Core Principles of Public Health Emergency Preparedness (PHEP)

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Core Principles of Public Health Emergency Preparedness (PHEP)

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C hairman Leek, Ranking Member Casello, and members of the committee—thank you for the opportunity today to present some general principles on public health emergency preparedness (PHEP). The views I share today draw upon a variety of peer-reviewed reports and journal articles that my RAND Corporation colleagues and I have produced since 2004, when I started working in this area.

COVID-19 is the latest in a series of disease outbreaks and other events that have put PHEP back in the spotlight. For many people working in the field, the current era of PHEP began with the anthrax attacks of October 2001 and grew after concerns about avian influenza and lessons from the 2005 Gulf Coast hurricane season. These events led to an influx of federal funds to strengthen what was, according to a 2003 report by the Institute of Medicine, a public health system that "remains in disarray" after years of underinvestment.[3] Since then, PHEP has developed into a distinct field of practice and research, and there have been measurable improvements in readiness, even as federal preparedness funding has ebbed and flowed over time.[4]

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[2] The RAND Corporation is a research organization that develops solutions to public policy challenges to help make communities throughout the world safer and more secure, healthier and more prosperous. RAND is nonprofit, nonpartisan, and committed to the public interest.

[3] Institute of Medicine, *The Future of the Public's Health in the Twenty-First Century*, Washington, D.C.: National Academies Press, 2003, p. 100. In a 1988 report, the Institute of Medicine had characterized the U.S. public health system as "in disarray" (Institute of Medicine, *The Future of Public Health*, Washington, D.C.: National Academies Press, 1998), so the phrase "remains in disarray" in the 2003 report was an updated conclusion. See also Nicole Lurie, Jeffrey Wasserman, and Christopher D. Nelson, "Public Health Preparedness: Evolution or Revolution?" *Health Affairs*, Vol. 25, No. 4, July–August 2006, pp. 935–945.

[4] See National Health Security Preparedness Index Program Office, *The National Health Security Preparedness Index 2020 Release*, Aurora, Colo.: Colorado School of Public Health, 2020; and Crystal R. Watson, Matthew

In the mid-2000s, my colleagues and I had the opportunity to convene a panel of accomplished emergency managers, physicians, public health practitioners, policymakers, and community representatives to develop a consensus definition of PHEP that, over the years, has provided a touchpoint for discussions about PHEP in the United States and Europe. This definition may be helpful in communicating some general principles of PHEP. The definition is as follows:

> Public health emergency preparedness (PHEP) is the *capability* of the public health and health care systems, communities, and individuals, to *prevent, protect against, quickly respond to, and recover* from health emergencies, particularly those whose *scale, timing, or unpredictability threatens to overwhelm routine capabilities*. Preparedness involves a *coordinated and continuous process of planning and implementation* that relies on *measuring performance and taking corrective action*.[5]

Next, I will speak about some of the key themes underlying this definition.

Public health emergencies are defined by their consequences, not their causes. In addition to defining PHEP, we must also identify what constitutes a public health emergency. The definition of PHEP above emphasizes events whose "scale, timing, or unpredictability threatens to overwhelm routine capabilities." Thus, public health emergencies are defined by their *consequences* for human health and well-being, not necessarily by their causes. It is very natural to think of COVID-19 and other infectious disease outbreaks as public health emergencies. But *any* incident or event with significant health impacts might constitute such an emergency, so long as it produces injuries or illness at a scale that overwhelms—or has the potential to overwhelm—routine community capabilities. Thus, hurricanes, large-scale industrial accidents, terrorist attacks, cyberattacks that interrupt health care and other critical infrastructure,[6] and even large concentrations of opioid overdoses over a short period of time can be considered public health emergencies.[7]

The "all-hazards" approach emphasizes the importance of core building blocks of PHEP. An important implication of this consequence-based—or "all-hazards"—approach is that PHEP planners and policymakers should focus much of their energy on developing the core building blocks of preparedness that can be used to address a wide variety of hazards. For instance, dealing with both infectious disease outbreaks and the health effects of hurricanes requires strong coordination and communication among multiple departments and disciplines.

Watson, and Tara Kirk Sell, "Public Health Preparedness Funding: Key Programs and Trends from 2001 to 2017," *American Journal of Public Health*, Vol. 107, Supp. 2, 2017, pp. S165–S167.

[5] Christopher Nelson, Nicole Lurie, Jeffrey Wasserman, and Sarah Zakowski, "Conceptualizing and Defining Public Health Emergency Preparedness," *American Journal of Public Health*, Vol. 97, Supp. 1, 2007, pp. S9–S11, emphasis added.

[6] On cyberattacks, see, for example, UK National Audit Office, *Investigation: WannaCry Cyber Attack and the NHS*, London, April 25, 2018, https://www.nao.org.uk/report/investigation-wannacry-cyber-attack-and-the-nhs.

[7] On opioid overdoses, see, for example, "Dozens Overdose in Connecticut Park Near Yale," BBC News, August 16, 2018.

Thus, multi-agency incident management and robust tactical communication systems are important core components of PHEP.

The expert panel that I mentioned earlier identified 16 common elements of PHEP that each community should have (see Box 1).

Box 1. Key Elements of Preparedness

Key Elements of Preparedness

A prepared community is one that develops, maintains, and uses a realistic preparedness plan, integrated with routine practices, having the following components:

Preplanned and coordinated rapid-response capability

1. *Health risk assessment.* Identify the hazards and vulnerabilities (e.g., community health assessment, populations at risk, high-hazard industries, physical structures of importance) that will form the basis of planning.
2. *Legal climate.* Identify and address issues concerning legal authority and liability barriers to effectively monitor, prevent, or respond to a public health emergency.
3. *Roles and responsibilities.* Clearly define, assign, and test responsibilities in all sectors, at all levels of government, and with all individuals and ensure each group's integration.
4. *Incident Command System.* Develop, test, and improve decisionmaking and response capability using an integrated Incident Command System (ICS) at all response levels.
5. *Public engagement.* Educate, engage, and mobilize the public to be full and active participants in public health emergency preparedness.
6. *Epidemiology functions.* Maintain and improve the systems to monitor, detect, and investigate potential hazards, particularly those that are environmental, radiological, toxic, or infectious.
7. *Laboratory functions.* Maintain and improve the systems to test for potential hazards, particularly those that are environmental, radiological, toxic, or infectious.
8. *Countermeasures and mitigation strategies.* Develop, test, and improve community mitigation strategies (e.g., isolation and quarantine, social distancing) and countermeasure distribution strategies when appropriate.
9. *Mass health care.* Develop, test, and improve the capability to provide mass health care services.
10. *Public information and communication.* Develop, practice, and improve the capability to rapidly provide accurate and credible information to the public in culturally appropriate ways.
11. *Robust supply chain.* Identify critical resources for public health emergency response and practice and improve the ability to deliver these resources throughout the supply chain.

Expert and fully staffed workforce

1. *Operations-ready workers and volunteers.* Develop and maintain a public health and health care workforce that has the skills and capabilities to perform optimally in a public health emergency.
2. *Leadership.* Train, recruit, and develop public health leaders (e.g., to mobilize resources, engage the community, develop interagency relationships, communicate with the public).

Accountability and quality improvement

1. *Testing operational capabilities.* Practice, review, report on, and improve public health emergency preparedness by regularly using real public health events, supplemented with drills and exercises when appropriate.
2. *Performance management.* Implement a performance management and accountability system.
3. *Financial tracking.* Develop, test, and improve charge capture,[a] accounting, and other financial systems to track resources and ensure adequate and timely reimbursement.

[a]Charge capture systems collect and analyze charges for medical care.

SOURCE: Nelson et al., 2007, p. S10.

The common elements of PHEP fall into three general categories:

- *Preplanned and coordinated rapid-response capabilities*. This category includes assessing the characteristics of the community and planning gaps; identifying and notifying responsible parties of their functions in a rapid response operation; and rapidly implementing public health functions, such as detecting emergencies, deploying countermeasures, providing information to the public, and maintaining disaster-hardened supply chains.
- *Expert and fully staffed workforce.* This category includes both professional responders and volunteers.
- *Accountability and quality improvement*. This category includes financial tracking systems.

Of course, there are limits to any set of common building blocks. Indeed, most PHEP plans include annexes for specific threats that require specialized equipment, treatments, or processes, in addition to common building blocks. The 2014 Ebola outbreak, for instance, illustrated the importance of precise and exacting personal protective equipment requirements and procedures to maintain the safety of health care providers.[8] In addition, PHEP planners and policymakers should remain alert to emerging threats and scenarios that might challenge even the best-conceived all-hazards plan. Yet the point remains that supporting the development and maintenance of broadly useful capabilities is key to maintaining flexibility and resilience.[9]

Having "stuff" and staff does not necessarily mean that they will be used effectively— the difference between capacity and capability. The term *capability* is a central feature of the earlier PHEP definition and of the official guidance documents on the topic.[10] We defined capability as "the ability to quickly execute preparedness tasks" using staff, supplies, and plans. The key point is that having staff, stuff, and plans (what is often called *capacity*) is no guarantee that they will be used effectively, especially during times of stress and where at least some responders are working outside their normal jobs and teams. As one classic text notes, disasters are difficult in part because they require people to do things they don't normally do, in different ways, with different people, and under stress.[11]

Maintaining capabilities, therefore, requires ongoing training and exercising in order to keep staff and resources ready. The need for training, moreover, increases when there is high turnover among staff, who often take important skills, institutional memory, and working relationships with them when they leave. Unfortunately, there has been considerable turnover of the public

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[8] Courtney A. Gidengil, Christopher Nelson, Laura J. Faherty, and Nabeel Shariq Qureshi, *Does the United States Need to Strengthen the System of Care for Infectious Diseases?* Santa Monica, Calif.: RAND Corporation, RR-2046-ASPR, 2018, www.rand.org/t/rr2046.

[9] Much important work in this area comes from the defense world. See, for example, Paul K. Davis, *Analytic Architecture for Capabilities-Based Planning, Mission-System Analysis, and Transformation*, Santa Monica, Calif.: RAND Corporation, MR-1513-OSD, 2002, www.rand.org/t/mr1513.

[10] Centers for Disease Control and Prevention, *Public Health Preparedness Capabilities: National Standards for State and Local Planning*, Atlanta, Ga.: U.S. Department of Health and Human Services, March 2011.

[11] Erik Auf der Heide, *Disaster Response: Principles of Preparation and Coordination*, St. Louis, Mo.: Mosby, 1989.

health workforce during the past decade, which was hit hard by the 2008–2009 recession and was not replenished in subsequent years.[12]

The ability to coordinate across organizational silos is key. Capability involves not just the skills of individuals but also their ability to work well together in teams, including those with members from multiple organizational silos. For instance, when a hospital must be evacuated, it may involve sending patients to hospitals owned by different providers, which could require transportation resources from multiple ambulance companies and law enforcement agencies to provide traffic control. Incident management systems have been developed over the past half century to help define common objectives and muster the resources of many organizations in a coordinated manner.[13] But doing so requires practice and trust.[14] Indeed, a common phrase among disaster practitioners is, "A disaster is not the time to be exchanging business cards."

PHEP planners and policymakers must consider both threats and vulnerabilities. There is a natural tendency to focus on the acute events that affect public health, such as disease outbreaks, storms, earthquakes, and fires. But the severity of public health emergencies depends considerably on the prior vulnerabilities of populations and infrastructure.[15] The human impact of hurricanes, for instance, largely depends on the quality of levies, seawalls, and other physical infrastructure. Similarly, the severity of public health emergencies largely depends on the resilience of health-related infrastructure. For instance, recent research has underscored how declines in demand for routine medical services during COVID-19 have pushed many financially precarious rural hospitals to the brink, thus reducing access to critical care in those areas and adding to the fact that some 82 million Americans live in areas with shortages of primary health care.[16] In addition, the severity of public health emergencies may depend on prior health conditions, such as obesity,[17] or exposure to environmental conditions, such as poor air quality,[18]

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[12] National Association of County and City Health Officials, *2019 National Profile of Local Health Departments*, Washington, D.C., 2020; and Jonathon P. Leider, Fatima Coronado, Angela J. Beck, and Elizabeth Harper, "Reconciling Supply and Demand for State and Local Public Health Staff in an Era of Retiring Baby Boomers," American Journal of Preventive Medicine, Vol. 54, No. 3, 2018, pp. 334–340.

[13] Federal Emergency Management Agency, "National Incident Management System," web tool, last updated March 10, 2021, https://www.fema.gov/emergency-managers/nims.

[14] Donald P. Moynihan, "The Network Governance of Crisis Response: Case Studies of Incident Command Systems," *Journal of Public Administration Research and Theory*, Vol. 19, No. 4, October 2009, pp. 895–915.

[15] For a compilation of relevant RAND studies, "Community Resilience", webpage, undated, https://www.rand.org/topics/community-resilience.html.

[16] Cecil G. Sheps Center for Health Services Research, "Most Rural Hospitals Have Little Cash Going into COVID-19," University of North Carolina at Chapel Hill, undated, https://www.shepscenter.unc.edu/product/most-rural-hospitals-have-little-cash-going-into-covid-19; and Bureau of Health Workforce Health Resources and Services Administration, *Designated Health Professional Shortage Areas Statistics*, Washington, D.C.: U.S. Department of Health and Human Services, December 31, 2020, https://data.hrsa.gov/Default/GenerateHPSAQuarterlyReport.

[17] Centers for Disease Control and Prevention, "Evidence Used to Update the List of Underlying Medical Conditions That Increase a Person's Risk of Severe Illness from COVID-19," webpage, November 2, 2020, https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/evidence-table.html.

[18] Donghai Liang, Liuhua Shi, Jingxuan Zhao, Pengfei Liu, Jeremy A. Sarnat, Song Gao, Joel Schwartz, Yang Liu, Stefanie T. Ebelt, Noah Scovronick, and Howard H. Chang, "Urban Air Pollution May Enhance COVID-19 Case-

which recent studies suggest is related to COVID-19 risk.[19] These vulnerabilities, moreover, tend to be concentrated in some communities.[20] The 2020 release of the National Health Security Preparedness Index, for instance, finds that regions scoring below average in overall public health preparedness "contain disproportionate numbers of low- and moderate-income residents and rural residents who have fewer personal and community resources to draw upon in the event of an emergency."[21]

Continuous learning is a key part of preparedness. As my colleagues and I noted in a 2007 paper, "PHEP is not a steady state."[22] Threats change—hurricanes may get stronger; wildfire seasons may grow longer and more intense in some areas. Vulnerabilities can change over time, too: Populations may grow older, homeless populations may increase, and health care access may evolve with policy changes. Thus, plans must sometimes be updated, staff retrained, and key assumptions reexamined.

One way to do this is through careful reflection on real-world responses and realistic exercises, which provide valuable opportunities to plans and systems in action. Thus, creating after action reports (AARs) is a common practice in PHEP.[23] Yet, our research suggests that AARs are too often treated as box-checking exercises or fail to identify root causes and meaningful corrective actions.[24] We have recommended best practices for making AARs as meaningful as possible.[25] For instance, it is important to choose events—or aspects of events—that are ripe for learning. Although large-scale incidents are certainly worthy targets of AARs, the public attention to them can make it difficult to undertake an objective analysis. Thus, in addition, it is often helpful to review smaller incidents, particularly those that challenge key planning assumptions, that are "near misses" (that is, things went well but could have been

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Fatality and Mortality Rates in the United States," *The Innovation*, Vol. 1, No. 3, 2020; and Nurshad Ali and Farjana Islam, "The Effects of Air Pollution on COVID-19 Infection and Mortality: A Review on Recent Evidence," *Front Public Health*, November 26, 2020.

[19] According to a recent estimate, less than 3 percent of the $3.6 trillion of annual health spending in the United States is directed toward public health and prevention (Rhea K. Farberman, Matt McKillop, Dara Alpert Lieberman, Daphne Delgado, Cecelia Thomas, Jonah Cunningham, and Kevin McIntyre, *The Impact of Chronic Underfunding on America's Public Health System: Trends, Risks, and Recommendations,* Washington, D.C.: Trust for America's Health, 2020).

[20] Centers for Disease Control and Prevention, "Health Disparities: Race and Hispanic Origin—Provisional Death Counts for Coronavirus Disease 2019 (COVID-19)," last updated March 10, 2021, https://www.cdc.gov/nchs/nvss/vsrr/covid19/health_disparities.htm.

[21] National Health Security Preparedness Index Program Office, 2020, p. 3.

[22] Nelson et al., 2007, p. S9.

[23] See, for instance, Federal Emergency Management Agency, "Homeland Security Exercise and Evaluation Program," webpage, February 2020, https://www.fema.gov/emergency-managers/national-preparedness/exercises/hseep.

[24] Michael A. Stoto, Christopher Nelson, Melissa A. Higdon, John Kraemer, and Christa-Marie Singleton, "Learning About After Action Reporting from the 2009 H1N1 Pandemic: A Workshop Summary," *Journal of Public Health Management and Practice*, Vol. 19, No. 5, 2013, pp. 429–434.

[25] Michael A. Stoto, Christopher Nelson, Rachael Piltch-Loeb, Landry Ndriko Mayigane, Frederik Copper, and Stella Chungong, "Getting the Most from After Action Reviews to Improve Global Health Security," *Globalization and Health*, Vol. 15, 2019, article 58.

problematic), or that appear to be harbingers of things to come. Second, with longer incidents (such as COVID-19), we recommend conducting reviews *during* the response—what some of my colleagues have termed *intra-action reports*.[26] Finally, regardless of the event analyzed, AARs are more likely to lead to effective corrective actions if they seek to identify a problem's root causes, not merely its symptoms.

    Policymakers can take several steps to support PHEP. There are several potential actions policymakers can take in supporting effective PHEP practice.

- **Keep PHEP on the public agenda**. There is a natural tendency for people to stop thinking about public health emergencies after the danger has passed. Researchers in safety science talk about an *accident-attention cycle*, in which periods with lots of accidents are followed first by increased vigilance and a decrease in accidents and then by inattention and disinvestment, which leads to more accidents.[27] Such ebbs and flows in attention and investment can make it difficult to develop and maintain the sustained capabilities needed to ensure readiness. Thus, a key role for policymakers is to help maintain focus and support over time.
- **Foster collaboration across organizational silos and with communities**. Policymakers can support cross-agency and cross-collaboration by asking agency heads to speak about inter-agency coordination issues during oversight processes; signaling support for boundary spanners; and supporting multi-agency working groups, joint planning processes, and strong multi-agency incident management structures. They can also encourage government agencies to collaborate with communities to better understand and respond to planning gaps and to build trust.
- **Foster a culture of learning**. Policymakers can provide resources for realistic multi-sector, multi-agency exercises to help assess and address gaps in operational capabilities. Of equal importance is fostering an environment where people are not afraid to learn from mistakes. Often the most-useful exercises are those that test systems to failure. But this is unlikely to happen where people perceive that such failures will be punished. One promising mechanism for doing this is through support of peer assessment of exercises and real-world incidents,[28] in which responders in one community play a "critical friend" role for other communities. This both signals the value placed on experts in the community and helps foster strong cross-jurisdictional working relationships, which are key for successful responses. Another promising approach is to use critical-incident

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[26] Margaret Chamberlin, Adeyemi Theophilus Okunogbe, Melinda Moore, and Mahshid Abir, *Intra-Action Report—A Dynamic Tool for Emergency Managers and Policymakers: A Proof of Concept and Illustrative Application to the 2014–2015 Ebola Crisis*, Santa Monica, Calif.: RAND Corporation, PE-147-RC, www.rand.org/t/pe147.

[27] See, for example, Thomas R. Krause, *Employee-Driven Systems for Safe Behavior: Integrating Behavioral and Statistical Methodologies*, New York: Van Nostrand Reinhold, 1995.

[28] Daniel A Waxman, Edward W. Chan, Francesca Pillemer, Timothy Wj Smith, Mahshid Abir, and Christopher Nelson, "Assessing and Improving Hospital Mass Casualty Preparedness: A No-Notice Exercise," *Prehospital and Disaster Medicine*, Vol. 32, No. 3, 2017, pp. 1–5; and Rachael Piltch-Loeb, Christopher D. Nelson, John D. Kraemer, Elena Savoia, Michael A. Stoto. "A Peer Assessment Approach for Learning from Public Health Emergencies," *Public Health Reports*, Vol. 129, Supp. 4, 2014, pp. 28–34.

registries. Used successfully in aviation and other sectors, these registries provide opportunities to learn from comparisons across responses and communities.[29]

- **Ensure adequate resources**. Finally, it is important to provide stable, predictable financial support for PHEP in order to manage staff turnover, enable regular opportunities for training and exercising, and allow for the emergence of strong and connected leaders across the state. Much of this involves supporting state and local health departments. However, it is also important to note the importance of actors and assets outside the traditional health sector, such as power grids, water supplies, and other functions that play an important role in maintaining continuity of health. Indeed, an important role for state policymakers is to keep an eye on the big picture and how investments in various sectors contribute to an effective and integrated whole-of-government approach to PHEP.

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[29] Rachael Piltch-Loeb, John D. Kramer, Christopher Nelson, and Michael A. Stoto, "A Public Health Emergency Preparedness Critical Incident Registry," *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science*. Vol. 12, No. 3, 2014, pp. 132–143.