

The COVID-19 Pandemic: Implications for Critical Infrastructure

Editor's Interview with Stephen E. Flynn,
Founding Director, Northeastern University
Global Resilience Institute



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Stephen Flynn directs Northeastern University's Global Resilience Institute (GRI) in Boston. GRI has emerged as an influential center of CI research, including its stewardship of a worldwide consortium of research institutions dedicated to CI scholarship and impact. He is a Professor of Political Science with affiliated faculty appointments in the College of Engineering and the School of Public Policy and Urban Affairs. Dr. Flynn previously served as President of the Center for National Policy and spent a decade as a senior fellow for National Security Studies at the Council on Foreign Relations. He was an active duty commissioned officer in the US Coast Guard for twenty years, including two tours as commanding officer at sea. He is co-author of the textbook *Critical Infrastructures Resilience: Policy and Engineering Principles* (2018), and author of *The Edge of Disaster: Rebuilding a Resilient Nation* (Random House, 2007) and the national bestseller *America the Vulnerable* (Harper-Collins 2004). He was interviewed by JCIP Editor Richard Krieg in mid-March 2020.

Krieg As we speak, Steve, the COVID-19 pandemic is primed to impact critical infrastructures across the world. What are your general observations and thoughts about US infrastructure operation and resilience during this outbreak?

Flynn First off, we need to sort through the second- and third-order effects of restricting public movement and asking many people to shelter in place.

When it comes to operating, maintaining, and repairing critical infrastructure, not all the important work can be done remotely. How will these systems be able to continue reliable operations when onsite work is necessary? What happens when essential personnel become sick? It is important that every individual who has a crucial function have a trained substitute to step in if that person is unable to report to work. One contingency might be to reach out to recent retirees and reintegrate them into the workforce for the duration of the pandemic. Also, companies should consider transitioning into very small groups or modular-type teams within operation or command centers. This would better facilitate allowing workers to maintain the recommended six-foot physical distancing from each other while overseeing critical functions. In short, public and private sector owners of critical infrastructure must ensure they have realistic contingency plans in place so that essential workers are available to operate infrastructure, while doing all that can be done to safeguard their health and well-being in the context of this rapidly unfolding pandemic.

Krieg In 2014, *Politico* published an article by you titled “All Ebola is Local.” The piece was prescient on a number of counts—not least of which were targeted recommendations that you made to prepare the nation for deadly disease outbreaks. The article emphasized the importance of local capabilities in epidemic response. How do you relate that to COVID-19?

Flynn Well, it remains very much the case that all the real capacity for controlling a disease outbreak—both preventing the spread as well as managing the early response when people become sick—has to be done at the local community-, neighborhood-, and household-levels. Yet, most of the focus for managing COVID-19 thus far has been on the federal efforts to confront the outbreak. While national leadership is important, it should be primarily directed at elevating local capacity to include providing individuals and households guidance and support on how they can stay safe and help others to stay safe. What we know is that when it comes to public health capacity at the local level, we’re starting from a very weak foundation. In many states and cities, public health budgets have been underfunded for years, the available public laboratory capability to conduct medical tests is minimal, and there is only nominal surge capacity for providing protective gear and emergency healthcare. In the face of this pandemic, we’ll need to engage in a warlike mobilization effort to build local capacity. This will require looking beyond the public sector to corporate leaders, universities, community foundations, and others who can marshal all the capabilities of civil society to contribute to the effort. Additionally, it is essential to develop creative and compelling ways to get life-saving prevention information out to public. It will take an “all-hands” effort at the individual-, household-, and neighborhood-levels to both contain the outbreak, as well

as meet the needs of vulnerable populations who are required to shelter in place.

Krieg You're quite right—beyond elementary messaging, federal agencies haven't yet produced nor effectively disseminated public service announcements to prevent COVID-19 infection. These need to be sufficiently detailed to provide actionable information on a range of decisions that people will need to make. I've heard that you've been doing some innovative work on that front.

Flynn Let's acknowledge something strange about the crisis we are facing. While we are drowning in news about the coronavirus, it is really difficult to find a single source of accurate information about what we should be doing at the individual, household, or neighborhood scale to lend a hand. At the Global Resilience Institute, we recognized that it is critical to fix that. So we have developed a short online "COVID-19 How to Be Safe" course with nine sub-modules that provides very specific authoritative "how to" skills that we all should be mastering at the individual-, household-, neighborhood-, and community-levels. We also provide guidance on how to stay socially connected while maintaining safe physical distancing. This module intends to cut through all the noise and provide the signal all of us need to get smart and to take actions that can reduce anxiety and save lives.

By making this short course widely available, we are trying to leverage the fact that virtually every university and college has been moving towards remote or online teaching as a modality for maintaining their educational functions through the outbreak period. We have encouraged professors and teachers to include the link to this course as a part of their online classes. Our hope is that students will not only learn this critical information, but interact with one another to reinforce it, and even take on a leadership role in passing along these skills to family members, friends, and neighbors. Young people are likely to stay healthier through this particular pandemic, so working to inform and empower them should be a no-brainer.

Beyond making this online module available to universities, colleges, and public schools to use as part of their online education, we are also sharing it with companies and corporations. Our hope is that they will share it with their employees who are working remotely.

"COVID-19 How to Be Safe" is publicly available at the website we established in response to COVID-19: *resilience-ed.org*.

Krieg All hazards planning in the context of a pandemic should identify potentially serious "single point failures" within individual CI sectors or cross-sector functions, especially in interdependent sectors. How can this be achieved, and what is the import for future CI and pandemic planning?

Flynn What's a clear and present global repercussion of the COVID-19 pandemic is its impact on supply chains. Key assets and elements of any manufacturing process—including those that we need in this health emergency—often are produced by just a few companies in a small number of locations. Mapping out where supplies come from and devising contingencies should those sources be disrupted is something that companies ideally would routinely be doing. Unfortunately, many have not and are now discovering their critical dependencies only after shortages are occurring in real time.

One of the key elements of anticipating points of failure is learning from failure. Complex interdependent systems are very difficult to model in advance. But when they fail, we have a window of opportunity to essentially reverse engineer the failure and identify where the actual critical points of failure were. This can then inform follow-on investments in mitigation and recovery efforts. So whenever disasters happen, including COVID-19, we should make sure to collect the data in real time about cascading failures. This will support postmortems that can enhance resilience going forward. COVID-19 is not going to be the only pandemic that we will be facing in the years ahead. Learning from the failures we experience is key to getting better at mitigating the cascading failures flowing from something as disruptive as a pandemic.

Network science models have great potential to enhance our understanding of how complex interdependent systems will behave under stress. But the effectiveness of these models depends on the data that feeds them. This translates into the need for a high degree of collaboration between public and private sector infrastructure owners and operators and researchers. One barrier to this kind of collaboration is that governments and companies are uncomfortable sharing data because of security and competitiveness concerns. However, data can be sanitized when creating realistic models. Once the systems are modeled, it is then possible to better understand how they will perform when disrupted and develop optimal responses by conducting simulations. Researchers and practitioners can then work together on developing applications and guidance for operations that will mitigate the risk of future cascading failures.

Krieg One of GRI's Distinguished Senior Fellows, Vilas Mujumdar, has been a proponent of convergence research—what is it, and how does it apply to building critical resilience in the context of pandemics?

Flynn Convergence research really goes to the heart of the how best to devise effective solutions and quickly advance them into wide use in order to effectively deal with emerging risks like pandemics. It starts with the premise that you need to move beyond multidisciplinary work to transdisciplinary research. Multidisciplinary research typically involves a division-of-la-

bor approach where experts from different disciplines are each assigned a specific problem to solve and then the answers are bundled together as a solution. An economist may tackle one piece, a chemist another, and an engineer yet another. Transdisciplinary research differs from this because it brings together experts from multiple disciplines to look at a common problem as a collaborative team, leveraging the insights of their distinct disciplines to devise the solution. Convergence research takes this work a step further by working with practitioners as well. The research is done as fieldwork, with the direct involvement of communities, policymakers, and private sector leaders. The goal is to quickly validate the research question as a real challenge and ideally to speed the discovery of workable solutions by getting near real-time feedback from practitioners. A core objective here is to compress the period of time it takes to go from basic research to developing and deploying an urgently needed application for wide use. The growing requirements of grappling with climate change and other disruptive events—including the COVID-19 pandemic—make clear the need to accelerate the speed at which we develop best practices and scale them.

Krieg Yes, across multiple projects, GRI has demonstrated that the cycle between applied research and common use can be accelerated. One reason is that you've built an extraordinarily productive ecosystem to understand and improve CI resilience. While I know you've developed specific tools to zero in on solutions and accelerate their application, can you give me a sense of your typical trajectory in engaging communities to do that?

Flynn I think the key effort here is the fieldwork—the need to get into the real world with tools that we've developed and to test them in as near to real time as we can. And then to take the feedback that generates to innovate as quickly as possible—to ideally find a solution set that can be widely applied. One way we have done this at the Global Resilience Institute is to act on my longstanding contention that “a disaster is a terrible thing to waste.” That is, disasters provide an extraordinary opportunity for learning—but also importantly an opportunity to deploy innovations as a part of investing in recovery. It is the height of negligence to not be injecting best practices into recovery efforts. What we must do is strive to bounce forward as opposed to bouncing back. At the Institute, we have been mobilizing distinguished practitioners to join with researchers in investigating major disasters several weeks after they occur to identify lessons learned and to provide advisory support to community leaders overseeing the recovery.

The second area we've been focusing on is how to embed resilience best practices into investment in community economic development. Each year, the federal government provides a tremendous amount of resourc-

es helping communities to build infrastructure and to undertake projects that will bolster their prosperity. Historically, these publicly funded investments have not incorporated a consideration of resilience when these projects are developed. They also are often undertaken in a piecemeal and uneven way depending on the availability of sector-specific funding, such as housing, transport, or energy grants. At the Global Resilience Institute, we have devised an assessment tool that allows us to go into a community and provide a baseline on where that community stands with respect to a dozen key resilience indicators. This allows us to then evaluate that community's economic development plan and provide guidance on how the community can adapt that plan to best achieve long-term resilience and sustainability outcomes. The value of that to the community is that it can open up access to a growing amount of funding by the federal government that is increasingly stipulating that applications must incorporate resilience into the project design.

Our long-term goal is for regional and urban planners and economic development agencies to prioritize resilience as integral to their work. One way to accomplish this is to require a formal community resilience assessment as a prerequisite to undertaking a publicly funded project.

Krieg Countries across the world are grappling with critical infrastructure protection and resilience—and the word “Global” in your organization’s name is no misnomer. Please comment on the scope and scale of your Global Resilience Research Network. What are the Network’s primary benefits?

Flynn At the outset, when we launched the Global Resilience Institute at Northeastern University, we realized that, at best, we would be contributing a drop in the bucket towards the overall global need. And given the urgency of the resilience imperative, right away we began reaching out to other research universities and institutes internationally who also were wrestling in some way with resilience issues. What we have been working to advance is transdisciplinary collaborative research across multiple institutions and geographies. Today we have thirty-seven universities and research institutes from eighteen countries around the world involved in our Global Resilience Research Network. In this way, we are both harnessing expertise that can be found in all corners of the globe and very importantly accelerating the speed at which our solutions will be quickly adopted by many jurisdictions. All participants in the network share a common commitment to not just improving the quality of discovery, but also to speeding up its application at a global scale.

Krieg Finally Steve, given the potential length and disruption of this pandemic, after its conclusion, the United States will likely experience a “new normal.”

In your view, how might this look, and what might be some fundamental steps that the nation should consider in the wake of this episode?

Flynn With the scale of disruption and potential loss of life that COVID-19 is likely to cause, there is the potential that it might finally generate a strategic focus on bolstering community and critical infrastructure resilience. That would certainly be the most positive of all outcomes. What we could actually move towards is making a focus on resilience at the individual-, community-, systems-, and societal-levels an organic part of how we live. Accomplishing that will require us to strive to enhance five things concurrently in order for such a strategic focus to emerge. The first is raising risk literacy across the general population. Many more people need to understand that there are not just hazards or threats, but also how they play out on things that they truly value. That needs to be done up front so that people really understand it. A key element of that is to empower individuals with actions that they can take. And that goes into the second area, which is to think about how we embed resilience into the designs of things that we need, as well as into the systems we rely on. This needs to be done both on a macro-level, such as embedding it in regional planning, and also on the micro-level by routinely incorporating resilience into the design of new projects and systems.

Once we have these plans and designs, we need to align incentive structures for quick adaptation of them. That can be accomplished by mandating resilience best practices through regulation, but a better, more sustainable approach would be to develop market-based incentives, such as through financing and insurance. Then we have to acknowledge that so many of the challenges, such as pandemics, that are animating the need for resilience are transnational in their character. Since individual jurisdictions cannot independently achieve optimal outcomes, we need to devise and nurture institutions and frameworks that facilitate collaborative actions across local, state, federal, and international boundaries.

And lastly is the need to invest in resilience training and education at every life stage, and as young as possible. We all have to understand that we have to live with risk, but there are many tools at our disposal to manage those risks. We don't have to live in fear. What we can do and must do is to understand that, while risks are real, we can be empowered to confront them. Working together we will not just survive, but we can thrive, as we confront the many challenges of our turbulent times.