have laid bare how these communities are disproportionately impacted by the COVID-19 pandemic due to decades of social injustice. These same communities are often disproportionately impacted by extreme weather events that are exacerbated by climate change.

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As communities across the country grapple with these intersecting crises, it is clear that these crises are impacting not only our citizens' physical well-being, but also their mental health.

The ongoing stress and trauma due to the pandemic, and for some communities, evacuations due to extreme weather, can take a severe toll on their mental health.

As the former Chief Psychiatric nurse at the Dallas Veterans Affairs Hospital, I have seen first-hand how trauma can affect mental health. The types of compounding crises we are currently seeing will have both short-term and long-term effects on our communities. It is important that we work to collect the data and conduct the research that is necessary to understand the impacts of this trauma.

I look forward to today's discussion with this panel of expert witnesses to better understand what research is needed for us to improve our preparation for, communication of, and response to compounding disasters.

Thank you, I yield back.

Chairwoman SHERRILL. Thank you, Madam Chairwoman.

If there are Members who wish to submit additional opening statements, your statements will be added to the record at this point.

And at this time I would like to introduce our witnesses. Dr. Roxane Cohen Silver is a Professor of Psychological Science, Medicine, and Public Health at the University of California, Irvine. Her work focuses on traumatic life events and deals with personal losses, as well as collective traumas. The themes of her research are the effects of collective traumas, community resilience, and the role news and social media plays in transmitting the stress of disaster. Dr. Silver has researched the mental health impacts of the September 11 terrorist attacks, the 2013 Boston Marathon bombings, Hurricanes Harvey, Irma, and Michael, and the Ebola public health crisis. Most recently, she has completed a national study of the effects of the coronavirus pandemic in the United States.

Unfortunately, our second witness, Ms. Colette Pichon Battle, who is the Founder and Executive Director of the Gulf Coast Center for Law and Policy, is no longer able to testify today.

Our final witness today is Dr. Samantha Montano. She is an Assistant Professor of Emergency Management at Massachusetts Maritime Academy and a self-described disasterologist. Her research analyzes different aspects of emergency management such as nonprofits, volunteerism, informal aid efforts in disaster, and the intersections of disasters with climate change, gender, and media. She began her career in disaster management after working for nonprofits on recovery efforts following Hurricane Katrina and the BP oil disaster.

Our witnesses will each have 5 minutes for oral testimony. Your written testimony will be included in the record for the hearing. When you all have completed your spoken testimony, we will begin with questions. Each Member will have 5 minutes to question the panel. And we will start with Dr. Silver. Dr. Silver?

**TESTIMONY OF DR. ROXANE COHEN SILVER,
PROFESSOR OF PSYCHOLOGICAL SCIENCE, MEDICINE,
AND PUBLIC HEALTH, UNIVERSITY OF CALIFORNIA, IRVINE**

Dr. SILVER. Yes, good morning, Chairwoman Sherrill and Members of the Subcommittee. Thank you for the invitation to speak

with you today on coping with the trauma of 2020, a year of grave stress, loss, and disruption for the United States.

I'm a Professor of Psychological Science, Public Health, and Medicine at the University of California, Irvine. And for over 3 decades I have studied the psychological impact of community disasters such as firestorms, mass violence, hurricanes, and infectious disease outbreaks. Almost all of my research over these years has been funded by the National Science Foundation.

The year 2020 has been marked by unprecedented compounding traumas. As I will briefly discuss but have described in more detail in a paper that will be published next week in the journal *Nature Human Behaviour*, these catastrophes have cascaded one to the next.

Next slide, please.

And individuals across the United States have concurrently grappled with direct exposure to these events and watched them unfold in real time in the media. Research I've conducted over the past several decades strongly suggests that the mental health consequences of direct and media-based exposure to these compounding stressors may be profound.

This year has taxed our capacity to cope, with the most vulnerable groups in our society at greatest risk. Policymakers must act to ease the burden of trauma to protect the public's mental as well as physical health.

Last week took us past a sad milestone. Over 200,000 people have now died of COVID-19 in the United States. The severe restrictions implemented to limit the spread of infection left thousands of businesses closed and millions of Americans unemployed. These crises hit low socioeconomic status and minority communities especially hard, highlighting economic and racial inequalities in healthcare in our country.

With the pandemic and economic recession as a backdrop, the absence of distraction and easy access to graphic videos of the deaths of unarmed Black Americans led to protests and ongoing social unrest. And over the past few months the United States has faced extreme weather events, including devastating hurricanes and disastrous wildfires that require evacuations that have been made more complicated during a pandemic that requires physical distancing.

Together, the combination of medical, economic, racial, and climate-based catastrophes highlights the need for serious attention to be paid by both public health officials and policymakers of the implications of cumulative trauma exposure.

In March—next slide, please—my colleagues and I published a commentary in which we used the research we have conducted on collective traumas over the past 2 decades to predict that widespread media exposure to a crisis like the COVID pandemic could amplify the distress people felt in response to this public health emergency. In fact, our past research suggested that repeated media exposure to COVID-19 news could lead to increased anxiety.

While we predicted negative effects of the media to the events of 2020 based on our earlier research, it was critical to conduct research on the pandemic specifically. However, the challenges of obtaining funding quickly in the aftermath of collective traumas often lead to a lack of early studies of large representative samples.

Fortunately, because the National Science Foundation (NSF) offered many COVID-specific RAPID grants, which enabled research funding for high-quality science, my colleagues and I were able to conduct a methodologically rigorous study of a national sample of 6,500 adults in the United States that began March 18th. The first report from our study was published last week in the journal *Science Advances*.

We started our project just as the pandemic unfolded beginning when there were 190 reported COVID-19 deaths in the United States to over 13,000 deaths less than 30 days later. We found that as the weeks went on and the cases across the United States grew, so did rates of acute stress and depressive symptoms.

Will we survive the trauma of COVID-19 and the cascading tragedies that have followed? As I wrote in an editorial in *Science* in July, I believe that we will. This is not to minimize the seriousness of the tragedy in any way. We do not know how long the pandemic will last or how bad it will get. But my decades of research on trauma make clear that people are extremely resilient. Although the timing of the end of COVID-19 remains unknown, I believe that most people will get to the other side of this pandemic recognizing strengths and coping skills they did not realize they had. Rigorous research by psychological scientists can offer understanding of human behavior during crises to minimize future rates of infection and death.

This concludes my testimony. Thank you.

[The prepared statement of Dr. Silver follows:]

Testimony of
Roxane Cohen Silver, Ph.D.
Professor of Psychological Science, Public Health, and Medicine
University of California, Irvine

Hearing on "Coping with Compound Crises: Extreme Weather, Social Injustice,
and a Global Pandemic"
Committee on Science, Space, and Technology
Subcommittee on Environment
U.S. House of Representatives
September 30, 2020

Chairwoman Sherrill and Members of the Subcommittee:

Good morning. My name is Roxane Cohen Silver and it is my pleasure to have the opportunity to appear before you today to testify on coping and surviving the trauma of 2020, a year of grave stress, loss, and disruption for the United States. I am a researcher and professor of psychological science, public health, and medicine at the University of California, Irvine. For over three decades, I have studied how individuals adjust to stressful life experiences and specifically the impact of community disasters – both natural and man-made -- on individuals' and communities' psychological responses over time. Almost all of my research over these years – including investigations of the impact of firestorms, school shootings, mass violence, terror attacks, hurricanes, and infectious disease outbreaks, including COVID-19 – has been funded by the National Science Foundation.

The year 2020 has been marked by unprecedented cascading traumas, including the COVID-19 pandemic, an economic recession, race-driven social unrest, and weather-related disasters. As I will briefly discuss, but have described in more detail in a paper that will be published next week in the journal *Nature Human Behaviour* (**Attachment A**), these catastrophes have cascaded one to the next, and individuals across the U.S. have concurrently grappled with direct exposure to these events and watched them unfold, in real time, in the media. Research I have conducted over the past several decades strongly suggests that the mental health consequences of direct and media-based exposure to these compounding stressors may be profound. This extraordinary stressful year has taxed our capacity to cope, with the most vulnerable groups in our society at greatest risk. Policymakers must act to ease the burden of trauma to protect the public's mental, as well as physical, health.

Last week took us past a sad milestone -- over 200,000 people have now died of COVID-19 in the United States. The severe restrictions implemented in the spring to limit the spread of infection left thousands of businesses closed and over 40,000,000 Americans unemployed. These crises hit low socioeconomic status and minority communities especially hard, highlighting economic and racial inequities in healthcare and the provision of essential services in our country. With the pandemic and pandemic-triggered economic recession as a backdrop, months of stay-at-home orders, absence of distractions, economic anxiety, and easy access to graphic videos of the deaths of unarmed Black Americans led to multi-racial protests and ongoing social unrest. And if that was not bad enough, over the past few months the U.S. has faced extreme weather events, including devastating hurricanes, record heatwaves, and disastrous wildfires that require evacuations that have been made more complicated during an unrelenting pandemic that requires physical distancing. Together, the combination of medical, economic, racial, and climate-based catastrophes highlights the need for serious attention to be paid by public health officials and policymakers of the implications of cumulative, compounding trauma exposure.

In March, my colleagues and I published a paper in the journal *Health Psychology* (**Attachment B**) in which we used the research we have conducted on collective traumas over the past 20 years to make the prediction that widespread media exposure to a collective crisis like the COVID pandemic could amplify the distress people felt in response to this public health emergency. We reviewed research suggesting that repeated media exposure to community crises can lead to increased anxiety, and these heightened stress responses can lead to negative health consequences downstream, as well as misplaced help-seeking behaviors that can overburden health care facilities and tax available resources. For example, following the Boston Marathon bombings, we found a strong positive association between the number of hours people were exposed to bombing-related media coverage and the number of acute stress symptoms they reported experiencing. In fact, people who had the greatest level of media exposure reported substantially *higher* levels of acute stress than did people who were actually at the Boston Marathon bombing themselves. These associations also appear to accumulate over time: As threats continue to emerge, repeated high levels of media exposure to collective traumas may create a cycle of distress such that those with the greatest concerns may seek out more media coverage of the crisis, further increasing their stress. In fact, in a study of a representative sample of over 1600 residents of Florida who were surveyed in the hours before Hurricane Irma made landfall in 2017, we found that individuals who forecast they would be experiencing posttraumatic stress after the storm were more likely to consume media in advance of the storm -- and had more negative post-storm mental health outcomes.

While we predicted negative effects of the media to the events of 2020 based on our earlier research, it was critical to conduct research on the pandemic specifically -- as well as the tragic events that have followed. However, to design and implement research on collective traumas requires overcoming formidable scientific and logistical challenges resulting from the fundamental unpredictability of these events. As a result, most studies are "post-only" designs, often with retrospective assessments made long after the event. However, without information on pre-event mental and physical health, it is difficult to disambiguate the effects of the trauma on subsequent responses to it. Moreover, because of difficulties receiving rapid Ethics Board approval, researchers can rarely get into the field quickly, yet without baseline assessments of psychological responses collected in the acute period, it is impossible to accurately evaluate trajectories of response and adjustment over time. Finally, surprisingly few studies have considered how cumulative exposure to collective and individual stressors -- in this case the combined stress of personal illness, loss, economic strain, social unrest and climate-based disasters -- may contribute to mental health outcomes.

Also, the challenges of obtaining funding quickly in the aftermath of collective traumas often lead to a lack of studies of large representative samples that preclude comparisons of responses across demographic groups or generalizability to the population as a whole. However, to understand how individuals have coped -- and will to cope -- with this slow-moving disaster before a vaccine enables individuals to re-activate their pre-pandemic activities, data collection on representative samples is critical. Understanding who will successfully adjust to this chronic stressor requires longitudinal research that follows a representative, probability-based sample of individuals over time. Data collection conducted during early stages of the crisis can help identify individuals who are most likely to engage in self-protective and socially responsible behaviors, can classify early patterns of response, can help isolate risk factors eventually associated with long-term psychological maladjustment, and can identify correlates of resilience. Critical variables to study include emotional (fear, worry, distress), cognitive (perceived risk), social (loneliness, sense of social cohesion) and behavioral (media use, health protective behaviors) responses to the COVID-19 outbreak to explore how they help shape mental and physical health outcomes over time. Exploring social benefits in the aftermath of a collective disaster and examining how individuals and communities make sense of this crisis also requires longitudinal research using large samples that can isolate religious, political and

cultural differences in responses. Additional important research questions include understanding the impact on stress responses of direct exposures to the pandemic versus indirect exposure through widespread traditional and social media coverage of the outbreak, articulating how ambiguous or conflicting communication may amplify perceived risk and stress, and examining how cognitive and affective processes shape risk assessments, behavioral responses, and mental health outcomes. Finally, limited research has examined how prior life events may affect perceptions of risk of future hazards – especially ones with uncertain outcomes – but having such information may help identify those at risk of poor adjustment following subsequent crises.

Thus, results from longitudinal research on probability samples during and after the pandemic would enable an opportunity not only to document predictors of variability in response to the COVID-19 crisis, but also to examine several significant questions relevant to community resilience to a national crisis more generally. Information collected via such research can advance future conceptual work on coping with highly stressful national threats and provide information to facilitate early identification of individuals at risk for subsequent difficulties. Finally, findings from such research efforts can add to the foundation of knowledge for helping policymakers, service providers, and educators design educational materials and intervention efforts that are evidence-based and responsive to the needs of the community at large.

Fortunately, because the National Science Foundation offered many hundreds of RAPID grants – which enabled research funding for high quality science in the Spring of 2020, my colleagues and I were able to conduct a methodologically rigorous study of a national sample of adults in the U.S. that began March 18th. The first report from our national study of over 6500 individuals was published last week in the American Association for the Advancement of Science online journal *Science Advances* (**Attachment C**). We started a longitudinal study of thousands of people as the pandemic unfolded in the U.S., beginning from a time when there were 190 reported COVID-19 deaths in the U.S. to over 13,000 deaths less than 30 days later. We found that as the weeks went on, and the cases across the U.S. grew, so did rates of acute stress and depressive symptoms. Our findings offer insights into priorities for building community resilience in the face of this pandemic. First, those with pre-existing mental and physical health conditions were more likely to show both acute stress and depressive symptoms. Secondary stressors, such as job and wage loss and a shortage of necessities, were also strong predictors in the development of stress and depressive symptoms. Finally, we found that as predicted, extensive exposure to pandemic-related news, as well as exposure to conflicting information in the news media, were among the strongest predictors of acute stress in the early weeks of the pandemic. As of 5 days ago, we began to re-survey our sample of 6500 people to understand how they have coped with the past several months, as more people have been exposed to the illness and death associated with COVID-19, the stress of social unrest, and the ongoing climate-related disasters – both personally and via the media.

Will we survive the trauma of COVID-19 and the cascading tragedies that have followed it? As I argued in an Editorial in *Science* in July (**Attachment D**), I believe that we will. But this is not to minimize the seriousness of the tragedy in any way. Hundreds of thousands of individuals across the U.S. have experienced the loss of a loved one, often without the opportunity to say goodbye in person, and without the opportunity for a ritual funeral. There have also been millions of symbolic losses – of senior years in high school, weddings, and milestone events without the presence of loved ones to celebrate in person. We may expect grief for many and unresolved grief for some. Isolation may exacerbate loneliness for many and trigger suicidal ideation for some. We do not know how long this pandemic will last, nor do we really know how bad it will get. The ambiguity is stressful and the outcomes are painful.

Prior research on cumulative exposure suggests the chronicity and compounding nature of collective traumas in 2020 will likely be associated with *stronger* emotional responses with each new exposure, rather than habituation. Therefore, how can we ensure that communities

and their residents prove resilient in the face of cascading collective traumas? It is critical that policy makers strengthen resources distributed at both community and individual levels. Potential options include mental health support, positive coping and resilience-building activities (e.g., outdoor exercise), and virtual programming to reduce loneliness (particularly for those most isolated). As Black, Latinx, and Indigenous communities in the U.S. are suffering disproportionately from COVID-19, compounded by historical trauma, systemic racism, and persistent poverty, allocating additional resources to traditionally underserved and working communities of color is critical. Underlying social inequities must be addressed to avert a mental health disaster, which will likely lead to further physical health impairments and a protracted economic and social recovery. Importantly, greater severity of exposure is likely to occur for the most vulnerable in society, adding to the burden of compounding effects. Our government must intervene to provide financial, social, and emotional support to our residents, particularly those at lower socioeconomic levels. Lost pay for these individuals should be compensated, especially because those with lower incomes will likely suffer the most from the economic burden of the compounding crises. It is critical that we provide resources to communities most in need of support right now – the unemployed, chronically ill, and young people. It is also critical that we encourage the public to limit their exposure to media as an important public health intervention.

Current public health guidance also recommends self-protective behaviors, including frequent hand washing, physical distancing, wearing face coverings, and avoiding crowds. Yet media reports show people congregating with no social distancing at parties, beaches, and at protests in the streets. Research ongoing in my lab aims to explain such contradictory behaviors. We suspect that exposure to conflicting information from government authorities, media sources, and personal social networks plays a role in understanding whether or not individuals will follow scientific recommendations to behave in a way that minimizes risk and maximizes public health. Indeed, in the aftermath of the 2014 Ebola outbreak, my colleagues and I found that the public is able to understand risk information that is clearly, directly, and repeatedly communicated by trusted authorities. This trust is maintained by honesty and competence. Most people will follow the rules. But health-protective behaviors must be encouraged with messaging that conveys clearly and consistently the costs and benefits of actions that can ensure the physical and mental health of oneself and one's community. Research by behavioral scientists can provide a roadmap for public officials to ensure their residents' cooperation, trust in, and implementation of what is learned from biomedical science.

My decades of research on personal and collective traumas make clear that people are extremely resilient. Research after tragedy tells us that people often find meaning in adversity. During the pandemic, we are reaching our friends and loved ones through new means, becoming more capable with technology, and finding new ways to connect with neighbors--all of which can help us make sense of this crisis. Recognizing that all of us working together to practice social distancing is helping us save lives can turn feelings of isolation into a sense of purpose. Although the timing of containment of COVID-19 remains unknown, I believe that most people will get to the other side of the pandemic recognizing strengths and coping skills they did not realize they had. Rigorous research by psychological scientists can offer understanding of human behavior during crises to minimize future waves of infection and death.

This concludes my testimony. Thank you.

ATTACHMENTS

- A: Silver, R. C., Holman, E. A., & Garfin, D. R. (2020). Coping with cascading collective traumas in the United States. *Nature Human Behaviour*. doi.org/10.1038/s41562-020-00981-x
- B: Garfin, D. R., Silver, R. C., & Holman, E. A. (2020). The novel Coronavirus (COVID-2019) outbreak: Amplification of public health consequences by media exposure. *Health Psychology*, 39, 355-357. doi.org/10.1037/hea0000875
- C: Holman, E. A., Thompson, R. R., Garfin, D. R., & Silver, R. C. (2020). The unfolding COVID-19 pandemic: A probability-based, nationally representative study of mental health in the U.S. *Science Advances*, 6, eabd5390. doi.org/10.1126/sciadv.abd5390
- D: Silver, R. C. (2020). Surviving the trauma of COVID-19. *Science*, 369, 11. DOI: 10.1126/science.abd5396

Coping with cascading collective traumas in the United States

The year 2020 has been marked by unprecedented cascading traumas, including the COVID-19 pandemic, an economic recession, race-driven social unrest and weather-related disasters. Mental health consequences of direct and media-based exposure to compounding stressors may be profound. Policymakers must act to ease the burden of trauma to protect public health.

Roxane Cohen Silver, E. Alison Holman and Dana Rose Garfin

With hindsight, 2020 will not easily be forgotten. Our world is in turmoil. A series of catastrophes has cascaded one to the next, and individuals across the US have concurrently grappled with direct exposure to these events and watched them unfold, in real time, in the media. This unprecedented stressful year has both taxed the public's capacity to cope and endangered the most vulnerable groups in society.

Escalating stress across America

In 2020, the COVID-19 pandemic rapidly spread from China, to Europe, the United States and globally. The pandemic overwhelmed hospitals, overtaxed healthcare workers and resulted in almost 1 million deaths worldwide in 9 months, leaving families grieving in isolation. In the US alone, over 200,000 people have died in the same period. Within months, severe restrictions to limit the spread of infection left thousands of businesses closed and over 40,000,000 Americans unemployed. These crises hit low socioeconomic status and minority communities especially hard, highlighting economic and racial inequities in healthcare and essential services provision. With the pandemic and pandemic-triggered economic recession as a backdrop, Americans then faced a confluence of the current collective traumas compounded by race-based historical traumas¹. Brutal killings of unarmed Black people including Ahmaud Arbery and Breonna Taylor shook the country, followed by the videotaped death of George Floyd after over almost 9 minutes with a white police officer's knee on his neck, and by then the police shooting, point-blank, seven bullets into the back of Jacob Blake. Belated recognition by whites of centuries of systemic racism in the US—primed by months of stay-at-home orders, absence of distractions, economic anxiety and easy access to gruesome videos—led

directly to widespread multiracial protests, ongoing social unrest, increasing political divisiveness and violence in the streets. Simultaneously, the US has faced extreme weather events, including devastating hurricanes, record heatwaves and disastrous wildfires requiring evacuations made more complicated during an unrelenting pandemic that requires physical distancing. Together, the combination of medical, economic, historical, racial and climate-based catastrophes highlights the need for attention to the meaning and implications of cumulative, compounding trauma exposure.

There are several characteristics of the current milieu that facilitate a perfect storm of stressors. These traumas are chronic events with an ambiguous endpoint. We do not know how bad things will get, nor when recovery can truly begin. Individuals must grapple with intense direct exposure to cascading events (for example, personal illness or loss, social isolation, economic loss, violent policing), with varying and sometimes conflicting policies dictating public response. Concurrently, these events have been broadcast in real time, as they unfolded, on traditional and social media, with individuals watching news coverage repeatedly and across multiple mediums, compounding their exposure. News has been almost entirely bad, with escalating intensity. The overlay of sensationalized media coverage in the context of repeated direct exposure to adversity is likely creating an additional crisis for public mental health.

What we know about collective trauma

Decades of research on collective traumas indicates that each of these crises may independently have mental health consequences for exposed individuals, ranging from short-term anxiety to longer-term depression and post-traumatic stress disorder (PTSD)². Although the 2003 SARS outbreak lasted less than a

year, healthcare workers who cared for SARS patients and survivors of SARS infections experienced substantial mental health difficulties³. Clinically concerning rates of mental health symptoms (anxiety, depression, PTSD) were seen in Sierra Leone among the general population exposed to the 2014 Ebola infectious disease outbreak for a year⁴. Population-based research before and after the mid-2000 US recession demonstrated increased risk of mental health ailments 3–4 years later among those who experienced direct consequences of the economic downturn (for example, financial, job or housing related-impacts), with low socioeconomic groups showing greater vulnerability to mental health problems⁵. Finally, data collected among nationally representative samples of Americans before and after police killings of unarmed Black residents demonstrated declines in mental health among Black residents in states where the killings occurred, although the state's white residents did not experience corresponding mental health deficits⁶.

The importance of the media

In recent decades, the media landscape has changed dramatically. In addition to a round-the-clock news cycle, individuals across the world have embraced pocket-sized smartphones with easily accessible cameras that capture graphic videos of disasters and other tragedies and rapidly disseminate them widely with a click. Traditional and social media now broadcast collective traumas across the country—and globally—in record time. Yet we have only recently acknowledged that repeated indirect media-based exposure is also associated with mental and physical health ailments during infectious disease outbreaks like Ebola⁷, the current COVID-19 pandemic⁸ and following other collective traumas⁹.

For the past two decades, using prospective, longitudinal research designs, we have examined the acute and long-term

comment

mental and physical health consequences of media-based exposure to collective traumas. We explored the cumulative effects of direct and indirect exposure to such events and found that real-time media exposure to multiple collective traumas (for example, the September 11, 2001 terrorist attacks; Superstorm Sandy; the Sandy Hook Elementary School massacre) was later associated with increased psychological symptomatology following the 2013 Boston Marathon bombings⁵. Moreover, individuals reporting several hours of combined media exposure in the days after the bombings also reported higher acute stress than individuals who were directly exposed (for example, at the Boston Marathon finish line⁶). Repeated bombing-related media exposure was also associated with ongoing worry about mass violence and traumatic stress symptoms over time. In turn, these responses predicted more media exposure following the Pulse Nightclub mass shooting in Orlando, Florida, 3 years later⁷. As threats continue to emerge, these findings suggest that repeated media-based exposure to collective traumas may initiate a cycle between exposure and symptoms over time. That said, while viewing traumatic imagery may contribute to development of PTSD-like flashbacks⁸, we also must recognize that exposure to widely available tragic videos of police brutality, such as George Floyd's slow-motion murder under the police officer's knee, is crucial to initiate a social reckoning, such as the past-due acknowledgement of anti-Black racism in the US.

Cascading collective traumas

Multiple crises are not uncommon following natural disasters, yet research on cascading traumas is limited. For example, residents of the Biobío region of Chile experienced three rapid succession disasters in 2010: an 8.8 magnitude earthquake, a deadly tsunami and subsequent flooding, and civil unrest that resulted in days of looting. Interviews of a representative sample of over 1,000 residents at the earthquake's epicentre revealed that post-disaster distress was more strongly associated with exposure to one particular event (i.e., the tsunami) than with the number of disaster components experienced⁹. The tsunami appeared to be devastating because of governmental assurances that the coastal area was safe and unlikely to flood, highlighting the detrimental impact of disasters that are exacerbated by failures of trusted authorities—a lesson highly relevant to ongoing pandemic-related illnesses and deaths in the US.

Although there are limited empirical data on the consequences of compounding

collective crises, more is known about the impact of cumulative exposure to lifetime adversity. Among a representative sample of over 2,000 individuals who were studied across several years, exposure to a lifetime of adversity was associated with more difficulties coping with subsequent stressors¹⁰. Indeed, having experienced more stressful life events was associated with greater distress, functional impairment and lower life satisfaction. Nonetheless, some exposure to traumatic events might serve to inoculate individuals against the distress of subsequent negative life experiences. Experiencing low (but not zero) levels of adversity may teach people what coping skills are most effective, help them engage effective support systems, promote a sense of mastery over prior crises and engender coping self-efficacy over time¹¹. Recognition of these personal and social resources may promote resilience when one encounters the next adverse life event.

While individuals across the US may be exposed to compounding traumas both directly and via the media, mental health symptomatology in response to these exposures will vary widely. Both personal factors (for example, history of adversity, pre-existing mental health conditions, lack of economic resources)^{12,13} and contextual ones (for example, lack of social resources, community demographics)^{14,15} can increase vulnerability to negative psychological outcomes following collective crises. In contrast, the presence of personal and community-based resources may promote resilience and thriving in response to the stress.

A call to action

The convergence of cascading collective traumas, both historic and concurrent, raises serious questions about our future. Many unknowns remain about how individuals and communities will fare as the pandemic and economic disruption wax and wane and as worldwide cases of COVID-19 cross 30 million and deaths continue to climb. Some have warned of a possible increase in suicide and self-harm¹⁶ following chronic isolation and loneliness if quarantines are repeatedly implemented to mitigate continued infection. For people living with health disparities born of historical and racial trauma, long-term economic turmoil and loss of health insurance may exacerbate chronic health conditions, with devastating consequences.

Without intervention, might we expect people to acclimate to the unending cascade of traumas, numbing themselves to each new devastating statistic? Prior research on cumulative exposure suggests

the chronicity and compounding nature of collective traumas in 2020 will likely be associated with stronger emotional responses with each new exposure, rather than habituation^{17,18}. Indeed, emerging data from the US Centers for Disease Control demonstrate marked increases in adverse mental health conditions, substance use and suicidal ideation in June 2020 compared to 2019¹⁹. Therefore, how can we ensure that communities and their residents prove resilient in the face of cascading collective traumas? Prior research on communities exposed to chronic violence offers hints regarding factors that may prevent escalation of distress. A study of two Israeli communities exposed to 7 years of daily rocket fire revealed minimal levels of PTSD in the community where residents reported more community commitment, integration, strong social networks and instrumental and emotional support²⁰. In contrast, the community where residents had high vulnerabilities, including low education, income and immigrant status, reported substantial symptoms of distress and PTSD. This demonstrates the value of strengthening resources distributed at both community and individual levels. Potential options include mental health support, positive coping and resilience-building activities (for example, outdoor exercise), virtual programming to reduce loneliness (particularly for those most isolated) and arts-based and life-skills based activities²¹.

As Black, Latinx and Indigenous communities in the US are suffering disproportionately from COVID-19, compounded by historical trauma, systemic racism and persistent poverty²², allocating additional resources to traditionally underserved and working communities of colour is critical. Underlying social inequities must be addressed to avert a mental health disaster, which will likely lead to further physical health impairments and a protracted economic and social recovery. Importantly, greater severity of exposure is likely to occur for the most vulnerable in society, adding to the burden of compounding effects. Governments must intervene to provide financial, social and emotional support to their residents, particularly those at lower socioeconomic levels. Lost pay for these individuals should be compensated, given that those lower in income will suffer the most from the economic burden of the crises. Healthcare must be provided to residents who are out of work due to the economic fallout of the pandemic and those sick with COVID-19. Essential workers and minorities, who are at greater risk for problems²³, must be provided the tangible (for example, personal

protective equipment) and educational (for example, explicit safety protocols) resources needed to stay protected throughout the duration of the pandemic. Targeted outreach efforts should include additional funding for telehealth services that have demonstrated efficacy for improving mental health. This may be particularly helpful for those at highest-risk for COVID-19-related complications and who must maintain maximum physical distance to protect themselves⁶. Finally, risk communications that promote maximum safety must be consistent at local and national levels if we are to mitigate the public health impacts of this trauma cascade.

As 2020 comes to a close while the pandemic and other tragedies continue, policymakers must make resources available to support community mental health and enact policies that directly address economic and racial inequity in the burden of these

crises. In so doing, they can strengthen the social fabric and ease the mental and physical health burden of these trying times⁷.

Roxane Cohen Silver^{1,2,5*},
E. Alison Holman^{2,3} and Dana Rose Garfin⁴

¹Department of Medicine and Program in Public Health, University of California, Irvine, Irvine, California, USA, ²Department of Psychological Science, University of California, Irvine, Irvine, California, USA, ³Sue & Bill Gross School of Nursing, University of California, Irvine, Irvine, California, USA.

*e-mail: rsilver@uci.edu

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References

1. Bryant Davis, T. & Ocampo, C. *Guern. Psychol.* **33**, 479–500 (2005).
2. Norris, F. H. et al. *Psychiatr.* **65**, 207–239 (2002).
3. Maudsley, R. G. *Gen. Hosp. Psychiatry* **31**, 316–317 (2009).
4. Jalloh, M. F. et al. *BMJ Glob. Health* **3**, e000471 (2018).

5. Forbes, M. K. & Krugger, R. F. *Glin. Psychol. Sci.* **7**, 900–913 (2019).
6. Bo, J., Verkharamani, A. S., Williams, D. R. & Tsai, A. C. *Lancet* **392**, 302–310 (2018).
7. Thompson, R. R., Garfin, D. R., Holman, E. A. & Silver, R. C. *Clin. Psychol. Sci.* **5**, 513–521 (2017).
8. Garfin, D. R., Silver, R. C. & Holman, E. A. *Health Psychol.* **39**, 355–357 (2020).
9. Bourne, C., Mackay, C. E. & Holmes, E. A. *Psychol. Med.* **43**, 1521–1532 (2013).
10. Garfin, D. R., Silver, R. C., Ugalde, F. J., Lim, H. & Inoué, M. J. *Alcohol. Psychol.* **123**, 545–556 (2014).
11. Seery, M. D., Holman, E. A. & Silver, R. C. *J. Pers. Soc. Psychol.* **99**, 1035–1041 (2010).
12. Holmes, E. A. et al. *Lancet Psychiatry* **7**, 547–560 (2020).
13. Creiden, M. E. et al. *MMWR Morb. Mortal. Wkly. Rep.* **69**, 1049–1057 (2020).
14. Gellay, M., Berger, R., Bleich, A. & Silver, R. C. *Soc. Sci. Med.* **74**, 737–766 (2012).
15. Curcio, K. & Choo, E. *Lancet* **395**, 1753 (2020).

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Competing interests

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COMMENTARY

The Novel Coronavirus (COVID-2019) Outbreak: Amplification of Public Health Consequences by Media Exposure

Dana Rose Garfin, Roxane Cohen Silver, and E. Alison Holman
University of California, Irvine

The 2019 novel coronavirus (COVID-2019) has led to a serious outbreak of often severe respiratory disease, which originated in China and has quickly become a global pandemic, with far-reaching consequences that are unprecedented in the modern era. As public health officials seek to contain the virus and mitigate the deleterious effects on worldwide population health, a related threat has emerged: global media exposure to the crisis. We review research suggesting that repeated media exposure to community crisis can lead to increased anxiety, heightened stress responses that can lead to downstream effects on health, and misplaced health-protective and help-seeking behaviors that can overburden health care facilities and tax available resources. We draw from work on previous public health crises (*i.e.*, Ebola and H1N1 outbreaks) and other collective trauma (e.g., terrorist attacks) where media coverage of events had unintended consequences for those at relatively low risk for direct exposure, leading to potentially severe public health repercussions. We conclude with recommendations for individuals, researchers, and public health officials with respect to receiving and providing effective communications during a public health crisis.

Keywords: infectious disease, media, coronavirus

In December 2019, scientists identified a novel coronavirus (COVID-2019) that was associated with an outbreak of pneumonia in Wuhan, China, and that was suspected of being zoonotic in origin. In a matter of weeks, over 100,000 of cases and thousands of deaths were confirmed globally, with numbers rapidly increasing daily. In less than a month, COVID-2019 surpassed SARS-Cov in terms of total number of reported cases, even though the SARS-Cov outbreak occurred over a 9-month period. On January 30, 2020, the World Health Organization (WHO, 2020) designated the COVID-2019 outbreak a “public health emergency of international concern.” Scientists rapidly started working to elucidate the characteristics of the virus, including transmissibility, death rate, and origin (Perlman, 2020). In tandem, public health officials started working to communicate critical information to the public so that individuals could take necessary and appropriate precautions and governments could plan and respond accordingly.

Paradoxically, while journalists and public health officials worked to communicate critical information globally regarding risk assessments and recommendations, a related threat emerged: psychological distress resulting from repeated media exposure to the outbreak. This has implications not only for immediate suffering in a population already grappling with unprecedented social and economic fallout, but also for downstream effects on physical and mental health over time. Prospective, longitudinal studies have demonstrated that heightened stress responses during and in the immediate aftermath of a threatening event are associated with adverse physical and mental health outcomes over time (Garfin, Thompson, & Holman, 2018). Moreover, these stress responses can increase help-seeking behaviors that may be disproportionate or not recommended in response to the actual threat, overburdening health care facilities and diverting critical resources. For example, panic buying of essential consumer items like toilet paper, first aid kits, bottled water, and hand sanitizer in response to COVID-19 has led to global shortages and price gouging of important necessities.

During a health crisis, the public depends on the media to convey accurate and up-to-date information in order to make informed decisions regarding health protective behaviors. During times of uncertainty and crisis, the public may increase their reliance on the media (Ball-Rokeach & DeFleur, 1976), and it is imperative that trusted sources are available to provide risk assessments and recommendations (Lachlan, Spence, Lin, Najarian, & Del Greco, 2016). Decision science has revealed that people tend to form accurate perceptions of risk when facts are known and communicated to the public effectively via the media (Fischhoff,

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Dana Rose Garfin, Sue & Bill Gross School of Nursing, University of California, Irvine; Roxane Cohen Silver, Departments of Psychological Science and Medicine and Program in Public Health, University of California, Irvine; E. Alison Holman, Sue & Bill Gross School of Nursing, University of California, Irvine.

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Correspondence concerning this article should be addressed to Dana Rose Garfin, Sue & Bill Gross School of Nursing, University of California, Irvine, 100C Berk Hall, Irvine, CA 92697. E-mail: dgarfin@uci.edu

Wong-Parodi, Garfin, Holman, & Silver, 2018). In the absence of information—whether because the information is unknown to officials or because it is ineffectively communicated—ambiguity can lead to heightened appraisals of threat. This occurred in the context of the H1N1 crisis when increased uncertainty and feelings of uncontrollability increased anxiety (Taha, Matheson, & Anisman, 2014). Similarly, data collected during a school shooting found that during the crisis, when official updates were not provided, rumors proliferated, along with psychological distress (Jones, Thompson, Dunkel Schetter, & Silver, 2017). When this ambiguity is combined with an invisible threat, such as a virus, fear and worry may be exacerbated, and contribute to the spread of misinformation.

These phenomena are particularly relevant to the COVID-2019 outbreak, as people tend to perceive novel viral threats as higher in risk compared to more common threats such as influenza (Hong & Collins, 2006). During an ongoing threat from a novel disease outbreak, timely updates from trusted sources about the relative risk of contracting the novel disease versus a more common one are critical. Without them, public fears may escalate, fuel rumors, and provoke stress responses.

Emergency management agencies tend to underuse social media as a source of risk communication. Strategic social media use (e.g., hashtags) may be an effective way for agencies to communicate accurate information to the public during times of crisis (Lachlan et al., 2016). Residents may be advised to connect with and follow local health agencies and service providers for the most geographically relevant information. Researchers may use publicly available “big data” (e.g., localized tweets) to gauge the risk communication efforts of local agencies (see Lachlan et al., 2016, for an example).

In our interconnected society, public health threats can extend far beyond their point of origin. However, ubiquitous media exposure during the global 24/7 news cycle can lead viewers to inaccurately estimate the threat to their own communities. For example, the incidence of Ebola in the United States was quite low during the 2014 outbreak, but a nationally representative sample of U.S. residents ($N = 3,447$) showed that heightened media exposure to Ebola-related stories was associated with increased distress, worry, and impaired functioning (Thompson, Garfin, Holman, & Silver, 2017).

These heightened distress responses to media exposure to collective crises may have long-term repercussions for physical health. In an early study of American’s responses to the September 11th terrorist attacks (9/11), increased hours of TV exposure in the days after 9/11 were associated with increased posttraumatic stress and new-onset physical health ailments 2 to 3 years later (Silver et al., 2013). High acute stress post-9/11 also predicted reports of new onset physician-diagnosed cardiovascular disorders over the 3 years following the attacks, especially among people who were worried about future terrorism (Holman et al., 2008). Such findings highlight the relationship between the stress responses and physical health outcomes, even for people who live far away from stress-provoking events or developments.

In the past decade, several studies have demonstrated that both the type and amount of media exposure affect psychological and physical responses to a community-wide traumatic event. Following the Boston Marathon bombings, for example, we found a strong positive association between the amount of exposure to

bombing-related media coverage and acute stress symptoms. People who reported the highest media exposure reported higher acute stress than did people who were directly exposed to the bombings (Holman, Garfin, & Silver, 2014). These associations also appear to accumulate over time; as threats continue to emerge, repeated high levels of media exposure to these kinds of events may create a cycle of distress (Garfin, Holman, & Silver, 2015; Thompson, Jones, Holman, & Silver, 2019). People with the greatest concerns may seek out more media coverage of the event, further increasing their stress response.

In addition to the amount of media exposure, the content of the exposure matters as well. Exposure to graphic images that included blood was associated with heightened posttraumatic stress and fear of the future 6 months after the Boston Marathon bombings, both of which were positively associated with poor functioning (Holman, Garfin, Lubens, & Silver, 2020). These findings remained statistically significant after accounting for the overall amount of media exposure, highlighting the importance of considering both amount and type of media exposure.

Beyond effects on physical health from the increased stress response, media-fueled distress may overtax health care facilities as they deal with an influx of concerned patients. This occurred during previous epidemics, where high levels of media exposure resulted in a surge of emergency department visits, even in communities that were not experiencing an increase in the incidence of the disease (McDonnell, Nelson, & Schunk, 2012). We are seeing the repercussions of this with respect to the COVID-2019 outbreak: Consumer hoarding of facemasks has led to a global shortage of facemasks and respirators (“Coronavirus: Demand for Face Masks,” 2020), which are critical to protecting those at high risk—particularly health care professionals performing routine and specialized care. This shortage imperils communities most at risk by impeding public health efforts to contain the virus. Visits to emergency departments from those with relatively mild symptoms are leading to further taxing of an already overburdened healthcare system.

Although it is critical for the media to convey information to the public to promote appropriate health protective behaviors and effective institutional responses, it is imperative that information be conveyed without sensationalism or disturbing images. The public, in turn, should be advised to avoid speculative stories and limit repetitious exposure to media stories that provide little new information, while staying abreast of critical updates. We recommend that the public rely on authoritative sources such as the Centers for Disease Control and Prevention or WHO for the most up-to-date information regarding transmission, protecting one’s health, and community-level threats. Given that new media such as Apple updates, Twitter, and Instagram may be less likely to expose individuals to graphic images (Jones, Garfin, Holman, & Silver, 2016), they may be among the best ways to provide ongoing information without sensationalism or distributing graphic imagery. However, misinformation can also spread on social media and can heighten perceived risk and fear about health-related topics (Ng, Yang, & Vishwanath, 2018; Wang, McKee, Torbica, & Stuckler, 2019), which makes the responsible use of social media imperative. Both the Centers for Disease Control and Prevention and WHO provide regular communications via social media and website updates.

During a public health crisis, it is essential to convey urgent information to the populace in real time, while simultaneously tempering untoward media exposure that can lead to traumatic stress responses and associated maladies. Health care providers, as trusted community agents, also play an important role in communicating essential information to patients and other community members. Practical advice that individuals can implement to protect from contagious viruses (e.g., washing hands, using and immediately disposing of tissues for coughs and sneezes, sanitizing surfaces, social distancing) may be particularly beneficial, while simultaneously working to prevent other common contagions (e.g., influenza). Capitalizing on the high-risk perception of a novel virus could help to "market" health protective behaviors that might increase protection from other pathogens like influenza (Hong & Collins, 2006) and serve as a critical inflection point to communicate often disregarded public health messages such as the importance of preparing an emergency supply kit (Beatty, Shimshack, & Volpe, 2019). Health care providers can provide critical information and make concrete suggestions while seeking to temper hysteria that may thwart overall public health efforts to effectively combat the COVID-2019 outbreak.

Finally, many questions regarding effective risk communication during a public health crisis, particularly with respect to the use of social media, need further research. We hope that health scientists begin to design and conduct such research during the current COVID-2019 outbreak to provide information that public health officials can use now and in the future.

References

- Ball-Rokeach, S. J., & DeFleur, M. L. (1976). A dependency model of mass-media effects. *Communication Research*, 3, 3–21. <http://dx.doi.org/10.1177/009365027600300101>
- Beatty, T. K., Shimshack, J. P., & Volpe, R. J. (2019). Disaster preparedness and disaster response: Evidence from sales of emergency supplies before and after hurricanes. *Journal of the Association of Environmental and Resource Economists*, 6, 633–668. <http://dx.doi.org/10.2139/ssrn.3208765>
- Coronavirus: Demand for face masks creates shortfall for those in real need. (2020, February 7). *U.N. News*. Retrieved from <https://news.un.org/en/story/2020/02/1056942>
- Fischhoff, B., Wong-Parodi, G., Garfin, D. R., Holman, E. A., & Silver, R. C. (2018). Public understanding of Ebola risks: Mastering an unfamiliar threat. *Risk Analysis*, 38, 71–83. <http://dx.doi.org/10.1111/risa.12794>
- Garfin, D. R., Holman, E. A., & Silver, R. C. (2015). Cumulative exposure to prior collective trauma and acute stress responses to the Boston marathon bombings. *Psychological Science*, 26, 675–683. <http://dx.doi.org/10.1177/0956797614561043>
- Garfin, D. R., Thompson, R., & Holman, E. A. (2018). Mental and physical health effects of acute stress following traumatic events: A systematic review. *Journal of Psychosomatic Research*, 112, 107–113. <http://dx.doi.org/10.1016/j.jpsychores.2018.05.017>
- Holman, E. A., Garfin, D. R., Lubens, P., & Silver, R. C. (2020). Media exposure to collective trauma, mental health, and functioning: Does it matter what you see? *Clinical Psychological Science*, 8, 111–124. <http://dx.doi.org/10.1177/2167702619858300>
- Holman, E. A., Garfin, D. R., & Silver, R. C. (2014). Media's role in broadcasting acute stress following the Boston Marathon bombings. *Proceedings of the National Academy of Sciences*, 111, 93–98. <http://dx.doi.org/10.1073/pnas.1316265110>
- Holman, E. A., Silver, R. C., Poulin, M., Andersen, J., Gil-Rivas, V., & McIntosh, D. N. (2008). Terrorism, acute stress, and cardiovascular health: A 3-year national study following the September 11th attacks. *Archives of General Psychiatry*, 65, 73–80. <http://dx.doi.org/10.1001/archgenpsychiatry.2007.6>
- Hong, S., & Collins, A. (2006). Societal responses to familiar versus unfamiliar risk: Comparisons of influenza and SARS in Korea. *Risk Analysis*, 26, 1247–1257. <http://dx.doi.org/10.1111/j.1539-6924.2006.00812.x>
- Jones, N. M., Garfin, D. R., Holman, E. A., & Silver, R. C. (2016). Media use and exposure to graphic content in the week following the Boston Marathon bombings. *American Journal of Community Psychology*, 58, 47–59. <http://dx.doi.org/10.1002/ajcp.12073>
- Jones, N. M., Thompson, R. R., Dunkel Schetter, C., & Silver, R. C. (2017). Distress and rumor exposure on social media during a campus lockdown. *Proceedings of the National Academy of Sciences, USA*, 114, 11663–11668. <http://dx.doi.org/10.1073/pnas.1708518114>
- Lachlan, K. A., Spence, P. R., Lin, X., Najarian, K., & Del Greco, M. (2016). Social media and crisis management: CERC, search strategies, and Twitter content. *Computers in Human Behavior*, 54, 647–652. <http://dx.doi.org/10.1016/j.chb.2015.05.027>
- McDonnell, W. M., Nelson, D. S., & Schunk, J. E. (2012). Should we fear "flu fear" itself? Effects of H1N1 influenza fear on ED use. *The American Journal of Emergency Medicine*, 30, 275–282. <http://dx.doi.org/10.1016/j.ajem.2010.11.027>
- Ng, Y. J., Yang, Z. J., & Vishwanath, A. (2018). To fear or not to fear? Applying the social amplification of risk framework on two environmental health risks in Singapore. *Journal of Risk Research*, 21, 1487–1501. <http://dx.doi.org/10.1080/13669877.2017.1313762>
- Perlmutter, S. (2020). Another decade, another coronavirus. *The New England Journal of Medicine*, 382, 760–762. <http://dx.doi.org/10.1056/NEJMe2001126>
- Silver, R. C., Holman, E. A., Andersen, J. P., Poulin, M., McIntosh, D. N., & Gil-Rivas, V. (2013). Mental- and physical-health effects of acute exposure to media images of the September 11, 2001, attacks and the Iraq War. *Psychological Science*, 24, 1623–1634. <http://dx.doi.org/10.1177/0956797612460406>
- Taha, S. A., Matheson, K., & Anisman, H. (2014). H1N1 was not all that scary: Uncertainty and stressor appraisals predict anxiety related to a coming viral threat. *Stress and Health*, 30, 149–157. <http://dx.doi.org/10.1002/smi.2505>
- Thompson, R. R., Garfin, D. R., Holman, E. A., & Silver, R. C. (2017). Distress, worry, and functioning following a global health crisis: A national study of Americans' responses to Ebola. *Clinical Psychological Science*, 5, 513–521. <http://dx.doi.org/10.1177/2167702617692030>
- Thompson, R. R., Jones, N. M., Holman, E. A., & Silver, R. C. (2019). Media exposure to mass violence events can fuel a cycle of distress. *Science Advances*, 5, eaav3502. <http://dx.doi.org/10.1126/sciadv.aav3502>
- Wang, Y., McKee, M., Torbica, A., & Stuckler, D. (2019). Systematic literature review on the spread of health-related misinformation on social media. *Social Science & Medicine*, 112552. <http://dx.doi.org/10.1016/j.socscimed.2019.112552>
- World Health Organization. (2020). *Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV)*. Retrieved from [https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-\(2005\)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-\(2019-ncov\)](https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov))

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The unfolding COVID-19 pandemic: A probability-based, nationally representative study of mental health in the U.S.

E. Alison Holman^{1,*}, Rebecca R. Thompson², Dana Rose Garfin¹ and Roxane Cohen Silver^{2,3,*}

¹Sue & Bill Gross School of Nursing, University of California, Irvine. ²Department of Psychological Science, University of California, Irvine. ³Departments of Psychological Science and Medicine and Program in Public Health, University of California, Irvine.

*Corresponding authors: Email: aholman@uci.edu, rsilver@uci.edu

The COVID-19 pandemic is a collective stressor unfolding over time, yet rigorous published empirical studies addressing mental health consequences of COVID-19 among large probability-based national samples are rare. Between 3/18-4/18/20, during an escalating period of illness and death in the United States, we assessed acute stress, depressive symptoms and direct, community, and media-based exposures to COVID-19 in three consecutive representative samples across three 10-day periods (total N=6,514) from the U.S. probability-based nationally representative NORC AmeriSpeak panel. Acute stress and depressive symptoms increased significantly over time as COVID-19 deaths increased across the U.S. Pre-existing mental and physical health diagnoses, daily hours of COVID-19-related media exposure, exposure to conflicting COVID-19 information in media, and secondary stressors were all associated with acute stress and depressive symptoms. Results have implications for targeting of public health interventions and risk communication efforts to promote community resilience as the pandemic waxes and wanes over time.

Introduction

As the COVID-19 pandemic unfolds across the world, the scientific community has focused on understanding the transmission, biology, and treatment of the novel Coronavirus (SARS-CoV-2). To date, empirical investigations of the mental health impact of this collective trauma represent less than 3% of the published literature, (1) even though the pandemic, including its associated social and economic fallout, represents a mental health crisis of unprecedented scope and scale. (2) Globally, COVID-19 has left hundreds of millions of people at risk for serious illness or death, (3) isolated in their homes, (4) and without jobs or income. These circumstances place people living with anxiety, depression or other mental health challenges at especially high risk for worsening symptoms and suicide. (2, 5-7)

When faced with ambiguous, ongoing disasters like the COVID-19 pandemic, people often turn to the media for information to guide them, (8) making media a critical source of exposure to the crisis. Yet previous research demonstrates that exposure to media coverage of collective traumas such as mass violence, (9, 10) infectious disease outbreaks, (11) or natural disasters, (12) may be a double-edged sword that can inform the public while simultaneously amplifying stress symptoms, worry, and perceived risk, with significant implications for public health. (13-15) Conflicting messages in the media may further exacerbate stress, (16) especially in the context of coping with life-threatening circumstances that

could worsen as the pandemic unfolds over time.

Moreover, the degree to which individuals experience distress as a result of direct exposure to COVID-19 (e.g., contracting the virus) and related secondary stressors (e.g., personal or economic losses, social distancing) varies widely. These different exposures may exacerbate early distress, especially in the context of coping with a collective stressor like the COVID-19 pandemic. For example, analyses of helpline usage data suggest that stricter lockdown orders were associated with more loneliness, anxiety, and suicidal ideation among German helpline users. (17) However, analysis of GoogleTrends data suggests that stay-at-home orders may have flattened rising distress as the number of distress-related searches in the U.S. plateaued soon after the lockdowns began. (18) At present, little is known about the relative impact of these various exposures—direct, media-driven, or community wide—on individuals' early pandemic-related psychological responses. Understanding the risk and protective factors affecting public response is critical to promoting community resilience as countries across the globe face a surge of new COVID-19 infections.

From a methodological perspective, the relatively small body of literature addressing COVID-19-related mental health issues has significant flaws that call into question the validity and utility of the findings. For example, only four of the peer-reviewed empirical studies addressing mental health response to COVID-19 include methodologically rigorous probability-based sampling to enable population inferences,

(6, 19–21) one of which includes only young adults. (6) Rather, the majority of population-based studies have used “snowball” sampling or drawn samples from opt-in, non-representative online panels and then weighted the data to the population – a process that exacerbates the selection biases inherent in opt-in panels and undermines the data’s utility for public policy purposes. (22) Big data studies (e.g., Google Trends data) also suffer from biases as their samples are self-selected, not probability-based. Finally, although one study used a probability-based sample from the U.S. population and documented an increase in psychological distress from 2018 to early post-pandemic 2020, (20) it did not examine types of exposure, media use, or other predictors of the psychological toll of the pandemic.

Beginning on March 18, 2020 and across the next 30 days, we conducted a rigorous rapid-response study of three consecutive probability-based, nationally representative cohorts in the U.S. (see Fig. 1) to examine early distress (i.e., acute stress and depressive symptoms) in response to the COVID-19 pandemic. Mental and physical health histories collected prior to the pandemic provided baseline data, and prior research on collective trauma informed appropriate predictors of the outcomes assessed. Over the course of our study, the size of the pandemic shifted dramatically in the U.S., from 9,415 COVID-19 positive cases and about 190 COVID-related deaths when data collection began for Cohort 1, to 124,763 positive cases and about 3,500 deaths when data collection began for Cohort 2, to 401,166 positive cases and about 18,300 deaths when data collection began for Cohort 3. (3)

Results

Three representative cohorts (Cohort 1, $n=2,122$; Cohort 2, $n=2,234$; Cohort 3, $n=2,158$) comprised a final weighted sample ($N=6,514$) that was 51.9% female, ranged in age from 18–97 years ($M=47.51$ yrs; $SD=17.45$), and was 63.6% white (non-Hispanic), 11.8% Black (non-Hispanic), 16.0% Hispanic, and 8.7% other ethnicities. One third of the weighted sample (33.6%) had earned a bachelor’s degree or higher; median annual income was between \$40,000 and \$49,999 USD. Almost two-thirds (66.0%) of the sample lived in an urban area, 10.4% lived in suburbs, 12.9% lived in a town, and 10.6% lived in a rural area. 17.3% of the sample lived in the Northeast region of the U.S., 21.0% lived in the Midwest, 37.7% lived in the South, and 24.1% lived in the West. Supplemental Table S1 provides the weighted sample demographics compared to February 2020 Current Population Survey benchmarks. (23)

Prior to the COVID-19 outbreak, participants reported a mean of 1.04 physical health ailments ($SD=1.22$), and 17.7% of the sample reported being previously diagnosed with a mental health ailment by a physician. Approximately a quarter of the sample (23.5%) reported that they or a close other had been exposed to COVID-19 (e.g., experienced symptoms, were

diagnosed). 29.8% of the sample reported having work-related exposures (e.g., essential/in-person worker). Participants also reported a mean of 4.87 (Range: 0–6; $SD=1.54$) community exposures to the outbreak (e.g., stay-at-home order for their community, school or restaurant closures) and a mean of 1.37 (Range: 0–7; $SD=1.21$) secondary stressors related to the outbreak (e.g., lost job or wages, waiting in long lines for necessary supplies). Media exposure to the outbreak was high; participants reported consuming a mean of 7.06 (Range: 0–33; $SD=6.91$) hours of outbreak-related coverage daily (summed across media sources), consuming more news coverage than pre-outbreak ($M=25.99$; Range: -100 to 100; $SD=47.55$), and receiving conflicting information from the news media on average “sometimes” ($M=2.95$; Range: 1–5; $SD=1.05$).

Acute stress increased across the three cohorts, with Cohort 1 reporting significantly lower acute stress than both Cohorts 2 and 3, and Cohort 3 reporting significantly higher acute stress than Cohort 2 (see Fig. 2). Depressive symptoms also increased over time, with Cohort 3 reporting significantly more depressive symptoms than Cohorts 1 or 2 (see Fig. 2).

Table 1 presents both standardized (beta) and unstandardized coefficients for predictors of acute stress and depressive symptoms for the full sample. Prior mental ($\beta=0.18$, $\beta=0.27$) and physical ($\beta=0.06$, $\beta=0.08$) health diagnoses were significantly associated with higher acute stress and depressive symptoms, respectively. Demographic characteristics were also important: females reported higher acute stress ($\beta=0.12$) but not depressive symptoms ($\beta=0.02$), whereas older people ($\beta=-0.10$, $\beta=-0.18$), and those who lived in suburban rather than urban areas ($\beta=-0.03$, $\beta=-0.04$) reported lower acute stress and depressive symptoms, respectively. Respondents who lived in regions outside of the Northeast (Midwest: $\beta=-0.07$; South: $\beta=-0.07$; and West: $\beta=-0.06$) all reported lower acute stress, but not lower depressive symptoms (Midwest: $\beta=-0.03$; South: $\beta=-0.03$; and West: $\beta=-0.01$) than respondents in the Northeast. Respondents with higher incomes reported lower levels of depressive symptoms ($\beta=-0.08$), but not acute stress ($\beta=-0.02$).

We then examined personal, work-related, media-based, and secondary stress exposures to the COVID-19 outbreak as predictors of acute stress and depressive symptoms, after adjusting for demographics and pre-COVID-19 mental and physical health histories. Acute stress and depressive symptoms were associated with personal exposure to the outbreak ($\beta=0.09$, $\beta=0.11$, respectively), but not community exposures ($\beta=0.00$, $\beta=-0.01$, respectively). Secondary stressors (e.g., job and wage loss) predicted higher acute stress ($\beta=0.19$) and depressive symptoms ($\beta=0.12$), and work-related exposures predicted lower depressive symptoms ($\beta=-0.07$).

Finally, all three forms of media exposure predicted

higher acute stress and depressive symptoms: Hours of COVID-19-related media consumption ($\beta=0.15$, $\beta=0.13$, respectively); increased media consumption relative to the participant's pre-outbreak media behavior ($\beta=0.12$, $\beta=0.04$, respectively); and higher frequency of exposure to conflicting information about the outbreak in the media ($\beta=0.17$, $\beta=0.09$, respectively). Supplemental Table S2 presents findings for each of the three individual cohorts. The pattern across all three cohorts was consistent with the findings reported above.

Discussion

We provide evidence that between March 18th and April 18th, 2020, as the rates of COVID-19 positive cases and deaths increased substantially across the U.S., COVID-19-related acute stress and depressive symptoms increased over time in the U.S. These findings are consistent with studies linking the COVID-19 pandemic with declines in well-being around the globe. (5, 24, 25) Unlike other studies, our unique study design allowed us to examine population-based trends in the early psychological consequences of the COVID-19 pandemic as it unfolded using a large, representative, probability-based national sample on whom pre-pandemic mental and physical health data were available (collected before the pandemic and hence not susceptible to concerns about recall bias). Three key findings in particular offer insights about ways to encourage community resilience when addressing a crisis of this magnitude: support individuals with pre-existing conditions, mitigate secondary stress, and monitor extensive media exposure.

First, results indicate that individuals with pre-existing mental and physical health diagnoses were more likely to exhibit both acute stress and depressive symptoms – importantly, having a history of pre-pandemic psychiatric diagnoses was the strongest predictor of depressive symptoms during the pandemic, highlighting the increased risk profile of individuals with pre-existing conditions. (2) These findings are consistent with those of other COVID-related studies including the probability-based Zurich Project on the Social Development from Childhood to Adulthood, a prospective longitudinal study of youth in Switzerland, (6) and several non-probability-based studies conducted in other countries. (5, 7) Prior life stress (e.g., bullying, other victimization) was also linked with young adults' emotional responses to the pandemic. (6) Together, these findings highlight the importance of prioritizing allocation of mental health services to individuals known to have prior victimization and/or mental health conditions.

Second, secondary stressors – job and/or wage loss, shortages of necessities – were strong predictors of both acute stress and depressive symptoms. Several previous studies have documented the negative mental health impact of

secondary, ongoing stressors following different types of collective trauma, (26, 27) including the current COVID-19 pandemic. (6) In the context of the COVID-19 pandemic, communities coping with combined effects of illness, death, job loss, and economic strain may benefit from early and efficient provision of support services to help prevent or mitigate the mental health risks associated with complex grief. (28) By mitigating the impact of secondary stressors, such interventions could reduce the risk for experiencing a painful "loss spiral" in which stress begets psychological distress, which begets more stress. (29) Addressing these potential threats to mental health would likely prove beneficial for physical health as well. (30)

Third, consistent with recent COVID-19 studies, exposure to pandemic-related media coverage was associated with greater pandemic-specific acute stress and depressive symptoms. (2, 14) Daily hours of pandemic-related media exposure, increases in daily media use, and exposure to conflicting information in the news media all predicted acute stress and depressive symptoms. Indeed, frequency of exposure to conflicting information in news media was among the strongest predictors of pandemic-specific acute stress symptoms, suggesting the importance of providing consistent messaging to promote resilience and protect mental health when coping with an ambiguous collective stressor. (16, 30) As demonstrated after the 2014 Ebola public health outbreak in the U.S., when given clear communication about risk and protective behaviors, the public can understand their contours and report risk assessments accurately. (31) However, if conflicting media messages increase public perceptions of uncertainty about one's own safety during the pandemic, they are likely to raise stress, anxiety, and depression levels, (32) highlighting the potential for harm associated with poor risk communication conveyed in the media. Relying on social media sources for information during the pandemic may exacerbate this risk by increasing users' negative affect, symptoms of stress, anxiety, and depression, (14) and promoting conspiracy theories that undermine engagement in health behaviors. (21) Given the degree to which the public relies on media sources for information during a crisis, (8) it is critical for them to provide accurate information in a non-sensationalistic manner, using clear, non-contradictory messaging. (2, 30)

During the early weeks of the pandemic, media reports of growing numbers of infections and deaths, and the economic turmoil associated with sweeping public health interventions (e.g., closure of businesses and schools) to mitigate the escalating threat, undoubtedly raised anxiety. Akin to what we found when individuals reported distress associated with an approaching hurricane, (12) increased media exposure to an impending threat is associated with distress and more media consumption over time, potentially creating a cycle of

distress, especially if the threat – like the pandemic – does not abate. (10) Studies have further demonstrated that subjective reports of acute stress following collective and individual traumas is associated with risk perceptions, (33) as well as subsequent physical health ailments, including higher risk of all-cause mortality. (34) Acute stress has been associated with subsequent cardiovascular illness in large population-based studies, (35) even when respondents' exposure to collective stress (i.e., 9/11 attacks) was primarily through the media. (13) Together, these findings suggest that heightened stress responses following media exposure may have important implications for the public's physical health. Encouraging the public to limit their exposure to media is an important public health intervention to prevent mental and physical health symptoms and promote resilience. (2)

Additionally, personal exposure (e.g., self or close other tested positive to COVID-19) was associated with higher acute stress and depressive symptoms, whereas community-level exposures (e.g., stay-at-home orders) were not, suggesting that concerns about contracting the disease outweighed concerns about pandemic-related disruptions in daily life. Unlike big data findings suggesting that stay-at-home orders may "flatten the curve" of psychological symptoms (e.g., anxiety, hopelessness, suicide) in the U.S., (18) our findings offer evidence that respondents' acute stress and depressive symptoms continued rising after the stay-at-home orders were implemented. Furthermore, our data suggest that individuals who continued working during this early phase of the pandemic were less depressed than individuals who were not working, even though they were at greater risk for contracting the virus. It is possible that respondents who lost their jobs in the lockdown experienced a spike in depressive symptoms as unemployment is robustly linked with depression. (36) Alternatively, remaining employed as an "essential" worker may have given new meaning to respondents' work that reduced their risk for depression. (37) Future research should address trends in specific types of exposures and their link to mental health outcomes over time as pandemic-related restrictions are relaxed.

In keeping with several recent studies, (19, 25, 38) young individuals reported higher acute stress and depressive symptoms than older respondents, suggesting that despite being most deadly for older populations at the time of our data collection, (39) the COVID-19 pandemic and its aftermath have had widespread impacts across populations. Indeed, the heightened stress and depression may reflect feelings of uncertainty about the future, or a foreshortened sense of the future, (40) as efforts to control the pandemic have led to an economic downturn impacting future plans/expectations for millions of young people. How these age differences in the early mental health response to the pandemic affect the subsequent well-being of young people

around the globe is another important topic for future research.

In this study, we provide three consecutive representative snapshots of early mental health responses weighted to a national sample to allow comparisons across cohorts over time. We acknowledge that without longitudinal data, we cannot address within-person change over time, and ongoing data collection will enable future examination of such change. Moreover, we acknowledge that a minority of individuals chose not to complete our survey during the fielding periods. Nonetheless, our sampling and weighting procedures ensure that we can make population estimates and draw conclusions accordingly.

We demonstrate that the COVID-19 pandemic and the media environment surrounding it are associated with higher acute stress and depressive symptoms in three consecutive, large cross-sectional studies among representative samples of Americans. Importantly, we employed a nuanced approach to conceptualizing media exposure by assessing amount (from varied sources), content (conflicting information), and relative increase/decrease. The many potential downstream public health consequences of this unfolding, ambiguous pandemic stretch far beyond the number of cases and deaths directly due to the novel Coronavirus itself. Future research should address the long-term public health impacts of the multiple threats of pre-existing risk, ongoing, secondary stressors, and media-related psychological distress. This information is critical for promoting resilience through effective communication and early interventions targeting public health and well-being during this unprecedented health crisis.

Materials and methods

Data Collection and Sample

The survey was conducted using NORC's AmeriSpeak panel, a probability-based panel of 35,000 U.S. households. AmeriSpeak panel households are selected at random from across the U.S. to form a representative cross section of U.S. households. NORC's AmeriSpeak panel is the only probability panel in the U.S. that uses random door-to-door interviewing to recruit its participants, who subsequently participate in AmeriSpeak surveys by web or telephone. As a result, AmeriSpeak attains response rates nearly three times higher than other probability panels in the U.S. (41) Unlike typical Internet panels, for which people who already have Internet access choose to opt in, no one can volunteer for the AmeriSpeak panel.

NORC drew our stratified random sample of 11,139 panelists from the AmeriSpeak panel using sample stratification to assure representativeness with respect to age, gender, race/ethnicity, and education. NORC fielded a 20-min survey for 10 days each to three consecutive cohorts of 3,713 panelists (Cohort 1, March 18-28, 2020; Cohort 2, March 29-April 7, 2020; Cohort 3, April 8-18, 2020); participants received notice

that the survey was available via a password-protected email address and completed the survey online anonymously. Surveys were confidential, self-administered, and accessible any time for the designated period; participants could complete a survey only once. Respondents received a small compensation (cash equivalent \$4 USD) for completing the survey. When the fielding period ended, 6,598 had completed surveys (59.2% completion rate); 84 cases (1.3%) were removed from the final sample due to unreliable survey completion times (under 6.5 min) or extensive missing data (>50% of questions), leaving $N=6,514$ ($n=2,122$, $n=2,234$, $n=2,158$ respondents/cohort 1, 2 and 3, respectively) in the final sample for analysis. Using standard definitions for survey response rate reporting proposed by the American Association for Public Opinion Research, (42) the survey cooperation rate was 58.5%.

Across all cohorts, ~85% percent of respondents completed the survey within the first 3 days of its fielding; surveys were completed on computers (44%), smartphones (54%), and tablets (2%). Prior to January 1, 2020, and thus before the start of the COVID-19 outbreak in the U.S., all respondents had completed mental and physical health assessments; we examined pandemic-related acute stress and depressive symptoms, controlling for these baseline data. Participants provided informed consent when they joined the NORC panel and were informed that their identities would remain confidential. All research activities were reviewed and approved by the University of California, Irvine Institutional Review Board for Human Subjects research.

Measures

Participants' **demographics** (including age, race/ethnicity, education, gender, income, geographic region of residence, residential area such as urban or rural) and **health information** were collected by NORC upon enrollment into the AmeriSpeak panel and updated periodically for accuracy; 56% of the sample completed pre-COVID health data in 2019, 25% completed it in 2018, and 19% completed it in 2017. Participants reported whether a doctor had ever diagnosed them with several physical and mental health ailments. Prior mental health diagnoses were coded as 0 (no prior mental health diagnosis) or 1 (prior anxiety, depression, or any other emotional, nervous, or psychiatric diagnosis). Prior physical health diagnoses were coded as a count of eight possible prior diagnoses (i.e., high cholesterol, hypertension, diabetes/high blood sugar, heart disease, stroke, cancer, lung disease, and other diagnoses). **Acute stress responses** to the COVID-19 outbreak were assessed using a modified version of the Acute Stress Disorder Scale 5. (43) Participants used a 5-point scale (1 "not at all," 5 "a great deal") to report the degree to which they had experienced 10 symptoms of acute stress as a result of the COVID-19 outbreak in the previous week ($\alpha=.86$).

Depressive symptoms were assessed with the depression subscale of the Brief Symptom Inventory-18. (44) Participants used a 5-point scale (0 "not at all," 4 "extremely") to report the degree to which they experienced six items in the past week ($\alpha=.86$).

Participants completed a checklist to report their degree of **exposure to the COVID-19 outbreak**. Ten items reflected **personal exposures**: direct or indirect disease exposure (e.g., I/someone close to me was diagnosed with Coronavirus); two items reflected **work exposures** (e.g., My job requires in-person interaction and I am still working); and six items reflected **community exposures**: community-wide outbreak-related impacts (e.g., my community has been instructed to "shelter in place"). Seven items reflected COVID-19 related **secondary stressors** (e.g., lost job, canceled travel plans). Four scores comprised counts of each of these personal, work, and community exposures, and secondary stressors; due to high skewness in the personal exposures subscale, responses to these items were dichotomized for analyses.

Media exposure to the COVID-19 outbreak was assessed using participants' reports of the number of hours per day (0-11+) spent in the previous week engaging with each of three sources of media coverage of the outbreak: traditional media (i.e., TV, radio, and print news), online news, and social media (e.g., Facebook, Reddit, Twitter). The COVID-19-related media coverage score reflected a sum of total daily hours of media exposure across these three sources. Because participants could simultaneously engage with multiple sources, the maximum score was 33. Participants then used a sliding scale to report how much more or less they were engaging with news media than they were prior to the Coronavirus outbreak; positive responses indicated an increase from their pre-outbreak behavior and negative responses indicated a decrease (possible range: -100 to 100; 0=no change). Participants also reported how often they felt they were receiving "conflicting or confusing information" from the news media over the previous week using a 5-point scale (1 "never," 5 "all the time").

Analytic Strategy

Statistical analyses were conducted using Stata 16.1 (StataCorp, College Station, TX). All data were weighted to adjust for probability of selection into the AmeriSpeak panel and to account for differences between our sample and U.S. Census benchmarks (23). Poststratification weights were iteratively constructed from respondents' design weights using probability estimates based on age, gender, race/ethnicity, education, and census region. The weighted sample closely matches the February 2020 U.S. Census data (see Supplementary Table S1). (23) Mean scores for acute stress and depressive symptoms were computed to capture variability in response. (45) We constructed Multiple Ordinary Least

Squares (OLS) regression models to examine predictors of the acute stress in response to the COVID-19 outbreak and depressive symptoms. To account for missing data, the model was estimated using a multiple imputation using chained equations (MICE) method. This method generates multiple possible observations for each missing value to create a pooled set of final estimates and robust standard errors for the model that accounts for uncertainty in variables with missing data. Due to low missingness across variables (0.02% to 2.76% missingness for individual variables), a total of 20 imputations was used. Acute stress and depressive symptoms were regressed on demographics, cohort membership, pre-outbreak mental and physical health ailments, personal, work, and community exposure to the outbreak, secondary stressors, hours of COVID-19-related media coverage consumed, relative media consumption compared to pre-outbreak levels, and the degree to which participants were exposed to conflicting or confusing information via the media.

REFERENCES AND NOTES

1. EpiCentre Social Science Research Unit, COVID-19: A living systematic map of the evidence. (Accessed July 22, 2020). <https://epi.cse.ac.uk/cse/Projects/DepartmentofHealthandSocialCare/PublicHealthReviews/COVID-19-19-a-living-systematic-map-of-the-evidence/3765/Default.aspx>
2. E. A. Holmes, R. C. O'Connor, V. H. Perry, L. Tracey, S. Wessely, L. Arseneault, C. Ballard, H. Christensen, R. C. Silver, L. Everall, T. Ford, A. John, T. Kabir, K. King, L. Madan, S. Michie, A. K. Przybylski, R. Shafran, A. Sweeney, C. M. Worthman, L. Yardley, K. Cowan, C. Cope, M. Hotopf, E. Bullmore, Multidisciplinary research priorities for the COVID-19 pandemic: A call for action for mental health science. *Lancet Psychiatry* 7, 547–560 (2020). doi:10.1016/S2215-0366(20)30168-1
3. Johns Hopkins University Coronavirus Resource Center, <https://coronavirus.jhu.edu/map.html>, Accessed June 14, 2020.
4. S. K. Brooks, R. K. Webster, L. E. Smith, L. Woodland, S. Wessely, N. Greenberg, G. J. Rubin, The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. *Lancet* 395, 912–920 (2020). doi:10.1016/S0140-6736(20)30460-8
5. N. Vindegaard, M. E. Benros, COVID-19 pandemic and mental health consequences: Systematic review of the current evidence. *Brain Behav. Immun.* S0889-1591(20)30954-5; Epub ahead of print (2020). doi:10.1016/j.bbi.2020.05.048
6. L. Shanahan, A. Steinhoff, L. Bechtiger, A. L. Murray, A. Nivette, U. Hepp, D. Ribeaud, M. Eisner, Emotional distress in young adults during the COVID-19 pandemic: Evidence of risk and resilience from a longitudinal cohort study. *Psychol. Med.* 1–10; Epub ahead of print (2020). doi:10.1017/S0033291720002411
7. M. Luo, L. Guo, M. Yu, W. Jiang, H. Wang, The psychological and mental impact of coronavirus disease 2019 (COVID-19) on medical staff and general public - A systematic review and meta-analysis. *Psychiatry Res.* 291, 113190 (2020). doi:10.1016/j.psychres.2020.113190
8. S. J. Ball-Rokeach, M. L. DeFleur, A dependency model of mass-media effects. *Commun. Res.* 3, 3–21 (1976). doi:10.1177/009365027600300101
9. E. A. Holman, D. R. Garfin, R. C. Silver, Media's role in broadcasting acute stress following the Boston Marathon bombings. *Proc. Natl. Acad. Sci. U.S.A.* 111, 93–98 (2014). doi:10.1073/pnas.1316265110
10. R. R. Thompson, N. M. Jones, E. A. Holman, R. C. Silver, Media exposure to mass violence events can fuel a cycle of distress. *Sci. Adv.* 5, eaav3502 (2019). doi:10.1126/sciadv.aav3502
11. R. R. Thompson, D. R. Garfin, E. A. Holman, R. C. Silver, Distress, worry, and functioning following a global health crisis: A national study of Americans' responses to Ebola. *Clin. Psychol. Sci.* 5, 513–521 (2017). doi:10.1177/2167772217692030
12. R. R. Thompson, E. A. Holman, R. C. Silver, Media Coverage, Forecasted Posttraumatic Stress Symptoms, and Psychological Responses Before and After an Approaching Hurricane. *JAMA Netw. Open* 2, e186228 (2019). doi:10.1001/jamanetworkopen.2018.6228
13. E. A. Holman, R. C. Silver, M. Poulin, J. Andersen, V. Gil-Rivas, D. N. McIntosh, Terrorism, acute stress, and cardiovascular health: A 3-year national study following the September 11th attacks. *Arch. Gen. Psychiatry* 65, 73–80 (2008). doi:10.1001/archgenpsychiatry.2007.6
14. M. Chao, D. Xue, T. Liu, H. Yang, B. J. Hall, Media use and acute psychological outcomes during COVID-19 outbreak in China. *J. Anxiety Disord.* 74, 102248 (2020). doi:10.1016/j.janxiety.2020.102248
15. J. Gao, P. Zheng, Y. Jia, H. Chen, Y. Mao, S. Chen, Y. Wang, H. Fu, J. Dai, Mental health problems and social media exposure during COVID-19 outbreak. *PLOS ONE* 15, e0231924 (2020). doi:10.1371/journal.pone.0231924
16. N. M. Jones, R. R. Thompson, C. Dunkel Schetter, R. C. Silver, Distress and rumor exposure on social media during a campus lockdown. *Proc. Natl. Acad. Sci. U.S.A.* 114, 11663–11668 (2017). doi:10.1073/pnas.1708518114
17. S. Armbruster, V. Klotzbocher, Lost in Lockdown? Covid-19, social distancing, and mental health in Germany. *CEPR COVID Economics*, No. 2020-04, Diskussionsbeiträge (2020).
18. N. C. Jacobson, D. Lekkas, G. Price, M. V. Heinz, M. Song, A. J. O'Malley, P. J. Barr, Flattening the Mental Health Curve: COVID-19 Stay-at-Home Orders Are Associated With Alterations in Mental Health Search Behavior in the United States. *JMR Ment. Health* 7, e19347 (2020). doi:10.2196/19347
19. L. Z. Li, S. Wang, Prevalence and predictors of general psychiatric disorders and loneliness during COVID-19 in the United Kingdom. *Psychiatry Res.* 291, 113267 (2020). doi:10.1016/j.psychres.2020.113267
20. E. E. McGinty, R. Presskreischer, H. Han, C. L. Barry, Psychological Distress and Loneliness Reported by US Adults in 2018 and April 2020. *JAMA* 324, 93–94 (2020). doi:10.1001/jama.2020.9740
21. D. Allington, B. Duffy, S. Wessely, N. Dhavan, J. Rubin, Health-protective behaviour, social media usage and conspiracy belief during the COVID-19 public health emergency. *Psychol. Med.* 1–7 (2020). doi:10.1017/S003329172000224X
22. M. Pierce, S. McManus, C. Jessop, A. John, M. Hotopf, T. Ford, S. Hatch, S. Wessely, K. M. Abel, Says who? The significance of sampling in mental health surveys during COVID-19. *Lancet Psychiatry* 7, 567–568 (2020). doi:10.1016/S2215-0366(20)30237-6
23. U.S. Department of Commerce Census Bureau, Accessed February 2020 at <https://www.census.gov/programs-surveys/cps/data.html>
24. H. Zacher, C. W. Rudolph, Individual differences and changes in subjective wellbeing during the early stages of the COVID-19 pandemic. *Am. Psychol.* Advance online publication (2020). doi:10.1037/amp0000702
25. N. Salari, A. Hosseini-Far, R. Jalali, A. Vaisi-Raygani, S. Rasoulpoor, M. Mohammadi, S. Rasoulpoor, B. Khaledi-Paveh, Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: A systematic review and meta-analysis. *Global Health* 16, 57 (2020). doi:10.1186/s12922-020-00589-w
26. R. C. Kessler, K. A. McLaughlin, K. C. Koenen, M. Petukhova, E. D. Hill, WHO World Mental Health Survey Consortium, The importance of secondary trauma exposure for post-disaster mental disorder. *Epidemiol. Psychiatr. Sci.* 21, 35–45 (2012). doi:10.1017/S2045796011000758
27. D. R. Garfin, R. C. Silver, F. J. Ugalde, H. Linn, M. Inostroza, Exposure to rapid succession disasters: A study of residents at the epicenter of the Chilean Bio Bio earthquake. *J. Abnorm. Psychol.* 123, 545–556 (2014). doi:10.1037/a0037374
28. S. Galea, C. R. Brewin, M. Gruber, R. T. Jones, D. W. King, L. A. King, R. J. McNally, R. J. Ursano, M. Petukhova, R. C. Kessler, Exposure to hurricane-related stressors and mental illness after Hurricane Katrina. *Arch. Gen. Psychiatry* 64, 1427–1434 (2007). doi:10.1001/archpsyc.64.12.1427
29. S. R. Lowe, M. Tracy, M. Cerdá, F. H. Norris, S. Galea, Immediate and longer-term stressors and the mental health of Hurricane Ike survivors. *J. Trauma Stress* 26, 753–761 (2013). doi:10.1002/jts.21872
30. D. R. Garfin, R. C. Silver, E. A. Holman, The novel coronavirus (COVID-2019)

- outbreak: Amplification of public health consequences by media exposure. *Health Psychol.* **39**, 355–357 (2020). [doi:10.1037/hea0000875](https://doi.org/10.1037/hea0000875) [Medline](#)
31. B. Fischhoff, G. Wong-Parodi, D. R. Garfin, E. A. Holman, R. C. Silver, Public Understanding of Ebola Risks: Mastering an Unfamiliar Threat. *Risk Anal.* **38**, 71–83 (2018). [doi:10.1111/risa.12794](https://doi.org/10.1111/risa.12794) [Medline](#)
 32. J. F. Brosschot, B. Verkuil, J. F. Thayer, The default response to uncertainty and the importance of perceived safety in anxiety and stress: An evolution-theoretical perspective. *J. Anxiety Disord.* **41**, 22–34 (2016). [doi:10.1016/j.janxdis.2016.04.002](https://doi.org/10.1016/j.janxdis.2016.04.002) [Medline](#)
 33. N. F. Popovic, U. U. Bentele, J. C. Pruessner, M. Moussaid, W. Gaissmaier, Acute stress reduces the social amplification of risk perception. *Soc. Rep.* **10**, 7845 (2020). [doi:10.3389/rsos.2001508](https://doi.org/10.3389/rsos.2001508) [Medline](#)
 34. Z. Solomon, Y. Levin, L. Crompton, K. Ginzburg, Is acute stress reaction a risk factor for early mortality? *Health Psychol.* **38**, 606–612 (2019). [doi:10.1037/hea0000744](https://doi.org/10.1037/hea0000744) [Medline](#)
 35. H. Song, F. Fang, F. K. Arnberg, D. Mataix-Cols, L. Fernández de la Cruz, C. Almqvist, K. Fall, P. Lichtenstein, G. Thorgeirsson, U. A. Valdimarsdóttir, Stress related disorders and risk of cardiovascular disease: Population based, sibling controlled cohort study. *BMJ* **365**, 11255 (2019). [doi:10.1136/bmj.11255](https://doi.org/10.1136/bmj.11255) [Medline](#)
 36. D. Dooley, J. Prause, K. A. Ham-Rowbottom, Underemployment and depression: Longitudinal relationships. *J. Health Soc. Behav.* **41**, 421–436 (2000). [doi:10.2307/2676295](https://doi.org/10.2307/2676295) [Medline](#)
 37. B. A. Allan, C. Dexter, R. Kinsey, S. Parker, Meaningful work and mental health: Job satisfaction as a moderator. *J. Ment. Health* **27**, 38–44 (2018). [doi:10.1080/09638237.2016.1244718](https://doi.org/10.1080/09638237.2016.1244718) [Medline](#)
 38. L. Shi, Z. A. Lu, J. Y. Que, X. L. Huang, L. Liu, M. S. Ran, Y. M. Gong, K. Yuan, W. Yan, Y. K. Sun, J. Shi, Y. P. Bao, L. Lu, Prevalence of and risk factors associated with mental health symptoms among the general population in China during the coronavirus disease 2019 pandemic. *JAMA Netw. Open* **3**, e2014053–e2014053 (2020). [doi:10.1001/jamanetworkopen.2020.14053](https://doi.org/10.1001/jamanetworkopen.2020.14053) [Medline](#)
 39. G. Onder, G. Rezza, S. Brusaferro, Case-fatality rate and characteristics of patients dying in relation to COVID-19 in Italy. *JAMA* **323**, 1775–1776 (2020). [doi:10.1001/jama.2020.4583](https://doi.org/10.1001/jama.2020.4583) [Medline](#)
 40. E. A. Holman, E. L. Grisham, When time falls apart: The public health implications of distorted time perception in the age of COVID-19. *Psychol. Trauma* **12** (S1), S63–S65 (2020). [doi:10.1037/tra0000756](https://doi.org/10.1037/tra0000756) [Medline](#)
 41. Dennis M.J. Technical Overview of the AmeriSpeak Panel. Accessed May 25, 2020 at amerispeak.com/wp-content/uploads/2020/05/Technical-Overview-of-the-AmeriSpeak-Panel.pdf
 42. American Association for Public Opinion Research Standard Definitions. Final Dispositions of Case Codes and Outcome Rates for Surveys. 2016. Accessed May 25, 2020 at <https://www.aapor.org/>
 43. R. A. Bryant, M. L. Moulds, R. M. Guthrie, Acute Stress Disorder Scale: A self-report measure of acute stress disorder. *Psychol. Assess.* **12**, 61–68 (2000). [doi:10.1037/1040-3590.12.1.61](https://doi.org/10.1037/1040-3590.12.1.61) [Medline](#)
 44. L. Derogatis, *Brief Symptom Inventory 18: Administration, Scoring, and Procedures Manual*. (NCS Pearson, Inc., Minneapolis, MN, 2001).
 45. R. C. MacCallum, S. Zhang, K. J. Preacher, D. D. Rucker, On the practice of dichotomization of quantitative variables. *Psychol. Methods* **7**, 19–40 (2002). [doi:10.1037/1082-989X.7.1.19](https://doi.org/10.1037/1082-989X.7.1.19) [Medline](#)

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SUPPLEMENTARY MATERIALS

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Figure 1. Study Design

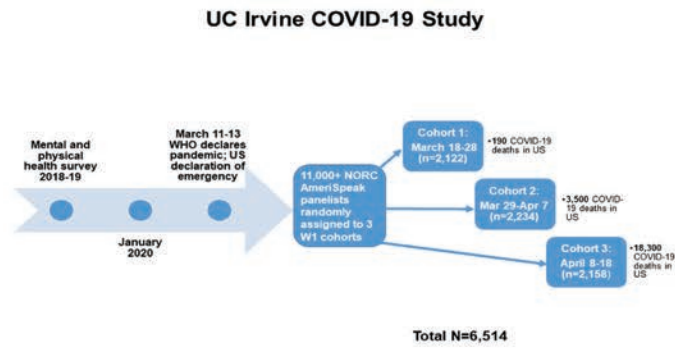
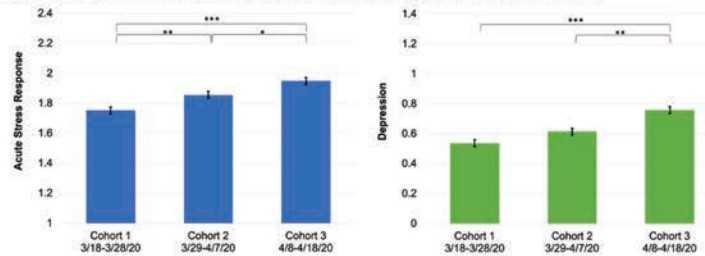


Fig. 1. Study design for examining early psychological responses to the COVID-19 pandemic in three consecutive probability-based, nationally representative cohorts in the U.S.

Figure 2. Mean pandemic-related acute stress response and depressive symptoms across cohorts (N=6,514)



Note: * $p < .05$; ** $p < .01$; *** $p < .001$. Values represent raw mean scores for each cohort. Range for acute stress: 1-5; range for depressive symptoms: 0-4.

Fig. 2. Mean pandemic-related acute stress response and depressive symptoms across cohorts (N=6,514).

Note: * $p < .05$; ** $p < .01$; *** $p < .001$. Values represent raw mean scores for each cohort. Range for acute stress: 1-5; range for depressive symptoms: 0-4.

Table 1. Adjusted regression coefficients for OLS regression models predicting pandemic-related acute stress and depressive symptoms to the COVID-19 outbreak ($N=6,514$)

Predictor Variables	Acute Stress			Depressive Symptoms		
	β	95% CI	b	β	95% CI	b
Cohort						
2 (3/29-4/7)	0.05*	0.01, 0.09	0.07	0.04	-0.00, 0.08	0.06
3 (4/8-4/18)	0.10***	0.06, 0.14	0.15	0.12***	0.07, 0.16	0.17
Outbreak-related media exposure (daily hours/week)	0.15***	0.10, 0.19	0.02	0.13***	0.08, 0.17	0.01
Relative media consumption	0.12***	0.08, 0.15	0.00	0.04*	0.00, 0.08	0.00
Conflicting info from news media	0.17***	0.13, 0.20	0.12	0.09***	0.05, 0.13	0.06
Personal exposures	0.09***	0.06, 0.13	0.15	0.11***	0.06, 0.15	0.17
Work exposures	-0.03	-0.06, 0.01	-0.04	-0.07***	-0.11, -0.03	-0.11
Community exposures	0.00	-0.04, 0.03	0.00	-0.01	-0.05, 0.02	-0.01
Secondary stressors	0.19***	0.15, 0.24	0.12	0.12***	0.07, 0.16	0.07
Prior mental health diagnoses	0.18***	0.13, 0.22	0.33	0.27***	0.22, 0.32	0.49
Prior physical health diagnoses	0.06**	0.02, 0.09	0.03	0.08***	0.04, 0.12	0.05
Age	-0.10***	-0.14, -0.06	0.00	-0.18***	-0.23, -0.14	-0.01
Race/Ethnicity						
Black, Non-Hispanic	-0.01	-0.05, 0.03	-0.02	-0.04	-0.08, 0.00	-0.09
Other, Non-Hispanic	-0.01	-0.04, 0.02	-0.02	-0.00	-0.03, 0.03	-0.01
Hispanic	0.01	-0.02, 0.05	0.03	0.03	-0.01, 0.07	0.07
Bachelor's degree +	0.02	-0.01, 0.05	0.02	-0.03	-0.06, 0.01	-0.04
Female sex	0.12***	0.08, 0.15	0.17	0.02	-0.02, 0.05	0.02
Income	-0.02	-0.06, 0.02	-0.00	-0.08***	-0.12, -0.04	-0.03
Residential area						
Suburban	-0.03*	-0.07, -0.00	-0.08	-0.04**	-0.07, -0.01	-0.10
Town	0.01	-0.03, 0.04	0.01	-0.01	-0.04, 0.03	-0.02
Rural	0.01	-0.03, 0.05	0.03	0.00	-0.03, 0.04	0.01
Region						
Midwest	-0.07**	-0.12, -0.02	-0.11	-0.03	-0.08, 0.03	-0.04
South	-0.07**	-0.12, -0.02	-0.11	-0.03	-0.09, 0.03	-0.04
West	-0.06*	-0.11, -0.01	-0.09	-0.01	-0.07, 0.04	-0.02
Constant	0.00	-0.03, 0.03	1.23	0.02	-0.01, 0.05	0.60
Model Statistics	$F(24, 6484.7) = 32.77; p < .001$			$F(24, 6484.6) = 23.59; p < .001$		
	$R^2=0.272$			$R^2=0.244$		

Note: Reference group for Cohort is Cohort 1 (3/18-3/28/2020); reference group for ethnicity is white, non-Hispanic; reference group for residential area is urban; reference group for region is Northeast. All models were estimated using sampling weights to account for sampling design and differences between the sample and U.S. census benchmarks. Standardized coefficients and confidence intervals were estimated by calculating z -scores for all model variables (including categorical indicators) and fitting a multiple OLS regression model to the standardized transformation.

* $p < .05$; ** $p < .01$; *** $p < .001$

The unfolding COVID-19 pandemic: A probability-based, nationally representative study of mental health in the U.S.

E. Alison Holman, Rebecca R. Thompson, Dana Rose Garfin and Roxane Cohen Silver

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EDITORIAL

Surviving the trauma of COVID-19

As a psychological scientist who investigates how individuals and communities respond to collective traumas, I study human resilience in a range of situations—from earthquakes and hurricanes to mass violence and war. Shortly after the 11 September 2001 terrorist attacks against the United States, I sat in the White House Office of Homeland Security discussing community resilience. Although the threat to society seemed real and continuing, national leaders were anxious to get people back on airplanes and into high-rise office buildings. In retrospect, the nation proved to be quite resilient: The threat of terrorism was never eliminated, but industries and urban centers continued to thrive. Decades later, the United States and world face another threat, equally amorphous and extremely deadly. In months, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus that causes coronavirus disease 2019 (COVID-19), has infected over 10 million people, killed over 125,000 Americans, and led to more than 500,000 deaths worldwide. A vaccine for COVID-19 is perhaps a year away. What does psychological science tell us about how individuals are responding—and will respond—as the pandemic waxes and wanes? What will the postpandemic “normal” look like? Will our society prove to be resilient?

COVID-19 is a physical illness that scientists are trying to understand from many angles. But the pandemic and its associated stressors also are likely to have serious mental health consequences. It is quite normal to experience distress as a result of chronic stress of this magnitude. Losses that are real (of loved ones, without the opportunity for a ritual funeral) or symbolic (graduation celebrations) abound. There may be grief for many, and unresolved grief for some. Isolation may lead to depression for many and suicidal ideation for some. But there will be no “one size fits all” response to this crisis.

Decades of psychological science on collective traumas indicate that individuals’ responses are likely to be based on several factors. These include their prepandemic circumstances and resources—prior exposures to adversity, physical and mental health vulnerabilities, and economic and social supports. One must also consider exposures encountered during the pandemic: Did a family member get sick or worse? Did the person lose a job or health insurance? Was the individual an essential worker whose actions ensured others’ well-being?

How much time was spent immersed in traditional or social media, repeatedly being exposed to hours of bad news? One must also consider community-level stressors. Did the individual live in a “hot spot”? Did shops and restaurants close, never to reopen? Was there unambiguous guidance from a governor that was backed by the best science? Emotional and behavioral responses to this ongoing crisis will be multidetermined but not random, and psychological science has isolated risk factors that can guide social service organizations and health care providers to identify the most psychologically vulnerable among us.

As the death toll due to COVID-19 crossed 125,000 in the United States, behavioral restrictions have been relaxed nationwide. Current public health guidance recommends self-protective behaviors, including frequent hand washing, social distancing, and wearing face coverings. Yet media reports show people congregating with no physical distancing at parties, beaches, and street protests. Research suggests that exposure to conflicting information from government authorities, media sources, and social networks plays a role in understanding whether or not individuals follow science-based recommendations to minimize risk and maximize public health. When Ebola virus cases appeared in the United States in 2014, the public proved to

understand risk information that is clearly and directly communicated by trusted authorities. Moreover, this trust must be maintained by honesty and competence. And just as the public returned to airplanes and high rises after 9/11, and just as people now go through x-ray machines without protest before they board a plane, most people will follow the rules.

Successfully managing COVID-19 and its aftermath will require that behavioral scientists provide a roadmap for public officials to ensure the public’s cooperation, trust in, and implementation of what is learned from biomedical science. Responsible health-protective behaviors must be encouraged with messaging that conveys clearly and consistently the costs and benefits of actions that can ensure the physical and mental health of oneself and one’s community. Although the timing of containment of COVID-19 remains unknown, most people will get to the other side of the pandemic recognizing strengths and coping skills that they did not realize they had.

—Roxane Cohen Silver



Roxane Cohen Silver is a professor of psychological science, public health, and medicine at the University of California, Irvine, CA, USA, and the president of the Federation of Associations in Behavioral and Brain Sciences, Washington, DC, USA. rsilver@uci.edu

“What will the postpandemic ‘normal’ look like?”

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Surviving the trauma of COVID-19

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Roxane Cohen Silver, Ph.D., is Professor in the Department of Psychological Science, the Department of Medicine, and the Program in Public Health, and Associate Director of the ADVANCE Program for Faculty and Graduate Student Equity, Diversity and Inclusion in the Office of Inclusive Excellence at the University of California, Irvine, where she has been actively involved in research, teaching, and administration since 1989. An international expert in the field of stress and coping, Silver has spent over four decades studying acute and long-term psychological and physical reactions to stressful life experiences, including personal traumas such as loss, physical disability, and childhood sexual victimization, as well as larger collective events such as terror attacks, war, and natural disasters across the world (e.g., U.S., Indonesia, Chile, Israel). Her research has been funded by the U.S. National Science Foundation, the U.S. National Institute of Mental Health, the U.S. Department of Homeland Security, and the U.S. Public Health Service. She has guided governments in the U.S. and abroad in the aftermath of terrorist attacks and earthquakes and served on numerous senior advisory committees and task forces for the U.S. Department of Homeland Security, providing advice to the Department and its component agencies on the psychological impact of disasters and terrorism. She has also testified at the U.S. House of Representatives' Committee on Science and given several briefings to policymakers at the White House and on Capitol Hill on the role of social science research in disaster preparedness and response and the impact of the media following disasters.

Silver is the President of the *Federation of Associations in Behavioral & Brain Sciences* (FABBS) and was the 2016 President of the *Society of Experimental Social Psychology*. She was also a founding Director and Chair of the Board of Directors of *Psychology Beyond Borders*, an international nonprofit organization that facilitated research, intervention, and policy development in the prevention, preparedness, and response to terror attacks, conflict, or natural disasters across the world. She is a Fellow of the American Psychological Association (in 4 Divisions), the Association for Psychological Science, the Academy of Behavioral Medicine Research, and the Society of Experimental Social Psychology. Silver has received a number of awards for her scholarship and service, including the 2007 American Psychological Association's Award for Distinguished Service to Psychological Science, the 2010 Public Advocacy Award from the International Society for Traumatic Stress Studies (for "outstanding and fundamental contributions to advancing social understanding of trauma"), the American Psychological Association's 2011 Award for Distinguished Contributions to Psychology in the Public Interest (Senior Career), the 2011 Award for Outstanding Service to the Field of Trauma Psychology, the 2014 International Society for Traumatic Stress Studies' Frank Ochberg Award for Media and Trauma Study, the 2016 Social Responsibility Award from the Western Psychological Association, the 2018 Robert S. Laufer Memorial Award for Outstanding Scientific Achievement from the International Society for Traumatic Stress Studies, the 2019 Application of Personality and Social Psychology Senior Career Contribution Award from the Society for Personality and Social Psychology, and the 2020 Award for Lifetime Achievement in the Field of Trauma Psychology from Division 56 (Trauma Psychology) of the American Psychological Association.

Silver is also a dedicated teacher and active mentor of predoctoral and postdoctoral students. In recognition of her efforts toward graduate and undergraduate education, she has received almost two dozen teaching/mentoring awards over her career, including the 2012 Distinguished Mentorship Award from the International Society for Traumatic Stress Studies, UC Irvine's 2001 Distinguished Faculty Lectureship Award for Teaching (the 16th recipient in UCI's history), and UCI's inaugural Tom Angell Fellowship Faculty Award for Mentoring in 2015. Silver received her Ph.D. in social psychology from Northwestern University.

Chairwoman SHERRILL. Thank you so much.
And next, we will hear from Dr. Montano.

**TESTIMONY OF DR. SAMANTHA MONTANO,
ASSISTANT PROFESSOR OF EMERGENCY MANAGEMENT,
MASSACHUSETTS MARITIME ACADEMY**

Dr. MONTANO. Thank you, Chairwoman Sherrill and Members of the Subcommittee, for the opportunity today to testify on issues related to coping with compound crises.

As the Chairwoman stated, I currently serve as an Assistant Professor of Emergency Management at Massachusetts Maritime Academy. I have a doctorate in emergency management from North Dakota State University and over a decade of emergency management experience in the field in research and in science communication.

For several years, there has been mounting evidence that the various components of our emergency management system are not keeping up with our needs across the country. In 2016, some national disaster nonprofits began talking about volunteer and funding fatigue. In 2017, FEMA (Federal Emergency Management Agency) struggled to meet the needs across the country in the wake of Hurricanes Harvey, Irma, Maria, and the California wildfires. This year, when the pandemic began, every emergency management agency at all levels of government activated simultaneously for the first time in U.S. history. Given our reliance on mutual aid between jurisdictions during times of crisis, the pandemic revealed the interconnectedness of this system and reinforced concerns about its capacity to meet the Nation's growing needs.

Research suggests that 2016, 2017, and 2020 are not outlier years. Rather, they represent just the beginning of what is to come as the consequences of the climate crisis began to manifest and collide with deferred infrastructure maintenance, social inequality, and decades of development decisions that have not accounted for hazard risk. Our system was not designed to manage a pandemic of this scope and scale, nor was it designed to manage the increasing number of disaster impacts across the country. And it's certainly not ready to meet the needs of the future.

Our current approach to emergency management is especially insufficient for Black, indigenous, low-income, and other marginalized communities. Decades of policy decisions have funneled these groups into especially vulnerable areas. Not only are these communities more likely to live in more physically vulnerable places, but they are also less likely to have the resources to be able to engage in pre-disaster mitigation and preparedness activities that would minimize their risk. When a hazard does occur, these communities experience disproportionate impacts and are less likely to have their needs met by existing recovery programs.

We need to urgently change our emergency management approach to one that is proactive, not reactive, one that centers environmental justice and quickly meets the actual needs of people before, during, and after disasters.

Empirical research must drive these changes. Scholars in many disciplines produce research that is fundamental to our understanding of disasters and their effects, but there is a particularly

important role for the discipline of emergency management, which studies how humans and their institutions create, interact, and cope with hazards, vulnerabilities, and associated events.

Historically, research has not been well-integrated into emergency management policy and practice despite its undeniable value to both. We need not only to ensure that future policy is built on empirical research but also that there are sustain funding mechanisms in place to support emergency management research specifically.

Currently, emergency management research is underfunded, which hinders our ability to inform emergency management practice and policy. Disasters do not happen in isolation from one another. We must address not only our Nation's readiness to manage a Hurricane Harvey, Maria, or a pandemic, but also our capacity to manage multiple threats at once because that is our reality.

As I testify before you today, people are struggling through disaster and its aftermath. Gulf Coast residents have had to manage a barrage of hurricanes as West Coast residents have had to manage constant wildfires. Parts of the Southeast are rebuilding after spring tornadoes, while Midland County, Michigan, recovers after dam failures, and communities in Iowa pick up the pieces after a derecho. People in all parts of the country are engaged in long-term recovery efforts, especially Puerto Ricans, who, 3 years post-Maria, are still waiting for all the assistance promised by the Federal Government.

In States, territories, and tribal lands all across the country, people are fighting against the repercussions of systemic racism and social injustice, all while a pandemic that has killed over 200,000 Americans persists unabated. These recent examples of trauma, loss of life, and destruction cannot be separated from each other, and emergency management is on the frontlines of addressing them all.

Thank you for your attention to these important issues. I look forward to answering any questions you may have.

[The prepared statement of Dr. Montano follows:]

Testimony by Samantha L. Montano
 Assistant Professor, Massachusetts Maritime Academy
samanthaLmontano@gmail.com
 House Committee on Science, Space, and Technology
 Subcommittee on Environment
 September 30, 2020

Introduction and Background

Thank you for the opportunity to prepare testimony on the role of emergency management research in coping with compound crises with a focus on extreme weather, social injustice, and the COVID Pandemic.

I currently serve as an assistant professor in the Emergency Management program at Massachusetts Maritime Academy. I have a doctorate in emergency management from North Dakota State University, the oldest emergency management doctoral degree granting program in the country. I have over a decade of emergency management experience beginning with recovery work in post-Katrina New Orleans. I have been to disasters across the country and seen first-hand the devastation they bring. I regularly conduct emergency management research related to disaster recovery, disaster volunteerism, the nonprofit sector, gender, and the relationship between emergency management and climate change. My work has focused not only on publishing research in academic outlets and making presentations to the scientific community, but also on advocating for the dissemination of emergency management research findings to practitioners and the general public through public engagement and science communication initiatives.

My testimony is organized into two sections. First, I will introduce the discipline of emergency management, its relationship to the broader study of disaster and emergency management practice. Second, I will highlight the urgency of funding for emergency management research, especially in the context of climate change and the COVID pandemic.

At this moment, people across the United States are struggling through disaster and its aftermath. Along the Gulf Coast, survivors of recent storms like Laura, Sally, and Beta have not yet returned home or rebuilt. People on the West Coast are trying to manage the public health effects of wildfire smoke. Iowa residents had to wait days for federal assistance after a derecho left Cedar Rapids and surrounding communities without power and with extensive damage. Three years after Hurricane Maria, Puerto Ricans are still waiting for all of the recovery assistance promised by the federal government. In states, territories, and tribal lands, all across the country people are fighting against the repercussions of systemic racism and social injustice, all while a pandemic that has killed over 200,000 Americans persists unabated.

These recent examples of trauma, destruction, and loss of life cannot be separated from each other. They are inextricably intertwined, and the emergency management system is on the frontlines of addressing them all.

People often mistakenly think emergency management is concerned only with efforts to save lives during the response to a disaster. In fact, emergency management encompasses much more, including the tasks done to mitigate risk, prepare our communities, and assist in disaster recovery. This is a broad and ambitious mission that requires the constant involvement of, as FEMA describes, the Whole Community — government, non-governmental organizations, the private sector, and individuals. While FEMA, at the national level, has the greatest emergency management responsibility, most of the actual work of emergency management is done by individuals, organizations, and agencies at all levels and in multiple sectors (Phillips, Neal, & Webb, 2017).

Another common misconception is that disasters affect us all equally and therefore require equal responses. In fact, disasters are inherently unjust. Research demonstrates that social vulnerability often intersects with physical vulnerability meaning the people who have the fewest resources often live in the most vulnerable places (Fothergill & Peek, 2004). With fewer resources these groups are less able to engage in pre-disaster mitigation and preparedness activities that would minimize their risk. So, when a hazard occurs these groups experience disproportionate impacts and have a particularly difficult time moving through the recovery process. While this occurs at the individual level it is also replicated at the community level. Gaining access to the resources needed to engage in effective emergency management may be more difficult for predominantly Black communities, and low-income communities. For example, FEMA funded home buy-outs have disproportionately benefited white communities (Benincasa, 2019) while programs like SBA loans disproportionately support the recovery of white communities compared to Black communities (Frank, 2020). Environmental racism is often found at the center of these disasters and so environmental justice must be centered in our response (see for example: Bullard & Wright, 2009).

As we see an increase in risk, impacts, costs, and needs related to disasters (NOAA National Centers for Environmental Information, 2020) there has arguably never been a more important moment for us to develop a more effective, efficient, and just approach to emergency management. In fact, as the consequences of climate change begin to manifest— especially changes to our risk of extreme weather events— emergency management's importance grows. Unfortunately, a persistent underinvestment in emergency management across the country has left this nation vulnerable (Krueger, Jennings, & Kendra, 2009). The longer inaction persists, the greater we can expect that vulnerability will become.

The State of Emergency Management Research

Scientists have long studied hazards and their impacts. Yet, it was not until the 1950s that a concerted effort was undertaken to understand human behavior during disasters. In the civil defense era, the federal government was concerned with how the American public would react to an attack on US soil. With federal funding from the Office of Civil Defense, a group of sociologists traveled across the country to systematically study the reactions of the public to all manner of hazards. Disaster sociologists dominated the field, doing this extensive fieldwork and writing foundational texts that laid the foundation for today's research (Rubin, 2012).

Over time, scholars across social and physical sciences have contributed to the study of disaster. Geographers provide empirical-based recommendations for land-use planning. Meteorologists

provide the information we need to be able to issue warnings. Engineers tell us how to design and construct infrastructure that can withstand various hazards. Sociologists help us understand the behavioral patterns in response. Psychologists explain how people interpret risk and address the mental health impacts in the aftermath of disaster (McEntire, 2004). While the scholarship from this diverse array of disciplines is fundamental to our understanding of disasters, these scholars do not synthesize their findings across disciplines, and rarely place them within an emergency management framework. This may inhibit the ability of practitioners to implement their important findings into practice.

In the 1990s (and further spurred by federal attention in the wake of 9/11) academic emergency management programs developed across the country (McEntire, 2004; Phillips, 2003) even as they too face challenges in accessing funding (Cwiak, 2014). Emergency management degree-holding has contributed to the professionalization of emergency management practice (Cwiak, 2018). Today, an estimated 46,000 students have graduated from these programs (Bennett, 2018). Their influence is reflected in practice as emergency managers have increasingly graduated from emergency management degree programs, and have some familiarity with the emergency management scholarship.

The granting of emergency management degrees, and the increase in scholars teaching emergency management, also invigorated a discussion about the emergence of an emergency management discipline. As the degree programs expanded to include several doctoral programs they produced scholars trained in emergency management research.

In the past decade, scholars determined that there was sufficient scholarship to suggest the emergence of an emergency management discipline (see further discussion in: Jensen, 2010; 2011; Klenow, 2008; McEntire, 2004). This spurred the FEMA Higher Education Program to sponsor a series of focus group meetings, which brought together the leading emergency management scholars and doctoral degree holders. Participants reached consensus on topics such as the disciplinary purview, basic research questions, and research standards. An important outcome of these focus groups was consensus on what emergency management scholars' study: "how humans and their institutions interact and cope with hazards and vulnerabilities, and resulting events and consequences" (Emergency Management Institute, 2015, p. 2).

One product of the FEMA Higher Education focus group was a summary of the primary research foci that fall within the purview of the emergency management discipline:

- *"Describe and explain variation in and patterns related to* how humans and their institutions perceive hazards, vulnerabilities, and resulting events;
- *Describe and explain variation in and patterns related to* the how humans and their institutions cope with hazards, vulnerabilities, and resulting events through tasks and activities related to preparedness, response, mitigation, and recovery;
- *Evaluation and measurement* of the degree to which humans and their institutions are prepared, have responded, have mitigated, have recovered;
- *Evaluation and measurement* of the degree to which the tasks and activities undertaken by humans and their institutions result are *effective and/or efficient*; and,

- *Evaluation and measurement* of the degree to which the tasks and activities undertaken by humans and their institutions are *adaptive* (e.g., lead to sustainability, resilience, and/or resistance).” (Emergency Management Institute, 2012, p. 4)

The group also reached consensus on the following research-related disciplinary responsibilities for emergency management:

- “Collect, analyze, integrate, synthesize literature related to hazards, vulnerabilities, and resulting events;
- Generate new knowledge through original research (i.e., basic and applied) and critical assessment of existing hazards and disaster literature; and,
- Promote the dissemination, application, and utilization of the results of original research.” (Emergency Management Institute, 2012, p. 4)

The emergence of the discipline has created a home for those who wish to study emergency management, and acts as a touchstone for the profession and others who do the work of emergency management. Importantly, the discipline of emergency management is distinct from the larger, more overarching field of disaster research. Emergency management scholars have unique responsibilities that no other academic discipline currently addresses. Further, the study of disasters remains incomplete without the efforts of emergency management scholars (Emergency Management Institute, 2012, p.3).

While these initiatives and the growing body of research are important and necessary steps, we lack a sustained funding mechanism for emergency management research. To my knowledge, there has been no comprehensive report analyzing the amount of funding specifically for emergency management research. However, in looking across the sources of disaster research funding, and the approach required to receive that funding, the barriers for emergency management scholars who wish to access these programs are apparent.

Disaster research funding has traditionally emphasized the hard sciences, specifically engineering and earth sciences, rather than the social sciences. Of course, research in these areas provides critical information that informs emergency management, but without a focus on social science research, these funding programs result in significant scholarly gaps (for a robust discussion see: Rodríguez, Wachtendorf, & Russell, 2004). While in recent years there has been a greater focus on social science research (see for example: Campbell, 2020) a negligible amount supports emergency management research specifically. When emergency management scholars are recipients of federal research dollars, it is often in the capacity as fulfilling a social science requirement for multi-disciplinary projects that focus heavily on the hard sciences. Again, while this work is important, emergency management scholars also need to do original emergency management research to be able to effectively participate in these multi- and inter-disciplinary projects.

The current lack of funding for original emergency management research (basic and applied) prohibits the advancement of the discipline and hinders our ability to better inform emergency management practice. Not knowing the answers to these questions means we may be investing resources ineffective, or at least investing in unproved strategies, that may be based on faulty

assumptions. In this way, emergency management scholars working within an emergency management framework, to answer questions relevant to emergency practice, are largely unable to utilize existing federal funding for the most pressing research questions in our discipline. The lack of funding for basic emergency management research is holding the discipline back, preventing researchers from being able to provide empirically supported advice to practitioners, or to contribute more substantively to inter-disciplinary disaster research. Those working in the discipline of emergency management are doing crucial work that no one else is doing. A research program that has specifically earmarked funding for emergency management scholars to do original research that could quickly be transitioned into practice and inform policy could lead to changes that save lives and money in the future. At the very least more social science disaster research funding is needed (Rodriguez, Wachtendorf, & Russell, 2004).

This is especially important in this moment because of the increasing interest in disaster research. Historically, individual researchers from diverse disciplines develop an interest in disaster research after large-scale or culturally important disasters (Comfort, Cigler, Waugh, 2012; Stallings, 2007). If this trend is to continue, the impending nature of climate change, societal trends, and policy choices are likely to result in continuous large-scale disasters that capture the interest and attention of more scholars across disciplines. Simultaneously, the logistical responsibility of emergency management scholars to synthesize the diverse themes and theoretical concepts produced in other disciplines will grow. This expected trend further cements our important role in the multi-disciplinary endeavor of disaster research.

Further, as there is an appropriate increase in interest among scholars in studying the consequences of climate change, and climate adaptation specifically, it would be particularly prudent to ensure that current findings of emergency management scholarship are well disseminated among academics, policymakers, and practitioners so that research efforts can be efficient and effective (see for example: Mercer, 2010).

Every year the federal government spends billions of dollars on mitigation, preparedness, response, and recovery (Currie, 2019). There is every indication that this expense will increase exponentially into the future unless urgent action is taken. We can engage in efforts to prevent these growing financial costs and minimize human suffering: climate change policy could be aggressively pursued and more could be invested in hazard mitigation (research has found that for every \$1 the federal government spends on mitigation \$6 is saved in response and recovery efforts (Multi-Hazard Mitigation Council (2019)).

Research also tells us, though, that we are not doing all that we could to effectively prepare for the response to and recovery from disasters when they do happen (see literature review: Nojang & Jensen, 2020). Further, once a disaster does happen the response and recovery do not always take an effective and efficient approach. We need more and better research on how to approach each phase more effectively, efficiently, and justly to ensure that our policy and practice recommendations are robust and well-supported by research.

We can expect the costs of disasters to continue to rise not only due to climate change inaction, but also in the absence of a concerted effort to invest in emergency management research and its implementation in policy and practice.

The Urgency of Funding Emergency Management Research

For many decades, the federal government has encouraged the development of emergency management practice. Mitigation measures have been implemented. We do more to prepare for disasters now than ever before. Our responses are often more effective and there are a number of recovery programs available for some survivors. These efforts have saved countless lives and helped communities across the country. However, emergency management needs to continue to increase across the country and the response to those needs has not always been commensurate.

Recently, there has been growing concern about the capacity of the emergency management system to meet these needs. Specifically, questions have arisen about the ability of federal programs that exist for these purposes to meet those needs.

The pandemic serves as a dramatic example of the strain felt within the emergency management system. At the beginning of the pandemic, every emergency management agency in the country, at all levels of government, activated simultaneously, for the first time in US history. Our current approach to emergency management necessitates that help will come from surrounding areas during times of crisis. The fact that each community was in the midst of their own response demonstrated a vulnerability in this system. I would like to tell you all about the effects of this simultaneous activation, but I cannot because we have not yet been able to study it in part for lack of funding.

Currently, I am serving as a Co-Lead alongside Dr. Tanya Corbin for the *Emergency Management and Policy Analysis* COVID Working Group through the CONVERGE program at the Natural Hazards Center at the University of Colorado Boulder as part of the Social Science Extreme Events Research Network funded by the National Science Foundation. This initiative seeks to advance social science, engineering, and interdisciplinary research. It is a much needed and incredibly valuable program that has brought together disaster researchers from around the world. The research agenda our team developed for this project focuses specifically on the capacity of the US emergency management community to respond to the COVID Pandemic (see the research agenda in full here: <https://converge.colorado.edu/resources/covid-19/working-groups/issues-impacts-recovery/emergency-management-and-policy-analysis-in-a-pandemic>).

Despite the federal funding, a total of \$1000, that our group received to support the compiling of the research agenda, we have yet to be able to identify federal funding whose parameters align with our research questions and theoretical framework. As a result, we have been working, unfunded, for months in an effort to study this incredibly important topic that requires the collection of perishable data, while hoping that at some point funding options become available. This is a familiar scenario to emergency management scholars and should not continue to be.

Studying the strain on our emergency management system is important not only for what it tells us about how we have managed the pandemic response, but also for what it can tell us about the near and distant future. While it may be tempting to suggest the pandemic is an outlier event, and therefore concern about the capacity of the system is exaggerated, we also have pre-pandemic evidence of this strain in the form of the 2017 hurricane season. In the wake of Hurricanes Harvey, Irma, Maria, and 2017 California wildfires, the GAO conducted a report investigating

the ability of FEMA to respond to disaster needs across the country. That report found that FEMA was understaffed by the time Hurricane Maria occurred and that many positions were staffed by employees not considered qualified by the agency (GAO, 2018).

Disasters do not happen in isolation from one another. We must address not only our nation's readiness to manage a Hurricane Harvey, Maria, or pandemic, but also our capacity to manage multiple threats at once. Can we, in the midst of a pandemic, respond to a constant barrage of hurricanes, wildfires across the west, a derecho in Iowa, the aftermath of spring tornadoes throughout the Southeast, dam failure in Michigan, a heat wave in the southwest, all while the public protests systemic racism and police brutality?

The research does not suggest that the number of disasters we now face is an outlier, but rather just the beginning of what to come as the consequences of the climate crisis begin to manifest (U.S. Global Change Research Program, 2017). Understanding the strain that emergency management is currently under can address the changes we need to make in anticipation of our increasing risk.

It is not only government that is responsible for the management of disasters. As FEMA has emphasized, emergency management requires a Whole Community approach. Unfortunately, non-governmental parts of the emergency management system are also showing signs of persistent strain. As the pandemic began our national disaster nonprofits, including groups like the American Red Cross and The Salvation Army, estimated they expected to have as much as 50% fewer volunteers than in a normal year (Montano, 2020). FEMA calls disaster volunteers the "backbone of our recovery system" so any hindrance to their involvement is of great concern. As is the case with FEMA, it is not only the pandemic that has led to concerns about the capacity of national disaster nonprofits. There is evidence dating back to 2016 that some of these organizations, at various points experienced what has been termed "volunteer fatigue" (Montano, 2017) meaning they did not have enough volunteers or funding to meet the disaster-related needs across the country.

Many people rely on these various forms of institutional support during disasters (Gould, 2014) and evidence would suggest that this support is even more necessary now. Across the country millions of people have filed for unemployment and there is an increasing demand across the country at food pantries (Arango, 2020), all while there is still no sign from Congress or the White House that another COVID relief bill will be passed. This uncertainty, and the depth and scope of need, makes it even more difficult for families to make evacuation decisions or rebuild their homes in the wake of disaster.

This all comes at a time when our risk across the country is increasing as we begin to experience the initial consequences of the climate crisis and decades of poor development decisions that have not accounted for hazard risk. To put it simply: at a time of great need the systems and organizations that might otherwise be available to help are themselves strained and overwhelmed. It is a perfect storm.

In this moment there is a desperate need to ensure that we urgently take an effective, efficient, and just approach to emergency management, which requires us to make decisions based on

empirical research. Yet, as I have discussed, this empirical research will require substantially more funding.

While the focus has reasonably been on how the pandemic affects our ability to respond to other acute disasters, it is important to remember that it also affects every other phase of emergency management. Nearly everything we do in emergency management requires people to be in close proximity to one another meaning every facet of emergency management has been affected by the pandemic. The way in which we prepare has had to change as exercises and trainings have moved online. Response efforts have changed as communities quickly rethought how to utilize virtual emergency operation centers and run shelters without starting an outbreak. Communities already undergoing disaster recovery have felt the impact as financial resources shifted and volunteer help slowed (Wagner, 2020). Across the country, as local and state governments have begun to cut their budgets, the futures of many hazard mitigation projects have been put in jeopardy (Sommer, 2020). The repercussions will continue to be felt long after the pandemic ends.

It should be of grave concern to us all, but to Congress specifically, that as we know our risk to extreme weather events and other forms of disasters is increasing, our ability to manage them is already struggling to keep up.

Conclusion

Disaster scholars and emergency management experts have long argued for changes to the federal approach to emergency management. Common recommendations include the need for comprehensive emergency management that accounts for individual and community vulnerability and takes a proactive rather than reactive approach (Tierney, 2007); adjust the proportion of preparedness funding to better support all hazards (Kaufman, 2020); and calls to restore FEMA to an independent, cabinet level agency (see for example: An Independent FEMA, 2009). While I have focused on the role of emergency management research funding, given the purview of this committee, I mention these other reforms here because to implement them successfully requires that they are driven by robust empirical research.

In 2007 disaster scholar Dr. Kathleen Tierney testified before Congress that:

“At this time, the goal of evidence-based emergency management remains elusive, but the need for objective assessments of programs and practices is clearer than ever before. Reasonable people might well wonder which emergency management practices actually achieve their intended results, where emergency management programs are falling short, and which investments are likely to bring the greatest return.” (Tierney, 2007, p. 12)

Nearly a decade later we are largely left still wondering.

I will conclude by reminding this committee that disasters are not “Acts of God”, nor are they natural. Decades of disaster research has exposed how it is the decisions that we make about where and how we live that create disasters (Kelman, 2020). The research shows us that disasters often stem from policy decisions, which indicates that different policy decisions will help minimize suffering and prevent disasters. In making those different policy decisions, we should

be guided by empirical research and support the advancement of that research through federal funding.

References

- An Independent FEMA: Restoring The Nation's Capabilities for Effective Emergency Management and Disaster Response: Hearing before the *Committee on Transportation and Infrastructure House of Representatives*, 111th Cong. 32 (2009).
- Arango, T. (2020, September 3). 'Just because I have a car doesn't mean I have enough money to buy food'. *The New York Times*. Accessed at: <https://www.nytimes.com/2020/09/03/us/food-pantries-hunger-us.html>
- Benincasa, R. (2019, March 5). Search the thousands of disaster buyouts FEMA didn't want you to see. *NPR*. Accessed at: <https://www.npr.org/2019/03/05/696995788/search-the-thousands-of-disaster-buyouts-fema-didnt-want-you-to-see>
- Bennett, D. (2018). 2018 Higher Education Emergency Management Programs: Status Update. Report for FEMA Higher Education Program. Emmitsburg, MD. Accessed at: https://training.fema.gov/hiedu/docs/latest/deedee%20bennett%20-%202018%20higher%20education%20emergency%20management%20programs%20status_final.pdf
- Bullard, R. D., & Wright, B. (Eds.). (2009). *Race, place, and environmental justice after Hurricane Katrina: Struggles to reclaim, rebuild, and revitalize New Orleans and the Gulf Coast*. Perseus Books.
- Campbell, Nnenia. 2020. *The Natural Hazards Center Quick Response Program: Compatibility with a Proposed Research Agenda for the Emergency Management Higher Education Community*. Report prepared for the Federal Emergency Management Agency Higher Education Program.
- Currie, C. (2019). FEMA has made progress, but challenges and future risks highlight imperative for further improvements. United States Government Accountability Office. Accessed at: <https://www.gao.gov/assets/700/699957.pdf>
- Comfort, L. K., Waugh, W. L., & Cigler, B. A. (2012). Emergency management research and practice in public administration: Emergence, evolution, expansion, and future directions. *Public Administration Review*, 72(4), 539-547.
- Cwiak, C. L. (2013). Increasing access and support for emergency management higher education programs. *Journal of emergency management* (Weston, Mass.), 12(5), 367-377.

- Cwiak, C. L. (2019). Framing higher education and disciplinary efforts through a professionalization lens. *Journal of emergency management (Weston, Mass.)*, 17(1), 61-66.
- Emergency Management Institute (2015). Statement of the Emergency Management Doctoral Degree Holder/ Seeker Focus Group. Accessed at: <https://training.fema.gov/hiedu/docs/emgt%20doctoral%20degree%20holder.seeker%20points%20of%20consensus.pdf>
- 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.
- Frank, T. (2020). Disaster Loans Entrench Disparities in Black Communities. *Scientific American*. Accessed at: <https://www.scientificamerican.com/article/disaster-loans-entrench-disparities-in-black-communities/>
- GAO. (2018). 2017 Hurricanes and Wildfires: Initial observations on the federal response and key recovery challenges. Accessed at: <https://www.gao.gov/assets/700/694231.pdf>
- Gould, L. A. (2014). A conceptual model of the individual and household recovery process: Examining Hurricane Sandy. Master's Thesis. North Dakota State University. Fargo, North Dakota.
- Jensen, J. (2010). Emergency management theory: Unrecognized, underused, and underdeveloped. In J. Hubbard, Integrating emergency management into higher education: Ideas, programs, and strategies (pp. 7-24). Fairfax, VA: Public Entity Risk Institute.
- Jensen, J. (2011). The argument for a disciplinary approach to emergency management higher education. In J. Hubbard, Challenges of emergency management in higher education (pp. 18-47). Fairfax, VA: Public Entity Risk Institute.
- Kaufman, L. (2020). FEMA spends more preparing for terrorism than hurricanes. *Bloomberg*. Accessed at: <https://www.bloomberg.com/news/articles/2020-08-27/hurricane-laura-fema-grants-aren-t-focused-on-climate-change>
- Kelman, I. (2020). *Disaster by Choice: How our actions turn natural hazards into catastrophes*. Oxford University Press.

Klenow, D. J. "Concepts, Frameworks, and Theory: Perspectives on the Emergency of Emergency Management Based Theory." Paper presented at the FEMA Higher Education Conference, Emmitsburg, MD, June 3, 2008.

Krueger, Jennings, Kendra 2009 - Krueger, S., Jennings, E., & Kendra, J. M. (2009). Local emergency management funding: An evaluation of county budgets. *Journal of Homeland Security and Emergency Management*, 6(1).

McEntire, D. A. (2004). The status of emergency management theory: Issues, barriers, and recommendations for improved scholarship. Paper presented at the FEMA Higher Education Conference. Emmitsburg, MD.

Mercer, J. (2010). Disaster risk reduction or climate change adaptation: are we reinventing the wheel?. *Journal of International Development: The Journal of the Development Studies Association*, 22(2), 247-264.

Montano, S. (2017). A Foundation for Factors that Explain Volunteer Engagement in Response and Recovery: The Case of Flooding in East Texas 2016. Doctoral Dissertation. North Dakota State University. Fargo, North Dakota.

Montano, S. (2020, June 18). Disaster Fatigue Is Real – and the Coronavirus Could Make It Worse. *Earther*. Accessed at: <https://earther.gizmodo.com/disaster-fatigue-is-real-and-the-coronavirus-could-make-1844079719>

Multi-Hazard Mitigation Council (2019). Natural Hazard Mitigation Saves: 2019 Report. Principal Investigator Porter, K.; Co-Principal Investigators Dash, N., Huyck, C., Santos, J., Scawthorn, C.; Investigators: Eguchi, M., Eguchi, R., Ghosh, S., Isteita, M., Mickey, K., Rashed, T., Reeder, A., Schneider, P.; and Yuan, J., Directors, MMC. Investigator Intern: Cohen-Porter, A. National Institute of Building Sciences. Washington, DC. www.nibs.org

Nojang, E.N. & Jensen, J. (2020). Conceptualizing Individual and Household Disaster Preparedness: The Perspective from Cameroon. *International Journal of Disaster Risk Science*: 1-14.

NOAA National Centers for Environmental Information (2020). U.S. Billion-Dollar Weather and Climate Disasters. Accessed at: <https://www.ncdc.noaa.gov/billions/>

Phillips, B. D. (2003). Disasters by discipline: Necessary dialogue for emergency management education. Presentation made at the Workshop "creating educational opportunities for the hazards manager of the 21st century" Denver, Colorado.

Phillips, B., Neal, D. M., & Webb, G. (2016). Introduction to emergency management. CRC Press.

Rodriguez, H., Wachtendorf, T., & Russell, C. (2004). Disaster research in the social sciences: Lessons learned, challenges, and future trajectories. Preliminary Paper #338 Newark, DE: Disaster Research Center, University of Delaware.

Rubin, C. B. (2012). *Emergency management: The American experience: 1900-2010*. Boca Raton, FL: CRC Press.

Sommer, L. (2020, June 7). California was set to spend over \$1 billion to prevent wildfires. Then came COVID-19. *NPR*. Accessed at: <https://www.npr.org/2020/06/07/867395353/california-was-set-to-spend-over-1-billion-to-prevent-wildfires-then-came-covid-?fbclid=IwAR2--EvqRGBh2Exr2Y0cv8LnUEPzTcjOPcMgSzSVnDdCgQWwdeYaKfqqedA>

Stallings, R. A. (2007). Methodological issues. In H. Rodríguez, E. Quarantelli, and R. Dynes (Eds.), *Handbook of Disaster Research* (pp. 55-82). New York: Springer Publishing.

Tierney, K. (2020). Testimony House Committee on Oversight and Government Reform. Accessed at: https://www.globalsecurity.org/security/library/congress/2007_h/070731-tierney.pdf

U.S. Global Change Research Program, 2017: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA.

Wagner, A. (2020, July 30). 'This is a yo-yo.' COVID-19 hits families still suffering from Hurricane Florence. *The News & Observer*. Accessed at: <https://www.newsobserver.com/article242434306.html>

Biography

Samantha Montano currently serve as an assistant professor in the Emergency Management program at Massachusetts Maritime Academy. She has a doctorate in emergency management from North Dakota State University, the oldest emergency management doctoral degree granting program in the country. She has over a decade of emergency management experience beginning with recovery work in post-Katrina New Orleans. Montano regularly conduct emergency management research. Her work has focused not only on publishing research in academic outlets and making presentations to the scientific community, but also on advocating for the dissemination of emergency management research findings to practice and the general public through public engagement and science communication initiatives.

Chairwoman SHERRILL. Thank you so much.

At this point we will begin our first round of questions. The Chair recognizes herself for 5 minutes.

So just to begin with, Americans, I know, are no strangers to dealing with extreme weather events, but during the current COVID-19 pandemic, it's really caused us to rethink our traditional methods of responding to disasters. In my own district we recently had a hurricane come through, and with the power outages, there was a constituent who was in the street crying really, and the mayor came up to her and said, you know, what's happening? And she said her elderly parents were stuck in their home without power. We were facing some 90-degree temperature days, and she was afraid to bring them to her home because she has teenaged children and she was afraid they would give her 90-year-old parents coronavirus.

There's also my in-laws who are in California right now facing the wildfires. I'm worried about their safety, and normally, I'd bring them over to stay with us in New Jersey, but like many families all over the country, you know, I don't think they want to get on an airplane, and I don't blame them. So these decisions aren't made lightly, and Americans are increasingly forced to decide which crisis is the one they have to respond to.

So Dr. Silver and Dr. Montano, for families and first responders, how are we working to understand the new set of challenges that come with responding to the compounding crises of extreme weather during the pandemic?

Dr. MONTANO. Thank you for that question. You know, what you described is definitely an experience that I think many families across the country right now are trying to manage. You know, everything we do in emergency management requires people to be in close proximity to one another, and that has meant that every facet of emergency management has been affected by the pandemic.

As you noted, response efforts have had to change as communities are rethinking how to utilize, you know, virtual emergency management operation centers, how to run shelters without starting an outbreak, and certainly we see that families are trying to make the best decisions they can with the resources that they have to prioritize those risks.

There are a number of researchers across the country that are working on studies looking at how these decisions are being made and what it potentially means for the future. There is a program called CONVERGE COVID-19 Working Groups that was supported by NSF through the Hazard Center at University of Colorado Boulder, and there are a number of publicly available research agendas that researchers have that are kind of in the process of seeking funding to help answer those questions.

Chairwoman SHERRILL. Thank you. And Dr. Silver, did you have anything to add?

Dr. SILVER. Just that while it's extremely important that we use science to help us make decisions, as you can imagine, we really have not been in this kind of situation before, and therefore, we are really stuck with not having adequate science to help guide us. As you correctly identified, these are competing mitigation strategies, and one needs to leave the area in which one might be threatened,

but in doing so, then one typically goes into a shelter that packs people in. So we really have not been in this situation. We are not adequately prepared. And our research now hopefully will help us when the next set of compounding crises hits us. And most scientists do say that we are in for this kind of a season of compounding crises in the future. This is the first time for our country right now, but I think that it's extremely important that we have research that will help guide us in the future as we cope and that we will be much better prepared in the future. At least that's my hope.

Chairwoman SHERRILL. Well, thank you very much. And my time is about to expire, so I will now recognize the Ranking Member of the Full Committee Mr. Lucas for 5 minutes.

Mr. LUCAS. Thank you, Madam Chairman. And Dr. Montano, I turn to you first.

Fundamentally, why do people still ignore evacuation mandates? In Oklahoma we have the National Weather Service Storm Prediction Center which is conducting research to try to increase the tornado prediction times, but even if we were to increase the warning to 45 minutes to an hour timeframe, what reasons do people have for ignoring it and staying in their vulnerable homes?

Dr. MONTANO. Thank you for that question. We have a fair amount of research on this actually across a number of disciplines that can contribute to our understanding of how people are making protective action decisions in the midst of a response.

Generally, we've pulled here from three disciplinary previews, and so we have psychologists that are contributing an understanding of how people are perceiving risk. We have communication researchers that are looking at the actual ways that people are receiving alerts through a phone or an outdoor siren, and then we have sociologists who are helping to describe the human behavioral aspects of this.

One thing that we do in emergency management is pull from across all of those different disciplines to understand how the findings of their research can help create a cohesive model for understanding those warning decisions. And what we see when we do that is that, you know, there are issues with people actually receiving warnings in terms of actually getting that alert on their phone or actually understanding how to interpret the message that has been given. We see that there may be educational issues, so they might not understand the risk and may not understand the actual actions that need to be taken.

And then kind of a third category is whether or not they actually have the resources to take action. So if you tell someone to evacuate for a hurricane but they don't have their own transportation or are unaware of public transportation opportunities, then they may not take that action. So we really need to be looking across those different disciplines and finding ways to make sure all of that is incorporated into our approach.

Mr. LUCAS. And the research you have access to, is this a problem, an issue that's in society as a whole or a part is becoming more complicated or less complicated? You know, there's a tendency out there right now to be distrustful of the government, of the internet, of everybody and everything, but a lot of these efforts rep-

resent their own best interest. We're really all together trying to help people. Do you see a change in the patterns of response by people?

Dr. MONTANO. Certainly, trust is a major factor here as well. I'm not aware off the top of my head of recent research from this year that has addressed that change. I think that it is something that several researchers are looking into, though. I'm not sure that those findings are available yet.

Mr. LUCAS. Continue with you, Doctor, you mentioned a common recommendation to restore FEMA to an independent Cabinet-level agency, and I of course understand your area of expertise is emergency management, but what role does weather prediction—and you can tell coming from the east side of the Rockies and the southern plains, I'm very sensitive about weather, too—what role does weather prediction have in our responses to emergencies? And do you believe an independent Cabinet-level NOAA would enable a more proactive rather than a reactive approach as we've been talking about here today?

Dr. MONTANO. Potentially. My focus is really on FEMA more than NOAA, so an independent Cabinet-level FEMA is definitely something that has been suggested by disaster and emergency management experts for a number of years. And certainly to the extent that NOAA is impacted by politics, we want to work against that as certainly the research, you know, brings up that issue of trust and people actually listening to those warnings.

Mr. LUCAS. One last question, and then I'll yield back the balance of my time. Along the theme of what we're talking about now, we have a variety of challenges in the country and not just new challenges. I represent a part of the world that was the abyss of the Great Depression, the dustbowl of the 1930's, which represented policy mistakes that went all the way back to the *Homestead Act of 1862*, a well-intended and it worked well in the Midwest, but different soil, different climate, different circumstances in my part of the world made for a challenge.

I guess my question to you is thinking about the issues, expand for a moment on the kind of research that's needed to ensure effective and efficient approaches. Is it sociology, is it environmental, just expand for a moment because we are the research Committee of the U.S. House.

Chairwoman SHERRILL. And if you could keep your response brief, the gentleman is out of time. Thank you.

Dr. MONTANO. Yes, definitely. Well, we need all disciplines to be involved in doing this research. Historically, there has been a greater emphasis on the physical sciences, Earth sciences. We've more recently seen more of an emphasis on social sciences, and that does need to continue. And then as I would reiterate is that emergency management research specifically does need to have that investment.

Mr. LUCAS. Thank you, Madam Chair. I yield back.

Chairwoman SHERRILL. Thank you. And I now recognize the Chairwoman of the Full Committee for 5 minutes.

Chairwoman JOHNSON. Thank you very much. I will start with Dr. Silver.

What should our research and data collection priorities be if we are to understand and address the impacts of the trauma that I spoke about in my opening statement? And who should take the lead on that data collection and research?

Dr. SILVER. Thank you very much for that question. As I mentioned, the National Science Foundation enables a mechanism unique to the Federal agencies to allow researchers to propose very quickly projects that are then funded through the RAPID mechanism. And across my career I have been fortunate to receive between 8 and 10 of those grants that enables me to start studying people at the very beginning of the crisis. And I would very much encourage any future research to be what we call longitudinal, that is, start in the immediate aftermath of a disaster and follow people over time.

What's even better, however—and this is research that I have been trying to conduct for many years—is to identify communities that are at risk of a disaster before it happens, develop research teams, interdisciplinary research teams that could be activated. We know that certain communities are going to be at risk for floods every year. We know that certain communities are going to be at risk for firestorms every year, and similarly for hurricanes. And what we can do is identify communities, enlist people to be in a research project before the disaster hits. We can understand what kind of decisions they are making prior to the disaster, what media they are listening to, whether or not they're trusting the communicator, and then once the disaster hits, we can follow people over time. And that is the best kind of research that we can do on these crises.

One other very, very important message is that we must conduct methodologically rigorous research that is using the best samples, using what the scientists—the scientists to help us identify the best samples so that we can make recommendations based on truly representative samples of people across the country that can help us in the future.

Chairwoman JOHNSON. Thank you very much. Any other witnesses want to add to that?

OK. Environmental and health research within the Federal Government is typically siloed with NIH usually conducting health research and science agencies such as NSF, DOE (Department of Energy), NOAA, and EPA (Environmental Protection Agency) conducting environmental and social science research. When it comes to diseases, climate change, and extreme weather, there is much overlap between public and environmental health, especially in the social science domain. Thus, interdisciplinary research and funding mechanisms are needed.

So I'd like each of the witnesses to comment. In your work, are there sufficient funding mechanisms for research in this interdisciplinary space and how Federal agencies breakdown disciplinary silos to obtain a stronger understanding of social and institutional dynamics following extreme weather events?

Dr. SILVER. I'd like to take that question first if you don't mind, and I'm going to use the example of the September 11 terrorist attacks. Unfortunately, because there were very few mechanisms to get funding shortly after the September 11 attacks, my colleagues

and I remarkably were the only team that obtained funding from the National Science Foundation within days of the 9/11 attacks and were able to follow several thousand people for several years, many years in which we could look at the impact of the 9/11 attacks on both physical and mental health.

The challenge has been getting the funding out quickly, and at this point, almost none—in fact, perhaps only one piece—research project that I've conducted in over 40 years has been funded by the NIH (National Institutes of Health) because there has not been a mechanism to get the funding out to me quick enough to be able to do my research.

The National Science Foundation in contrast has specifically developed a mechanism. It used to be called something different than it is now, which is now called RAPID and which was implemented very quickly. Their mechanism was implemented very quickly after COVID. Over 900 proposals were funded via the RAPID mechanism through the National Science Foundation. But the NIH did not have that flexibility, that ability to speedily get funding out to researchers, and this is a very, very serious problem.

Chairwoman SHERRILL. Thank you. The gentlewoman's time is expired. Thank you, Madam Chairwoman.

I now recognize Representative Babin for 5 minutes.

Mr. BABIN. OK. Thank you. Thank you very much, Madam Chair. I want to thank you and as well as our witnesses today.

I have the great honor of representing southeast Texas, which unfortunately has been the center of devastating floods that seem to come annually now. Three years ago, Hurricane Harvey dumped the single largest amount of rainfall in the recorded history of our country in my district. Since then, we have had several hurricanes and tropical storms that leave much of southeast Texas under water. This sort of reoccurring devastation not only upends the lives of thousands but has enormous implications on our Federal budget. These disasters every year leave the taxpayers responsible for the colossal bills that are needed for our recovery. Investing money in mitigation efforts is an incredibly wise investment and will save billions of dollars every year in damages.

So my question to Dr. Silver and Dr. Montano, since Hurricane Harvey, there has been an effort to promote resilience to help communities be better prepared for future extreme weather events. So I want to ask both of you, to what degree should the Federal Government be involved, and how much responsibility should the States have in these projects? And what is needed to rebuild even faster than what we're seeing? Thank you.

Dr. MONTANO. Thank you. I will take that question first. I have experience doing research in southeast Texas, so I'm well familiar with the particular challenges of those communities. What we're seeing in multiple places around the country but specifically southeast Texas is that the next disaster is happening before people can get through recovery, and some folks are really stuck in this cycle of recovery where they can't rebuild before the next disaster comes.

When we look at our approach to recovery in the United States, [inaudible] limited intervention model. The government is intentionally limited in their involvement. And folks are reliant on their own resources, on insurance, and also the nonprofit sector.

As I mentioned in my opening testimony, there are signs from the nonprofit sector that they are feeling overwhelmed and are unable to meet all of the needs across the country. We—and we see that people don't have—

Chairwoman SHERRILL. [inaudible]. I'm sorry. Just one moment. We're getting just a little bit of feedback, so if you're not speaking, can you mute your mic? Thanks.

Dr. MONTANO. So we are seeing that folks don't necessarily have their own resources to be able to go through the recovery process, which is suggesting that there is perhaps a larger role for government here. And when we look at those recovery programs through FEMA, through HUD (Department of Housing and Urban Development), that operate at that—for the purpose of rebuilding individual homes, we see that people very often tend to navigate those programs. They can be very complex. They take a long time. There are issues with the speed of dealing with insurance companies in the National Flood Insurance Program.

So I would say overarchingly to create a more efficient recovery process, we need to be doing more to streamline those individual and household recovery programs, but also we need to make sure that when people are going through recovery, they are integrating mitigation efforts into that. There needs to be, you know, a speedier process for buyout programs, a speedier grant process for lifting homes up, and of course, ideally, we would be doing those mitigation efforts before the disaster even happens. But to the extent that we can incorporate that into recovery, certainly research supports that that is the best approach.

Dr. SILVER. I'd just like to take 1 minute to talk about the important role of trust, which has been raised previously. Most individuals trust their local governments or their local policymakers, and I think that that—people are looking to make decisions about whether or not they're going to [inaudible] emergency management teams.

So I think it's very important whatever might happen at the Federal level, we need to make sure that local emergency management personnel are getting the best recommendations, are getting the best information, they're receiving it quickly. And I know that, for example, during the pandemic, this is a big challenge of getting the correct information out to the local governments so that they can then deliver that content to their residents because, ultimately, it's about trust. And if people don't trust the communications and they don't trust the communicator, it doesn't matter really what science tells us.

Mr. BABIN. Absolutely. Thank you all both very much. And with that I will yield back, Madam Chair.

Chairwoman SHERRILL. Mr. Babin yields back. And now I recognize Representative Bonamici for 5 minutes.

Ms. BONAMICI. Thank you so much, Chair Sherrill and Ranking Member Marshall, and thank you to our witnesses.

I don't know if Mr. Lucas is still in the hearing, but I do recall having many conversations about the value of social science research when we worked together on the weather *Research and Forecasting Innovation Act*. It's so critical.

So I represent a district in Oregon. My home State has seen wildfires at unprecedented rates this year. Nearly a million acres have already burned in the past month as a result of historic winds and dry fuel conditions. For comparison, on average, approximately 500,000 acres burn each year during an entire fire season over the last 10 years. And, unfortunately, we've had air quality that has surpassed hazardous levels. That further endangers the health and livelihoods of those already at risk from respiratory issues from coronavirus. It was also incredibly stressful. A lot of people were relieving their stress during the pandemic with a walk through the neighborhood or the park, and they could not go out.

Many Oregonians have been placed under evacuation orders, hundreds have lost homes. We're very grateful to the State and Federal agencies that have made lifesaving measures a priority, but the road to recovery is going to be long, and it's going to be challenging. Many experts are predicting significant flooding and landslides this winter as precipitation increases, the soil conditions remain unstable.

The compounding crises were not unexpected. In fact, in April I joined with my colleague on this Committee Congressman Jerry McNerney from California in calling on FEMA to develop disaster preparation and recovery plans that reflect the challenges of the ongoing pandemic during natural disasters. And I've also joined my colleagues in calling on the White House Coronavirus Task Force to take proactive steps to protect firefighters from contracting COVID-19.

So I wanted to ask, Dr. Montano, in your testimony you noted that disasters do not happen in isolation from one another, and we're certainly seeing that now. Which emergency management research gaps are the most important to address to improve preparedness for these compounding crises within the next decade?

Dr. MONTANO. Well, there are a lot of research gaps in emergency management. You know, when we talk about the research that needs to be done, there is some really basic research that we have not had the opportunity yet to do. As a discipline, emergency management is relatively young. There are relatively few emergency management researchers across the country, and so we have significant gaps.

In terms of prioritizing those gaps, certainly looking at what we can do to more effectively prepare. Historically, we've had a relatively narrow idea of what preparedness is. We're focused on individual go-bags, individual plans, but really when we think about disasters, they require this community response, which suggests that there's much more that we could be doing in terms of community preparedness, so really studying what the most effective and most efficient changes that we can make to our approach to preparedness is something that is critical for us in emergency management research.

Ms. BONAMICI. And I don't want to cut you off but I want to get another question in, and I am going to ask to follow up on the record with some specific recommendations about that, the research gaps.

So we know that disasters often exacerbate inequities for our frontline and vulnerable communities, especially low-income com-

munities and communities of color. We have seen that with the pandemic. So I recently joined my colleagues on the Select Committee on the Climate Crisis in releasing a climate action plan that supports community-led, voluntary just and planned transitions from the riskiest flood- and wildfire-prone areas. Our plan will help provide communities with information on future climate risk, technical assistance to communities to help them plan ahead, and also funding to help those who are ready to move to safer ground.

So, Dr. Montano, what steps can Congress take now to support proactive rather than reactive emergency management? And how can those efforts best support our environmental justice communities?

Dr. MONTANO. You know, one issue that we have across the country is that many communities only have a part-time emergency manager who kind of doubles as the fire chief. Some communities even have a volunteer emergency manager. So we really need to invest in the emergency management system at that local and State level. And I think that there is potentially a place for Federal funding to help fulfill those positions, which would really grow that capacity at that local level, which would also provide much more of an opportunity for those marginalized groups to be involved in those planning efforts.

Ms. BONAMICI. And that would be a very good investment. I think about Seaside, Oregon, and the district I represent. It took them years to get the resources to move their schools where their young children are learning out of the tsunami inundation zone, again, a good investment to make sure these communities can plan.

And I see my time is expired. I yield back. Thank you, Madam Chair.

Chairwoman SHERRILL. Thank you, Representative Bonamici.

Next, I recognize Representative Casten for 5 minutes.

Mr. CASTEN. Thank you, Madam Chair, and thank you to our speakers.

Dr. Montano, I want to start with a—sort of a selfishly personal question if you'll allow me. I'm new to this line of work. I spent 16 years as a CEO (chief executive officer). And one of the—sort of the things that they beat into you whether in, you know, in business school or then when you get PR (public relations) consultants, as the leader of an organization in a crisis, No. 1, you have to be enormously transparent about what you know and what you don't know; No. 2, that as you develop plans to deal with the crisis to be very clear about how you develop that plan because as information is always changing and people are nervous, it's important for them to understand your thought process as much as what the information is so that when new information comes in and the plan changes, they don't get nervous. And then last, just to massively overcommunicate because otherwise the rumor mill takes over.

My sort of selfish question is, given your expertise, would you amend that plan for those of us in public service, or is that still basically the right way for us to be dealing with these sorts of crises as we speak to our constituents and beyond?

Dr. MONTANO. Yes, absolutely. The research certainly suggests what you explained, that, you know, trust, clear communication, excessive transparency is a good approach in the midst of a re-

sponse to a disaster. Sometimes we see politicians hesitate to be forthright with what is happening during a crisis because they are concerned with creating some kind of panic among the public. In fact, we have research dating back almost 7 decades that supports that people don't panic during disasters, that actually that information is useful for them and leads to them being able to be an active participant in that response and make those really effective decisions for themselves and their families. So certainly, yes, transparency with communication is the right approach.

Mr. CASTEN. So my second question and—is that the—it strikes me that politicians are generally good at doing that for crises that are right on top of us. When the hurricane is bearing down on the coast and you've got to tell people to put up sandbags or get out of the way, we do a good job.

It strikes me that we have done a completely horrible job of dealing with that with COVID. That's a slow-moving crisis, which is only—which I guess is—only looks good relative to climate change that's somewhat slower moving. And too many folks in our line of work are just outwardly lying. Should we adopt a different approach for slower-moving crises?

Dr. MONTANO. I'm not familiar with any research that would suggest any kind of different approach. I think, again, being honest with the public about what the risks are is the best approach. Again, it's about empowering the public to be active participants in that response. And when you tell people that everything is fine and they look out the window and see that the sky is not the normal color, you know, there is going to be extended trust issues that extend past just that disaster.

Mr. CASTEN. Well, so I guess my last question—and I I don't know if this is best for you or Dr. Silver—but you've confirmed my own preconceived biases, which is helpful. But if we're not doing a good job of communicating, if we're telling people that you can ignore climate change because it's not real until it's a hurricane bearing down on your house, if we're telling people that COVID is going to magically go away until your loved ones in nursing homes are dying and you can't visit them, what kind of stresses does that—in other words, what are the consequences of us failing to follow these strategies and how people behave?

And, you know, Dr. Silver, your research on how that stresses people out, what does that do to people when we—instead of empowering them to lead, we pile that stress on top of them?

Dr. SILVER. Well, one of the things that we're seeing now with COVID-19 in particular is conflicting information. It's—we are hearing and individuals are hearing one message from perhaps one set of leaders, another message from another set of leaders. There's a lot of controversy being communicated via some public health individuals that may be politically driven. This becomes a real challenge. And we found in our research that we just published last week in *Science Advances* that when people hear a lot of conflicting information, that does exacerbate stress. That does increase the likelihood that people are going to exhibit depressive symptoms. So it's not just hearing message A. It's hearing message A and message negative A. These are the big challenges for us because it's very difficult to know who to believe because we see, unfortunately,

people are choosing different sources, and that leads [inaudible] and the challenges that we—that are exacerbated right now.

Mr. CASTEN. Thank you. I'm out of time and I yield back, but here's hoping we can all take some of your wisdom and take it forward as we lead our own constituencies. Thank you. I yield back.

Chairwoman SHERRILL. Thank you, Representative Casten.

I now recognize Representative Beyer for 5 minutes.

Mr. BEYER. Madam Chair, thank you very much. This has been really fascinating to listen to. And if you forgive me, I just want to emphasize the link between income and wealth inequality and the vulnerability to extreme weather events, which I think you point out again. I just think the worst Virginia disaster in our lives was Hurricane Camille in 1969. We lost 153 people in a couple of hours. It was mountain slides and flash floods, 21 members of the Huffman family. And it was all relatively poor or low-income people living in very fragile homes that were washed away.

Every time I see a tornado on the TV, the people killed seem to be the ones in mobile home parks. When floods kill people, they tend to be living in flood zones down along the river. Even earthquakes, it's the lower home values. You know, we had—was it 2009 we had Haiti that killed all those people as their homes just collapsed? A few years later we had a six-point-something Richter scale in Virginia that didn't injure a single person because of the difference in construction.

So it's our commitment to economic growth for everyone, overcoming the systemic racism that's shown up in 10 and 12 time multiples for the net worth between an average White family and a Black family or a White family and a Latinx family, that economic justice and environmental justice are basically the same thing.

Dr. Silver, in your study on the Ebola pandemic in 2014 you talk—you noted that people who consumed more media about the crisis were more afraid of contracting Ebola even though the risk is relatively low. How do we interpret that in the context of COVID-19 when we want people to know that social distancing, mask wearing, don't go inside a restaurant, all these things are so important in balancing that with the fear of contracting the virus?

Dr. SILVER. So you raise an extremely important point, which is that the media is a double-edged sword. It helps us communicate the protective actions that people can take. It's a very important way to get information out. But at the same time we know that many media outlets want to keep viewers—keep people watching, and the stories that they are telling are all bad news all the time. So what we're talking about in terms of media exposure is media about bad—you know, bad news, sad stories, graphic images, which we haven't seen, fortunately, with COVID.

But we did find in our paper that just came out that in fact the more media people were watching in—or engaged with either in traditional media or social media in the days after COVID began really hitting the news waves in the United States, the more media people were watching, the more stress they were reporting, the more depressive symptoms they were reporting. So if we were only delivering content that was providing information about health protective behaviors, that would be one thing. But, as you know, the media is filled with all sorts of other conflicting messages and con-

troversies, and so it's not as simple as just saying we understand that the media can be good. It's a double-edged sword.

Mr. BEYER. Dr. Montano, let me pile on with that, too, because, as Dr. Silver had mentioned, we've had tripling of people diagnosed with depression, anxiety, a frightening statistic that a quarter of young people 18 to 29 have had suicide ideation since the beginning of this. How do we better communicate the need to get out of dodge before the volcano blows or before the hurricane hits or to take protective actions and not push people into these depressive states?

Dr. MONTANO. You know, one thing that I think is really important here is making sure people have the needed resources to actually protect themselves. When we look at some of the research post-disaster, we see increases of domestic violence, we see increased stress, we see an increase in suicide rates. And much of that seems to be tied to the actual stress of the post-recovery community and not having access to resources, not having access to jobs.

So the things that we do in emergency management ahead of time in preparedness to ready our communities to better withstand these disasters I think could have a benefit on that—on those mental health repercussions in the aftermath.

Mr. BEYER. Thank you very much. Madam Chair, I yield back.

Chairwoman SHERRILL. Thank you. And at this time I'd like to open it up for any Members who would like another opportunity to ask questions. Does anyone have any further questions?

Mr. BEYER. I love the idea—

Chairwoman SHERRILL. [inaudible] I'd like to recognize Representative Beyer for 5 minutes.

Mr. BEYER. Thank you. Thank you, Madam Chair. I think, Dr. Montano, it was your notion that we need to make FEMA an independent agency and give it Cabinet-level status. Can you expand on that a little?

Dr. MONTANO. Certainly. So prior to 9/11 FEMA was a Cabinet-level independent agency. This afforded them a number of useful things, namely a direct line to the President when a disaster did happen, and a greater stature among the other Federal agencies that are of course very important to much of what we do in emergency management.

Post 9/11, as DHS (Department of Homeland Security) was proposed and created, FEMA was incorporated under the Department. At the time there were former heads of FEMA, James Lee Witt, and other disaster researchers who warned that doing so could inhibit FEMA from meeting the needs across the country.

Since that time, though, however, FEMA has stayed put, and there have been times where there were potential concerns about how well the Administrator of FEMA was able to connect with the President and the White House and just the overarching role and responsibility of FEMA within this huge department.

So moving forward, as we think about changes post-COVID to our emergency management approach, to our public health approach, I do think that perhaps it might be wise to reconsider this idea of FEMA being an independent Cabinet-level agency again.

Mr. BEYER. Thank you very much. I yield back, Madam Chair.

Chairwoman SHERRILL. Thank you. And do we have any further questions?

Well, before we bring the hearing to a close, I want to thank our witnesses for testifying before the Committee today. The record will remain open for 2 weeks for additional statements from the Members and for any additional questions the Committee may ask of the witnesses.

The witnesses are excused, and the hearing is now adjourned.
[Whereupon, at 12:47 p.m., the Subcommittee was adjourned.]

Appendix I

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

*Responses by Dr. Roxane Cohen Silver***Questions for the Record**

Roxane Cohen Silver, Ph.D.

Professor of Psychological Science, Public Health, and Medicine
University of California, Irvine

U.S. HOUSE OF REPRESENTATIVES

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

Hearing on "Coping with Compound Crises: Extreme Weather, Social Injustice,
and a Global Pandemic"**Submitted by Chairwoman Eddie Bernice Johnson**

1. Environmental and health research within the federal government is typically siloed, with NIH usually conducting health research, and science agencies such as NSF, DOE, NOAA and EPA conducting environmental and social science research. When it comes to diseases, climate change, and extreme weather, there is much overlap between public and environmental health, especially in the social science domain. Thus, interdisciplinary research and funding mechanisms are needed.

a. What areas of convergence between public and environmental health do you see as ripe for federal investment in research and development?

b. Why is it important for social and behavioral scientists to be included in these interdisciplinary research efforts in the design, funding, and execution phases, and how is this relevant in planning for climate-driven emergencies as well as pandemic response?

ANSWER:

a. This is an extremely important issue. As we have seen in the United States in 2020, it is impossible to disentangle the social, psychological, and health effects of disaster cascades.

I would like to highlight a particular example in my own community in California, which this Fall has been confronted with a series of wildfires exacerbated by heat, dry conditions, and extreme winds. But the issues I raise are equally relevant in communities across the U.S. that have been repeatedly at risk for – or exposed to -- hurricanes, tornadoes, or floods.

In 2020, the confluence of crises in communities at risk for climate-related disasters has created a tragic situation where thousands of people are suddenly asked to evacuate to shelters, potentially imperiling themselves and others to COVID-19. This is an understudied topic, the shape of which will undoubtedly repeat itself even after the current pandemic is over. Thus, risk information about the climate-related disaster must be compiled by scientists and communicated by emergency managers and policymakers. Evacuation routes must be identified by transportation engineers. Risk information must be processed by individuals, often during a rapidly moving crisis characterized by a great deal of uncertainty. Vulnerable populations such as low income, disabled, or elderly individuals may be unable – or unwilling -- to follow directives. Thus, complex behavioral decisions are being made by individuals under extreme stress, with both short- and long-term public health consequences.

Research that addresses any one of these pieces in isolation will miss the fact that this is a complex social system, with rapidly moving parts that are potentially influenced by political considerations and competing agendas. These questions are best addressed by social and behavioral scientists (social psychologists, decision scientists, political scientists, health psychologists), working together with media scholars, civil and environmental engineers, transportation scientists, and community members, to tackle complex problems. Research must involve interdisciplinary teams, each bringing their own disciplinary perspectives and expertise. Artificial disciplinary divisions cannot address the real-world complexity rigorously or efficiently.

b. Scholars often approach research questions from perspectives with which they are most comfortable and familiar. But as described above, from a solitary disciplinary lens, individuals may not see the elephant in their midst. Consider an approaching hurricane. Meteorologists and wind engineers may be trying to estimate the storm's path, time and place of arrival, amount of rain and potential for flooding, and wind speed. Once they make those estimates, their best guess, usually filled with uncertainty, must be communicated to political decision-makers and the media. But that scientific uncertainty must *also* be communicated to the population at large, who will be influenced by a variety of factors (including their own prior experiences with hurricanes, trust in the messenger, or chronic stressors that may be otherwise capturing their attention) when deciding whether to evacuate their homes. Indeed, there is a science behind risk communication. Then, following the storm, engineers will analyze building data and work to develop structures that can withstand future storms. A myriad of social psychological factors will also influence whether individuals will rebuild their homes in at-risk communities in the future. I maintain that the issues on which behavioral scientists focus is as important as the work of the meteorologists and engineers in mitigating the economic and public health disaster of the annual hurricane season. In fact, the integration of these disciplines will undoubtedly lead to the best outcomes.

We can apply the same sort of analysis to the pandemic. Since it began, biomedical science has focused on the ways in which the virus is transmitted, the ways in which the virus attacks the organs, isolating individuals at greatest health risk, and developing and testing a vaccine. But that is only part of the equation. The public must engage in health-protective behaviors, including frequent hand washing, physical distancing, wearing face coverings, and avoiding crowds. Moreover, these health-protective behaviors must be encouraged with messaging that conveys clearly and consistently the costs and benefits of actions that can ensure the physical and mental health of oneself and one's community. Similarly, an effective vaccine is only useful if a population trusts its safety, understands its side-effects, and follows the instructions (e.g., obtain two doses with several weeks between administrations). These are the questions that are addressed by social and behavioral scientists. Thus, research by social and behavioral scientists can provide a roadmap for public officials to ensure their residents' cooperation, trust in, and implementation of what is learned from biomedical science.

In sum, these are complex questions that are difficult to tackle without large teams with varying expertise. These teams also require adequate funding, training, and flexibility – perhaps identified and put in place in *advance* of a disaster, ready to activate when a crisis hits. It is critical that social and behavioral scientists be involved at the start of the design of projects that address these complex issues and are seen as important partners as these

large projects are rolled out. This would ensure that the right kinds of questions, methods, and samples are included from the start.

2. The NSF RAPID grant program is one of the only federal programs that supports quick-response research on urgent, unanticipated events, such as natural or anthropogenic disasters. When these unexpected events occur, it is essential that research begin immediately to understand short-term impacts, and receive sustained funding in order to understand long-term impacts.

a. How can funding mechanisms like NSF RAPID grants be strengthened to allow social scientists to be on the ground collecting data as soon as possible after disasters? Is there need for additional quick-response funding opportunities, and if so, what should they be, and what gaps in research could be filled by such programs?

b. How can we improve data collection for post-disaster and emergency management research? Why is this data so vital to decision-making?

ANSWER:

a. Funding mechanisms such as NSF RAPID grants are absolutely critical to enable nimble research teams to design and mobilize quickly to address urgent time-sensitive topics such as rapidly unfolding natural disasters, infectious diseases, or social movements – all of which converged in 2020 to create a perfect storm of tragedy and adversity in the U.S. No other federal funding mechanism currently exists to tackle such topics, particularly when data are ephemeral. Moreover, if researchers do not mobilize quickly, data will be permanently unavailable and critical questions left unanswered. However, as currently configured, there are questions of relevance to social and behavioral science that can fall between the cracks of the NSF and other funders, such as the National Institutes of Health. It would be extremely useful to expand such funding opportunities to enable joint collaborations between funders, such as NSF, NIH, DOE, NOAA, and EPA. Combining resources would tackle two goals at once – enlarging the pot of money available and facilitating interdisciplinary teams to examine these complex questions quickly.

b. We can improve data collection for post-disaster and emergency management research by 1) collecting data *before* the disaster (to study decisions making and risk communication as it unfolds in real time), 2) stand up teams of researchers in advance of a disaster so that they are available and ready to mobilize quickly, 3) provide funding to encourage collaboration between researchers and end users of this research (e.g., emergency managers, political leaders), and 4) provide funding for repositories that can collect and aggregate historical data that can help inform research on future disasters as society prepares for the inevitable future threats to our health and well-being.

Responses by Dr. Samantha Montano

U.S. HOUSE OF REPRESENTATIVES COMMITTEE ON SCIENCE, SPACE, AND
TECHNOLOGY

“Coping with Compound Crises: Extreme Weather, Social Injustice, and a Global Pandemic”

Submitted by Chairwoman Eddie Bernice Johnson

Questions for the Record:

Dr. Samantha L. Montano

Assistant Professor of Emergency Management

1. Environmental and health research within the federal government is typically siloed, with NIH usually conducting health research, and science agencies such as NSF, DOE, NOAA and EPA conducting environmental and social science research. When it comes to diseases, climate change, and extreme weather, there is much overlap between public and environmental health, especially in the social science domain. Thus, interdisciplinary research and funding mechanisms are needed.
 - A. In your work, are there sufficient funding mechanisms for research in this interdisciplinary space? How can Federal agencies break down disciplinary siloes to obtain a stronger understanding of social and institutional dynamics following extreme weather events?**

It is difficult to say the extent to which funding for environmental and social science research is insufficient. To my knowledge, there has not been a comprehensive assessment of funding for disaster research broadly, and emergency management research specifically. In the absence of such an accounting I can only rely on my personal experience and the experience of colleagues who have consistently face substantial challenges in finding federal funding for emergency management research.

One challenge in particular is the specificity of grants. Grants are generally written for more established disciplines and do not allow for the flexibility that disaster research often requires. This is a particular challenge for emergency management researchers as a newer discipline. The lack of emergency management specific grants results in scholars being ineligible for many grants even when they have a disaster focus. It would be helpful for federal agencies to have a wider scope of eligibility and funding mechanisms that offer sustained funding specifically for emergency management research.

One specific problem is that there is not a pool of research that is funding basic emergency management research in the social sciences. Funding in specific departments are focused on their own departmental missions. The dissemination of disaster and emergency management research findings is complicated and hinders both researchers and practitioners from implementation and building off their work. Federal disaster research funding is spread out across federal agencies making it difficult for scholars to find funding opportunities and makes it difficult for the findings of that research to make their way to both academics & practitioners.

B. What areas of convergence between public and environmental health do you see as ripe for federal investment in research and development?

As an emergency management researcher, not a public or environmental health researcher, I do not feel I am the appropriate person to answer this question.

2. The NSF RAPID grant program is one of the only federal programs that supports quick-response research on urgent, unanticipated events, such as natural or anthropogenic disasters. When these unexpected events occur, it is essential that research begin immediately to understand short-term impacts, and receive sustained funding in order to understand long-term impacts.

A. How can funding mechanisms like NSF RAPID grants be strengthened to allow social scientists to be on the ground collecting data as soon as possible after disasters? Is there need for additional quick-response funding opportunities, and if so, what should they be, and what gaps in research could be filled by such programs?

A significant portion of disaster responses are spontaneous in nature and rely on substantial improvisation among response groups and agencies. It is difficult for emergency management scholars to adequately understand these emergent responses in the aftermath of disaster as much of the data is perishable. Historically, disaster researchers have found great success in being able to quickly receive funding to go to the site of disasters as the response is still unfolding to make first-hand observations and collect this perishable data (see for example the work of the Disaster Research Center at the University of Delaware).

NSF RAPID grants are useful in providing research finding in the aftermath of specific events but they are not activated quickly enough to get researchers on the ground during the actual response (i.e., when life-saving measures are being undertaken). The current RAPID grants are structured to really only allow researchers to retroactively study the response and study the recovery. While valuable, there is still a window of time during which perishable data is regularly lost. One solution to this would be developing a pre-approved RAPID grants program. Disaster researchers could have a standing approval for RAPID funding and be able to deploy to disaster sites in under 24 hours notice. It would also be useful to have RAPID grants that are specifically earmarked for emergency management research and scholarship so that we could develop our knowledge of emergency management response.

B. How can we improve data collection for post-disaster and emergency management research? Why is this data so vital to decision-making?

Emergency management scholars have long discussed the benefit of a national database of disaster data (e.g., death tolls, damages, policies, volunteer numbers, nonprofit involvement). Various government agencies already collect some of this information but collection methods are inconsistent. Further, it is often difficult to know which agencies have collected data and much is not made publicly available. Data collected by independent and private entities is also done in a piecemeal way and largely depends on individual researchers having the resources and interest to study a given event. Further, we need research that is not simply a case study of a specific event that produces “lessons learned” but rather empirical research that crosses events. It is particularly important that we have longitudinal data.

Further, funding and interest in disaster research tends to skew towards the largest disasters leaving many smaller events (which make up most of what emergency management responds to) understudied. This makes it particularly difficult to study disaster trends overtime. A central, open-sourced database with standards for data collection across all events would help to create a baseline understanding of these events and influence decision-making across sectors. In the absence of consistent data collection and open-sourced access researchers and policymakers are having to make decisions using partial data sets.

Appendix II

ADDITIONAL MATERIAL FOR THE RECORD

LETTER SUBMITTED BY REPRESENTATIVE MIKIE SHERRILL

**Letter of Support from
Dr. Kristina Dahl, Senior Climate Scientist
Union of Concerned Scientists**

"Coping with Compound Crises: Extreme Weather, Social Injustice, and a Global Pandemic"

House Science Committee

September 30, 2020

I am a senior climate scientist at the Union of Concerned Scientists, and I appreciate the opportunity to provide support to today's hearing.

For decades—if not longer—people in the United States have found themselves on one side or another of a widening equity chasm.¹ The vast majority of people are on the side of that chasm that is also crumbling beneath our feet, yet somehow the chasm remains invisible in the list of the nation's priorities. But sometimes there are events that lay our vulnerability so bare, so crystal clear that they serve as clarion calls for change. Just as Hurricanes Katrina, Harvey, and Maria were before it, the COVID-19 pandemic is such an event.

The United States currently finds itself at the intersection of several inextricably entwined crises: a centuries-old crisis of systemic racism, a climate crisis with its origins in the Industrial Revolution, and a pandemic. This moment feels—and may actually be—unprecedented. Research by my colleagues at UCS and me has shown, however, that communities will increasingly find themselves coping with simultaneous crises as climate change progresses. Limiting future harm, particularly to low-income communities and communities of color, will require bold action and a strong commitment to establishing a more just nation for all its inhabitants.

Climate change fuels extreme weather

During the first six months of 2020, as thousands were losing their lives and millions more losing their jobs to COVID-19 and the resulting shutdown of the US economy, the nation also endured 10 climate-related disasters with losses of more than \$1 billion each. These disasters included hail storms in the Ohio Valley and South Texas, extreme rainfall and severe weather in the Carolinas and Georgia, and tornadoes in the Southeastern US.² By August, two hurricanes, widespread wildfires across the West, and a derecho brought the tally up to at least 14 so-called "billion dollar disasters," each of which unfolded as communities across the country faced a surge in COVID-19 cases.³

¹ <https://www.npr.org/2019/09/26/764654623/u-s-income-inequality-worsens-widening-to-a-new-gap>

² <https://www.ncdc.noaa.gov/billions/>

³ <https://weather.com/storms/severe/news/2020-09-17-billion-dollar-weather-disasters-august-us>

Hurricanes, wildfires, heavy downpours, and other types of severe weather have always been a part of our climate. But climate change is increasing the frequency and severity of many types of extreme weather events and will continue to do so as heat-trapping emissions from the burning of fossil fuels continue to accumulate in our atmosphere. Below is a brief summary of the ways in which climate change is already amplifying the severity of extreme weather events.

Hurricanes and climate change

If the past five hurricane seasons have taught us anything, it is that hurricanes are becoming stronger, wetter, slower, and more destructive.⁴ Each of these trends has been linked to human-caused climate change. Since the late 1970s, global warming has increased the likelihood of a given tropical cyclone becoming a Category 3-5 (the strongest three categories of storms) by roughly 8 percent per decade. The rapid intensification of hurricanes we witnessed as Harvey (2017), Michael (2018), Lorenzo (2019), and Laura (2020) approached landfall has also been made more likely as a result of climate change.⁵ Meanwhile, sea level rise and a warmer atmosphere have enabled storms to reach farther inland and produce more rainfall.⁶

The 2020 hurricane season has been demonstrative of theoretical trends scientists have long identified as being hallmarks of a warming climate. Hurricane Laura, which made landfall near Lake Charles, Louisiana, for example, transformed from a Category 1 storm to a Category 4 storm within 24 hours, a rapid intensification that was made more likely by a warmer climate.⁷ The phenomenon of rapid intensification is difficult for forecasters to predict. And as the likelihood that tropical cyclones will reach Category 3 or higher grows, so does the destructive potential of those storms.

Wildfires and climate change

This year's wildfire season in the western US has been record-breaking as well as heartbreaking. As of mid-September, there were more than 50 major wildfires burning across California, Oregon, and Washington. Wildfires in the three states have burned more than 4 million acres of land—an area larger than the state of Connecticut.⁸ With 2.5 million acres having burned in California alone, this year's fires have been the most extensive on record for the state. Four of the five largest fires in the state's history have burned just since August, and all five of those largest fires have occurred in the last three years.⁹ The currently-burning August Complex fire

⁴ <https://blog.ucsusa.org/astrid-caldas/highlights-firsts-and-worsts-of-hurricane-season-2019-and-the-future-of-hurricanes>

<https://rd.springer.com/article/10.1007/s00382-013-1713-0>

<https://www.nature.com/articles/s41586-018-0673-2>

<https://www.nature.com/articles/s41612-019-0074-8>

<https://www.pnas.org/content/116/48/23942>

⁵ <https://www.nature.com/articles/s41467-019-08471-z.pdf>

⁶ <https://nar.ucar.edu/2019/mmm/climate-change-impacts-tropical-cyclones>

⁷ <https://www.washingtonpost.com/climate-environment/2020/08/27/hurricane-laura-rapid-intensification/>

⁸ <https://www.nifc.gov/fireInfo/nfn.htm>

⁹ <https://www.nifc.gov/fireInfo/nfn.htm>

https://www.fire.ca.gov/media/11416/top20_acres.pdf

sits in the #1 slot for the largest California fire on record with more than 400,000 acres more burned area than #2 (2018's Mendocino Complex fire). In Oregon, wildfires have destroyed five small towns, threatened or forced evacuation for half a million people, encroached on Portland's suburbs, and caused a record number of wildfire-related deaths for the state.^{10,11} Tens of millions of people have been living with wildfire smoke for weeks. In the Bay Area alone, experts estimate that the prolonged exposure to smoke is responsible for as many as 3,000 indirect deaths.¹²

Globally and for the western US, wildfire trends are very clear (Figure 1). Whether measuring by the length of the fire season,¹³ the area burned,¹⁴ the number of large fires,¹⁵ or a variety of other metrics, it is clear that wildfire activity has been increasing since the 1980s.

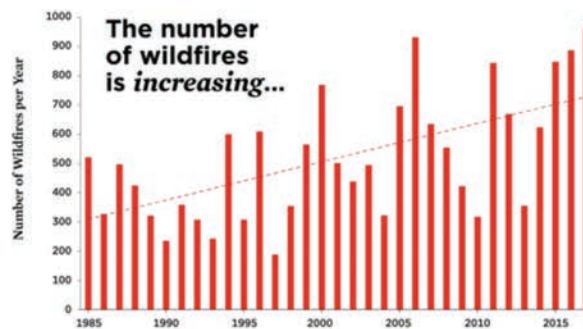


Figure 1 Data from the Monitoring Trends in Burn Severity program show that the number of wildfires in the United States has increased since the 1980s. MTBS only includes large fires in the United States (>500 acres for the eastern US, >1000 acres for the west). Prescribed fires removed.¹⁶

There are many factors that contribute to overall wildfire risk, some climate-related (such as temperature, drought, soil moisture) and others not (such as vegetation type, human development in the wildland-urban interface, and fire suppression practices). Because of the range of variables involved in determining wildfire risk, attributing trends in wildfire activity to human-caused climate change is more difficult than for other types of extreme events such as

¹⁰ <https://www.reuters.com/article/us-usa-wildfires/explosive-western-u-s-wildfires-threaten-oregon-towns-idUSKBN260361>

¹¹ <https://www.oregonlive.com/news/2020/09/oregon-said-500000-people-have-been-evacuated-because-of-wildfires-the-numbers-dont-add-up.html>

¹² <https://www.sfchronicle.com/california-wildfires/article/Hidden-cost-of-wildfire-smoke-Stanford-15595754.php>

¹³ <https://www.nature.com/articles/ncomms8537>

¹⁴ <http://www.pnas.org/content/113/42/11770>

¹⁵ <https://science2017.globalchange.gov/chapter/8/>

¹⁶ <https://www.mtbs.gov/>

heat waves or coastal flooding.¹⁷ Yet the fingerprints of climate change on wildfire are increasingly clear.¹⁸

Recent studies have attributed over half of the recent trends in the aridity of wildfire fuels and forest fire areas directly to climate factors. In particular, warming temperatures—particularly in spring and summer—earlier snowmelt, and drying soil are contributing to heightened wildfire risk across the western US.^{19,20}

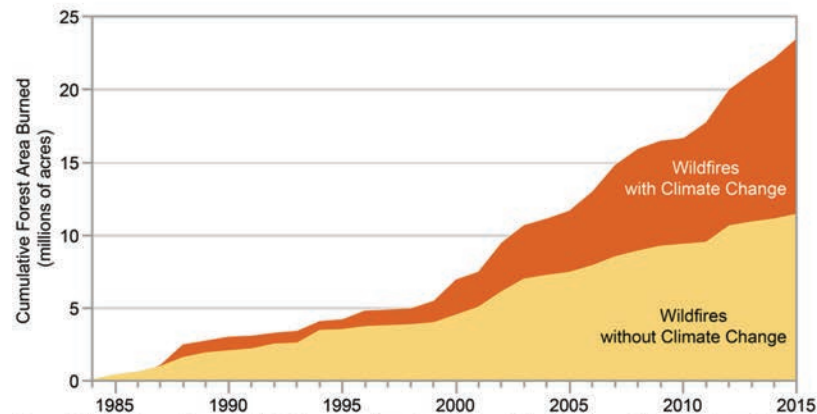


Figure 2 Studies have determined that the area of western US forests that has burned since 1984 was twice as large as it would have been without climate change.²¹

Extreme heat and climate change

On track to be the first or second warmest on record, 2020 has been the latest step in the globe's long march toward an increasingly inhospitable climate.^{22,23} A growing body of work attributes both the trends in extreme heat as well as specific extreme heat events to the influence of anthropogenic greenhouse gas emissions (Diffenbaugh and Scherer 2013, Knutson

¹⁷ <https://www.ucsusa.org/sites/default/files/attach/2018/06/The-Science-Connecting-Extreme-Weather-to-Climate-Change.pdf>

¹⁸ <https://www.ucsusa.org/resources/climate-change-and-wildfires>

¹⁹ <http://www.pnas.org/content/113/42/11770.short>

²⁰ https://www.ucsusa.org/global_warming/science_and_impacts/impacts/climate-change-development-patterns-wildfire-costs.html#.W2nxT2gvybg

²¹ https://nca2018.globalchange.gov/downloads/NCA4_Report-in-Brief.pdf (Figure 25.4).

²² <https://www.noaa.gov/news/2019-was-2nd-hottest-year-on-record-for-earth-say-noaa-nasa>

²³ <https://www.noaa.gov/news/northern-hemisphere-just-had-its-hottest-summer-on-record>

et al 2013, Knutson and Ploshay 2016).^{24,25,26} As heat-trapping gases like carbon dioxide continue to accumulate in the atmosphere, extreme heat is projected to become more frequent and more severe for all parts of the country (e.g. Wuebbles et al 2014, Vose et al 2017).^{27,28}

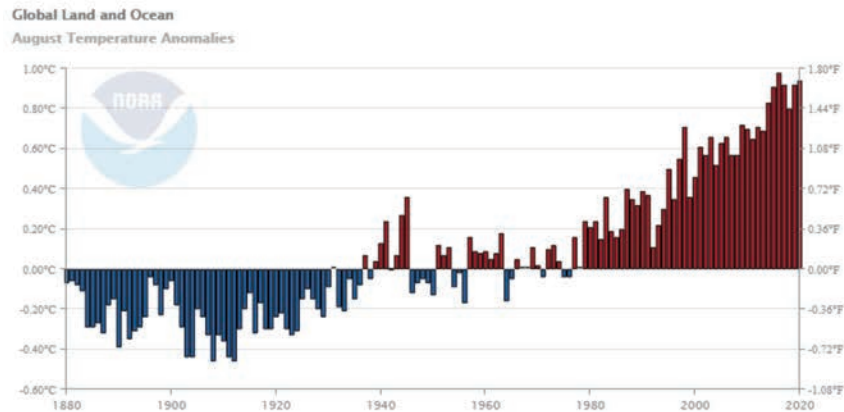


Figure 3 NOAA records show that globally averaged August temperatures have risen by nearly 1.8°F since 1880, with much of the increase occurring since the middle of the 20th century.²⁹

Extreme heat is one of the most fatal natural hazards in the US and poses grave risks to human health.³⁰ Due to underlying physiology, groups such as children, the elderly, and people with preexisting conditions or physical/mental disabilities, and people are particularly susceptible to heat-related illness. People who lack access to cooling or the ability to pay for it are also susceptible to heat-related illness.³¹ Occupationally, people employed in low-wage, outdoor occupations such as farmworkers, construction, or landscaping are also highly susceptible to heat-related illness.

²⁴ <https://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-13-00085.1>

²⁵ <https://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-13-00085.1>

²⁶ <https://link.springer.com/article/10.1007%2Fs10584-016-1708-z>

²⁷ <https://journals.ametsoc.org/bams/article/95/4/571/89716>

²⁸ <https://science2017.globalchange.gov/chapter/6/>

²⁹ <https://www.ncdc.noaa.gov/sotc/global/202008>

³⁰ <https://www.weather.gov/hazstat/>

³¹ <https://oxford.universitypressscholarship.com/view/10.1093/oso/9780190886455.001.0001/oso-9780190886455-chapter-2>

Research by my colleagues and me shows that the frequency of and population exposure to extreme heat conditions in the US will increase substantially by mid-21st century under a range of emissions and population change scenarios. By late century, depending on the scenario, these changes amount to a 4- to 20-fold increase in person-days per year of extreme heat conditions from 107 million historically to as high as 2 billion.

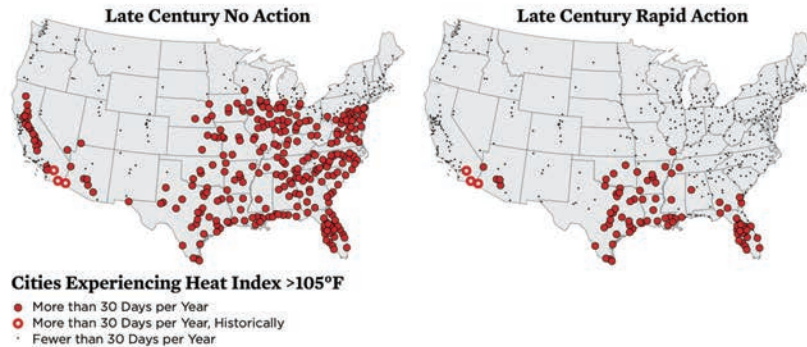


Figure 4 Historically, only three cities in the United States have experienced 30 or more days per year with a heat index (or “feels like” temperature) above 105°F. With no action to reduce global heat-trapping emissions, 292 cities would experience such frequent, intense heat by late century (left). In contrast, rapid action to reduce global emissions and hold future warming to 2°C or less would limit the number of cities experiencing such heat annually to just 85 (right).³²

Extreme precipitation, flooding, and climate change

Climate change is also making heavy rain heavier and more frequent in many areas of the country. With human alteration of the land—like the engineering of rivers, the destruction of natural protective systems, increased construction on floodplains, and increased area of impermeable surface—many parts of the United States are at greater risk of experiencing destructive and costly floods.

Across the United States, increasingly frequent heavy rain since the late 1950s is one of the clearest signals of a changing climate. The regions experiencing increases in extreme precipitation generally align well with those experiencing increases in flood frequency. Studies of precipitation extremes around the globe have found that human-caused warming is playing a role in driving increasingly heavy downpours.³³

³² <https://www.ucsusa.org/sites/default/files/attach/2019/07/killer-heat-analysis-full-report.pdf>

³³ http://iacweb.ethz.ch/staff/fischer/download/etc/fischer_knutti_15.pdf

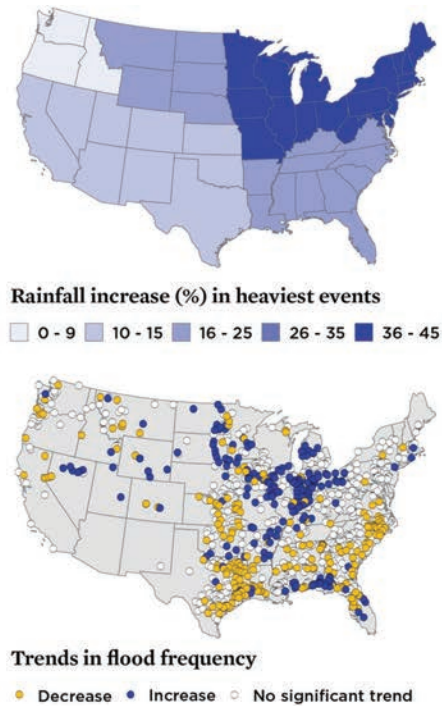


Figure 5 Top: Percent increase in the amount of rain falling during the top 1% of events per region between 1958 and 2016. Bottom: Trends in the number of days per year above the National Weather Service minor flood threshold based on daily gauge height data measurements from the US Geological Survey from 1985-2015.^{34,35}

Widespread and long-lasting flooding across the Midwest US during the spring of 2019 exemplifies the trend toward heavier rainfall and increasingly frequent flooding.³⁶ The spring's record-breaking flooding washed out roads and bridges in many places, sometimes for days on end. In Nebraska alone, the flooding caused an estimated \$100 million in damage to the state's highway system.³⁷ Widespread agricultural losses—from being unable to plant crops to losing

³⁴ <https://science2017.globalchange.gov/>

³⁵ <https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1002/2016GL071199>

³⁶ https://www.washingtonpost.com/nation/2019/05/10/really-genuinely-scary-torrential-rain-houston-strands-cars-leaves-thousands-without-power/?utm_term=.9612e14621c9

³⁷ <https://dot.nebraska.gov/news-media/nebraska-flood-2019/>

them before they could be harvested—financially crushed the region’s farmers and their communities.³⁸

Increases in extreme precipitation frequency and intensity are projected to continue across much of the United States over the 21st century, particularly in the northern and midwestern regions (Easterling et al. 2017; IPCC 2012), with important regional and seasonal differences.^{39,40} Precipitation intensity is projected to increase in the Northeast and Southeast in most seasons, while a decrease is expected over the Southwest (Wang and Kotamarthi 2015). The projected changes in precipitation suggest that flooding will also increase in frequency and intensity.⁴¹

The disproportionate impacts of climate-related disasters

Black, Brown, Indigenous, and low-income communities are disproportionately affected by climate-related extreme events. In some cases, these communities are more *exposed* to climate threats. In others, lack of access to personal and/or governmental relief resources leaves these communities more *vulnerable* to climate threats.

Both extreme heat and flooding often disproportionately expose low-income communities and communities of color. Extreme heat is amplified in high-density urban areas that are home to greater percentages of people of color. In such environments, where pavement, concrete, and other manmade materials absorb heat during the day and radiate it back out into the city at night, residents are more exposed to extreme heat. Similarly, housing in flood-prone places is often more affordable precisely because of the risk of inundation. It follows that people whose financial opportunities have been limited disproportionately live in such places.

The inequitable distribution of resources both before and after natural disasters leaves communities of color more vulnerable to climate threats. In the wake of disasters, relief and recovery measures lag for Black, Latinx, and low-income people.⁴² Recent research suggests that federal financial aid after natural disasters is not equitably distributed among communities and may even exacerbate income inequality.^{43,44} Low-income communities and communities of color consequently struggle to prepare in advance of and recover in the wake of natural disasters.^{45,46}

³⁸ <https://blog.ucsusa.org/juan-declet-barreto/record-2019-precipitation-in-midwest-financially-crushed-farmers>

³⁹ <https://science2017.globalchange.gov/chapter/7/>

⁴⁰ <https://archive.ipcc.ch/report/srex/>

⁴¹ <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2015EF000304>

⁴² <https://www.npr.org/2019/03/05/700289776/minorities-likely-to-receive-less-disaster-aid-than-white-americans>

⁴³ <https://www.tandfonline.com/doi/full/10.1080/17477891.2019.1675578>

⁴⁴ <https://academic.oup.com/socpro/article/66/3/448/5074453>

⁴⁵ <https://www.ucsusa.org/sites/default/files/attach/2015/11/surviving-and-thriving-full-report.pdf>

⁴⁶ <https://www.sciencedirect.com/science/article/abs/pii/S0143622810000548>

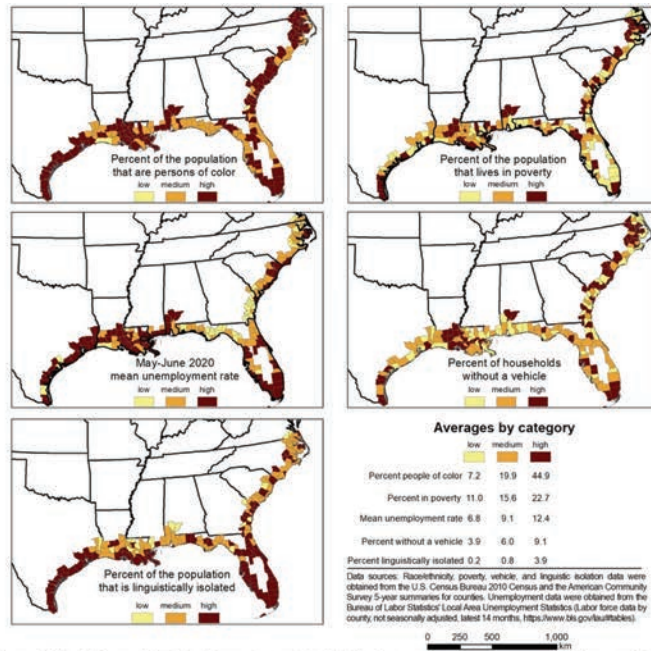


Figure 6 The US counties that have the potential to be exposed to storm surge from a Category 5 hurricane are home to many socioeconomically vulnerable people, including people of color, those struggling with poverty or unemployment, those who lack a vehicle that could be used for evacuation, and those who are linguistically isolated. Maps courtesy of Juan Declet-Barreto.⁴⁷

The disproportionate impacts of COVID-19

The same conditions that have left to communities of color more exposed and vulnerable to climate-related disasters have caused the same communities to be more exposed and vulnerable to COVID-19. As a result, disproportionately high numbers of Black, Latinx and Indigenous people have contracted COVID-19, died from it, or seen their financial security evaporate in the associated economic fallout.

Many people of color have been disproportionately *exposed* to COVID-19 as a result of the types of jobs that have been available to them throughout their lives. A mass testing study conducted in San Francisco early this summer found that Latinx people who were considered

⁴⁷ <https://blog.ucsf.edu/juan-declet-barreto/hurricane-laura-and-the-inequities-of-evacuating-to-safety>

essential workers were much more likely to have had COVID-19 than their counterparts who were able to work from home.⁴⁸ Similar outcomes were found in a ZIP-code level study of COVID-19 cases in New York City.⁴⁹ From these studies, it's clear that people who live in more crowded conditions and/or those who have been unable to work from home have disproportionately contracted the virus. The same is true for agricultural workers and low-wage workers in the nation's poultry plants, two groups of workers predominantly composed of people of color.^{50,51}

Centuries of preventing or undermining the ability of people of color to access quality education and jobs, health care, healthy foods, clean air, and other basic necessities has resulted in a greater incidence of preexisting health conditions that heighten vulnerability to COVID-19.

On the whole, Black and Hispanic people in the U.S. have relatively high rates of underlying health conditions, such as hypertension, obesity, and diabetes, which the CDC lists as risk factors for severe COVID-19 illness.^{52,53} These same groups have lower rates of health insurance than Whites, which translates to having less preventative care and, in the long-term, potentially poorer health outcomes that increase risk to falling ill to COVID-19.^{54,55} Finally, non-White groups in the US tend to have higher exposure to air pollution from industrial or vehicular sources.^{56,57} Recent research has shown that the COVID-19 death rate is higher in counties with certain types of air pollution.⁵⁸

The consequences of this heightened exposure and vulnerability have been devastating for the communities of color in the United States. Over the course of the pandemic so far:

- Black and Latinx people have been three times as likely as their White peers to contract COVID-19.⁵⁹
- The incidence rate of COVID-19 among American Indian and Alaska Native people has been 3.5 times that of White people.⁶⁰

⁴⁸ <https://www.sfchronicle.com/bayarea/article/Coronavirus-testing-in-SF-s-Mission-district-15246512.php>

⁴⁹ <https://furmancenter.org/thestoop/entry/covid-19-cases-in-new-york-city-a-neighborhood-level-analysis>

⁵⁰ <https://blog.ucsusa.org/rebecca-boehm/with-trump-executive-order-are-meat-and-poultry-plants-a-covid-19-ticking-time-bomb>

⁵¹ <https://www.npr.org/2020/09/07/909314223/farm-workers-face-double-threat-wildfire-smoke-and-covid-19>

⁵² <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5673593/>

⁵³ <https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/groups-at-higher-risk.html>

⁵⁴ <https://www.kff.org/disparities-policy/issue-brief/changes-in-health-coverage-by-race-and-ethnicity-since-the-aca-2010-2018/>

⁵⁵ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2881446/>

⁵⁶ https://www.epa.gov/sites/production/files/2016-11/documents/mohai_presentation-national_tri-oct162016.pdf

⁵⁷ <https://blog.ucsusa.org/dave-reichmuth/air-pollution-from-cars-trucks-and-buses-in-the-u-s-everyone-is-exposed-but-the-burdens-are-not-equally-shared>

⁵⁸ <https://projects.iq.harvard.edu/covid-pm>

⁵⁹ <https://www.nytimes.com/interactive/2020/07/05/us/coronavirus-latino-african-americans-cdc-data.html>

⁶⁰ <https://www.cdc.gov/mmwr/volumes/69/wr/mm6934e1.htm>

- Black people have been twice as likely as White people to die from COVID-19.⁶¹
- Black and Latinx employment fell by 16 and 18%, respectively, whereas White employment fell by only 11%.⁶²

The underlying cause that runs through these issues and has let them build up to these devastating consequences is racism, plain and simple.

Compounding crises

With event after devastating event, the COVID-19 pandemic has exposed how nascent and limited our understanding of compound climate events has been to date. Just in the last six weeks, the US has witnessed the intersection of heat waves, power outages, and a hurricane (during Hurricane Laura in Louisiana), as well as the intersection of heat waves, power outages, wildfires, and extremely unhealthy air (during California's record-breaking wildfires season). As the frequency and intensity of climate-related disasters grows, so, too, will the likelihood that these disasters overlap with one another and strain our infrastructure past critical breaking points.

To date, however, there has been little to no research into how climate-related extremes might intersect with a pandemic.⁶³ Nonetheless, 70% of the world's weather-related disasters in 2020 have intersected with the COVID-19 pandemic and more than 50 million people worldwide—including many in the United States—have been directly affected by that intersection.⁶⁴ With mass evacuations likely to cause the number of COVID-19 cases to rise,⁶⁵ evacuees from this year's hurricanes, wildfires, and floods had to try to keep themselves safe from the virus while evacuating. Texas and Louisiana offered evacuees from Hurricane Laura vouchers so they could stay in hotels rather than in shelters, though a similarly planned program to do the same was scrapped in Florida.⁶⁶ As thousands evacuated their homes during recent wildfires in California, fear of contracting COVID-19 in public shelters led some to simply sleep in their cars instead.⁶⁷

A climate-resilient future necessitates fighting for a racially just future

Our ability to rise to the complex challenges presented by future climate extremes will be defined by how well we equitably equip people with the basic tools that ensure their safety tools such as access to and the ability to pay for air conditioning; equal access to preventative health care; and a guarantee that we are all doing our best to keep one another healthy.

⁶¹ <https://rhg.com/research/a-just-green-recovery/>

⁶² <https://rhg.com/research/a-just-green-recovery/>

⁶³ <https://nca2018.globalchange.gov/chapter/17/>

⁶⁴ <https://media.ifrc.org/ifrc/wp-content/uploads/sites/5/2020/09/Extreme-weather-events-and-COVID-19-V4.pdf>

⁶⁵ <https://www.medrxiv.org/content/10.1101/2020.08.07.20170555v1>

⁶⁶ <https://blog.ucsusa.org/kristy-dahl/as-hurricane-laura-bears-down-on-gulf-coast-data-shows-how-covid-19-may-affect-evacuations>

⁶⁷ <https://www.sfchronicle.com/california-wildfires/article/Fire-evacuees-during-pandemic-steer-clear-of-15501184.php>

Like the nation's scattershot approach to COVID-19 safety measures across the country, the chronic discounting of the health, lives, and safety of Black and Latino people in the face of climate extremes demonstrates the extent to which our country's White majority has kept these basic tools out of the reach of people of color. In the absence of sufficient federal and state guidance, materials, and direct support, individuals are forced to be on the right side of impossible choices: to evacuate to a public shelter when a wildfire approaches despite the risk of contracting a deadly virus; to move away from a flood-prone home and community without the guarantee of finding work in a new place because of the color of one's skin; to continue to show up to harvest grapes in a field cloaked in wildfire smoke because doing otherwise would mean not having enough to eat. As we speed toward a future where record-breaking heat waves, larger and more intense wildfires, more powerful hurricanes, and unprecedented levels of rain become the norm, we must do better.

We can't fix the climate crisis—or any other major societal problem—if we don't build justice and equity into our solutions from the outset. Addressing the cumulative burden of toxic and harmful pollution in overburdened communities and ensuring that these communities benefit directly and equitably from investments in clean energy must be part of the climate justice agenda, as detailed in the Just and Equitable National Climate Platform.⁶⁸ Developed by environmental justice advocates and national environmental organizations, the platform advances the goals of economic, racial, climate, and environmental justice to improve the public health and well-being of all communities, while tackling the climate crisis. Communities need safe, affordable housing, adequate nutrition, good jobs, and affordable healthcare, and our nation must address long-standing racial and socioeconomic inequities, to ensure that all can thrive in a low-carbon climate-resilient future. That's why UCS supports the Transform, Heal, and Renew by Investing in a Vibrant Economy (THRIVE) Agenda and the Environmental Justice for All Act.^{69,70}

A fair clean energy transition must also center the needs of working people—powerfully detailed in the BlueGreen Alliance's *Solidarity for Climate Action Platform* and the National Economic Transition Platform.^{71,72} The *Solidarity for Climate Action Platform* was developed by the BlueGreen Alliance and its labor and environmental partners to help address the dual crises of climate change and increasing economic inequality, and advance solutions that put working people front and center.

As with the global COVID-19 pandemic, solutions for climate change have to scale up from the local to the global. Our ability to solve these complex interdependent challenges depends on working in cooperation with other countries and multilateral institutions such as the World Health Organization and the United Nations Framework Convention on Climate Change. To

⁶⁸ <https://ajustclimate.org/>

⁶⁹ H. Res. 1102. <https://www.congress.gov/bills/116/congress/house-resolutions/1102/text>

⁷⁰ H. R. 5986. <https://www.congress.gov/bills/116/congress/house-bills/5986/text>

⁷¹ <https://www.bluegreenalliance.org/work-issue/solidarity-for-climate-action/>

⁷² <https://nationaleconomictransition.org/>

minimize the threat of future compound climate hazards, the United States must work with nations around the world to decarbonize the global economy and aim to reduce global carbon emissions to net zero by 2050.^{73,74} A swift, just, and equitable clean energy transition can drive tremendous economic and public health benefits, especially for communities that are overburdened by pollution and face dire economic challenges today.

The events of this year, from the 200,000 US lives lost to the COVID-19 pandemic to the millions of acres of land that has burned, have exposed how decades of disinvestment have left our most vulnerable people and most treasured environments with little hope of successfully coping with disasters. The science tells us that the events we've witnessed this year are not a new normal. Rather, they represent a step along the trajectory of steadily worsening disasters we have put in motion by our dependence on fossil fuels. The protests that have erupted across the country in response to police killings of Black people are not a new normal, either, but represent a step along our country's trajectory toward a society that rights the inequalities of the past and recognizes the value of Black and Brown people. The federal government has a unique role to play in determining the shape of these trajectories in the years ahead, and the choices we make now will shape the lives of people in the United States for generations to come. We must rise to this occasion and work collectively toward a safe, climate-resilient future for all.

Thank you,

Kristina Dahl

⁷³ Intergovernmental Panel on Climate Change (IPCC). 2018. Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emissions pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.

⁷⁴ In model pathways with no or limited overshoot of 1.5°C, global net anthropogenic CO₂ emissions decline by about 45% from 2010 levels by 2030, reaching net zero around 2050.