



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Contents lists available at ScienceDirect

Social Science &amp; Medicine

journal homepage: [www.elsevier.com/locate/socscimed](http://www.elsevier.com/locate/socscimed)

## Modeling epidemic recovery: An expert elicitation on issues and approaches

Monica Schoch-Spana<sup>\*</sup>, Sanjana J. Ravi, Elena K. Martin

The Johns Hopkins Center for Health Security, 621 East Pratt Street, Pier IV Building, Suite 210, Baltimore, MD, 21202, USA

### ARTICLE INFO

#### Keywords:

Epidemic  
Pandemic  
Disaster  
Recovery  
Resilience  
Public health  
Preparedness  
Global health

### ABSTRACT

Since the emergence of the SARS-CoV-2 virus in late 2019, the world has been in a state of high alert and reactivity. Once the acute stage of the infectious disease crisis does abate, however, few if any communities will have a detailed roadmap to guide recovery – that is, the process of becoming whole again and working to reduce similar, future risk. In both research and policy contexts where data are absent or difficult to obtain, expert judgment can help fill the void. Between November 2019 and February 2020, we conducted an expert elicitation process, asking fourteen key informants – with specializations in infectious diseases, disaster recovery, community resilience, public health, emergency management, and policymaking – to identify the design principles, priority issues, and field experiences that should inform development of an epidemic recovery model. Participants argued that recovery from epidemics is distinct from natural disasters due to epidemics' potential to produce effects over large areas for extended periods of time and ability to generate high levels of fear, anticipatory anxiety, and antisocial behavior. Furthermore, epidemic recovery is a complex, nonlinear process involving many domains – political, economic, sociocultural, infrastructural, and human health. As such, an adequate model of post-epidemic recovery should extend beyond strictly medical matters, specify units of interest (e.g., individual, family, institution, sector, community), capture differing trajectories of recovery given social determinants of health, and be fit for use depending upon user group (e.g., policymakers, responders, researchers). This formative study commences a longer-term effort to generate indicators for a holistic, transformative epidemic recovery at the community level.

### 1. Introduction

Although commenced prior to the novel coronavirus's emergence, this study takes up an idea the pandemic has made urgent – recovery from an infectious disease emergency. The profound yearning for a “return to normal” distinguishes much public discourse as the COVID-19 pandemic enters its eighteenth month in the [United States \(U.S.\)](#) ([Tsi-pursky, 2020](#)). The SARS-CoV-2 virus has stressed individuals and communities through a mixture of impacts: ill health and excess deaths, social isolation, economic hardship, and the psychological strain of it all ([COVID Impact Survey, 2020](#)). This compounded misery has prompted what some people have called “pandemic fatigue” ([Kossakovski, 2020](#)). As the infectious disease crisis has dragged on and on, the urge to reopen – that is, to resume the familiar rhythms of school, work, worship, and play – has been so acute that, sometimes, it led to a premature lifting of public health controls over the virus (“[See reopening plans and mask mandates,](#)” 2021). As a result, some communities, states, and regions

rebounded not to a comfortable normal, but instead, to resurgent infection and the need to reapply interventions like “lockdowns” once again.

Exhausted by COVID-19, people struggle now to imagine the way beyond the infectious disease emergency and its totalizing effects. There is, however, no detailed pandemic recovery roadmap. While public health emergency management (more commonly, public health emergency preparedness or PHEP) has expertly problematized readiness for, and response to major outbreaks, recovery after the acute crisis period lacks a comparable level of analysis and set of policy guidance, planning templates, and/or field best practices ([Schoch-Spana, 2020](#)). By contrast, in the life cycle of a natural disaster (where the hazard is meteorological or geological, not biological), recovery is the subject of a maturing body of research and conceptual models ([Smith et al., 2018](#); [Lindell, 2013](#)), nationally recognized emergency management strategies ([U.S. Department of Homeland Security \[DHS\], 2016](#); [Public Safety Canada, 2019](#)), and international doctrine on disaster risk reduction

<sup>\*</sup> Corresponding author.

E-mail addresses: [mschoch1@jhu.edu](mailto:mschoch1@jhu.edu) (M. Schoch-Spana), [sanjana@jhu.edu](mailto:sanjana@jhu.edu) (S.J. Ravi), [emarti92@jhu.edu](mailto:emarti92@jhu.edu) (E.K. Martin).

<https://doi.org/10.1016/j.socscimed.2021.114554>

Received 2 July 2021; Received in revised form 20 October 2021; Accepted 5 November 2021

Available online 6 November 2021

0277-9536/© 2021 The Authors.

Published by Elsevier Ltd.

This is an open access article under the CC BY-NC-ND license

<http://creativecommons.org/licenses/by-nc-nd/4.0/>.

(United Nations [UN], 2015). This study is meant to help address this imbalance in PHEP.

PHEP initially coalesced in the U.S. around atypical threats such as bioterrorism, chemical terrorism, and pandemic influenza before broadening out to “all hazards” model and gaining more adherents globally (Erwin and Brownson, 2017; Rose et al., 2017). At the outset, the discipline conceived society’s confrontation with health emergencies as a multiphase process including recovery: “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” (Nelson et al., 2008). Though underdeveloped, recovery is a recurrent theme in frameworks developed to standardize the work of public health agencies for extreme events in the U.S., Europe, and beyond (Gibson et al., 2012; Stoto et al., 2017; World Health Organization [WHO], 2017). In some frameworks, recovery manifests as long-term response activities such as demobilizing operations.

Since 2011, “community recovery” has been one of 15 PHEP capabilities informing local and state strategic planning in the U.S., with a focus on reconstituting public health, medical, and behavioral health infrastructure (Martinez et al., 2019). In practice, however, recovery is not among the capabilities shaping the PHEP training, exercises, and evaluation activities in which most local and state health agencies engage (Horney et al., 2021). Recovery, too, represents a negligible portion of PHEP primary and analytical research; most studies from 1998 to 2013 relate to response (42%), preparedness (34%), and prevention/mitigation (21%), and only modestly to recovery (3%) (Khan et al., 2015). Recently, however, a rethinking of recovery in PHEP is underway, due to growing interest in fostering resilience to extreme events and in using recovery as the strategic moment for enhancing protective conditions rather than recreating the status quo (Institute of Medicine [IOM], 2015; Wulff et al., 2015).

The US government has developed documents that, together, are meant to address recovery from an epidemic (whether natural, intentional, or accidental), yet gaps remain. The National Disaster Recovery Framework (NDRF) defines disaster recovery as restoration and revitalization of a community’s health, social, economic, natural, and environmental fabric (DHS, 2016). While holistic, the NDRF’s framing of recovery is still written from the vantage of events that compromise physical structures, rather than epidemics in which people continue to fall ill while buildings stand. The Recovery Federal Interagency Operations Plan (FIOP) guides the coordination of federal support to response and recovery in affected jurisdictions (DHS, 2016), while its Biological Incident Annex (BIA) outlines the uniqueness of pathogen-driven events (United States Department of Homeland Security). Informing federal resource mobilization, the FIOP and BIA do not detail epidemic recovery for communities. Other influential DHS documents regarding biological incidents conceive recovery narrowly (versus NDRF’s holism), by emphasizing the cleanup of contaminated buildings and wide areas (DHS, 2012, 2009).

Outside the US, operational frameworks address recovery considerations associated with natural disasters, environmental crises, and man-made catastrophes. The United Nation’s Office for Disaster Risk Reduction (2012) has published guidance on pre-disaster recovery planning to help government officials improve recovery outcomes, and the World Bank’s Global Facility for Disaster Reduction and Recovery (2020) has helped develop a disaster recovery framework with partners in the European Union, Africa, the Caribbean, and Pacific. Other guidance and frameworks also consider gender-specific and health sector-specific aspects of disaster recovery (World Bank Group, 2020; Pan American Health Organization et al., 2017). There exists a large, multi-disciplinary body of literature examining the ontology of disaster recovery and promoting sustainability in disaster recovery (Herring, 2016; Rao et al., 2009; Smith and Wenger, 2007). Yet, to our knowledge, comprehensive recovery from acute infectious disease outbreaks at the

community level has yet to be explicated systematically.

Recent crises involving communicable disease (e.g., severe acute respiratory syndrome, H1N1 pandemic influenza, Ebola virus disease) have prompted the global public health community and national governments to enhance their ability to contain outbreaks before they escalate into international emergencies. Largely informing these developments are the 2005 International Health Regulations (IHR) – the governing framework for global health security – and the Joint External Evaluation Tool (JEE) that countries can use to assess their abilities to prevent, detect, and rapidly respond to public health threats (WHO, 2016a; 2016b). However, the IHR and JEE scarcely mention recovery. Recent reviews of major global health security initiatives (Carlin et al., 2019), high-level recommendations on national preparedness for public health emergencies (WHO, 2019), and tools for countries to monitor PHEP capabilities (Haebeler et al., 2020) all identify epidemic recovery as a persistent gap.

Against this background, this study’s goal is to lay a foundation for more comprehensive treatment of epidemic recovery – a now ambiguous state-of-being manifesting as the acute health crisis, associated with a pathogen, resolves. The process by which communities recuperate from an epidemic’s extreme public health conditions as well as attendant social, political, economic, and psychological effects requires improved framing, more systematic study, and translation into guidance and practical tools. For study purposes, the words “epidemic” (that is, an increase, often sudden, in the amount of disease above that normally expected in a geographic area [U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2012]) and “major outbreak” are used interchangeably to refer to incidents where an infectious agent spreads readily in a population, over a wide geography. The study’s focus is a large-scale infectious disease incident that emerges abruptly, significantly disrupts everyday happenings, and/or calls for exceptional control measures (Nelson et al., 2007).

This study comprises an expert elicitation about design principles, priority issues, and field observations that can inform the development of a conceptual framework for epidemic recovery. The study commences a longer-term effort to generate indicators that would help operationalize community recovery post-epidemic. Swifter, greater healing from a major outbreak, and enhanced resilience to future ones, may be more likely if planners and practitioners have empirically informed metrics to guide pre- and post-incident epidemic recovery planning and to track real-time progress made by public health and its interagency and non-governmental partners (Horney et al., 2017, 2018).

## 2. Methods and materials

Focused on the understudied topic of epidemic recovery, this study drew principles from expert elicitation wherein a panel of experts with diverse knowledge, background, and opinion together provide insights to manage uncertainty around an issue or problem (Butler et al., 2015; Colson and Cooke, 2018). We conducted semi-structured interviews with a range of subject matter experts to ascertain prevalent themes that could inform the follow-on generation of an epidemic recovery model. The findings constitute an early input among others into a much larger process of indicator development. The framework underpinning the study is constructivist grounded theory, which seeks to understand how participants construct meaning in connection with an area of inquiry, recognizing the researcher as a collaborator in the process (Charmax and Bryant, 2011).

Comprising the research team were a senior social scientist with expertise in disasters, epidemics, and community resilience and two junior public health researchers with expertise in infectious disease management, health-systems strengthening, and global health security. To recruit the expert panel, the team employed relevance screening, selecting participants based on *a priori* judgment of the individuals’ expertise. Participant selections reflected a range of academic disciplines, scholarly and operational careers, as well as specializations in

infectious diseases, disaster recovery, community resilience, and public health emergency management—points of vantage the team considered essential to framing the complex problem of epidemic recovery (Table 1). Following initial outreach to known experts, the study team used snowball recruitment wherein experts nominated peers as potential interviewees.

Between November 2019 and February 2020, fourteen participants were interviewed – the majority by phone for 45-min, and in a single instance, via email at the participant’s request, with responses submitted electronically. Based on professional experience and expertise, including a prior review of disaster recovery frameworks, the team developed a set of semi-structured interview questions for all participants and adapted the conversation around interviewees’ respective expertise. During the interviews, key informants were asked to present their definitions of epidemic recovery; consider recovery across infectious disease incidents of varying scale, scope, and origin; address similarities and differences with natural disaster recovery; review recovery challenges faced by differently resourced countries; and outline important considerations for the development of an epidemic recovery model.

During each interview, the social scientist led the questioning with at least 1 other researcher present to take notes and prepare a detailed report. Conducted on a not-for-attribution basis to allow for frank discussion, the interviews were recorded with participant permission to ensure the capture of all relevant points. Throughout the period of data collection, the team met periodically to discuss interviewee responses, trends, and implications; the entire team completed an analytic review of the aggregate of interview reports. Categories, themes, and subthemes were produced iteratively, with *a priori* themes embedded in the interview guide and others induced from individual reports and comparison across them (Ryan and Bernard, 2003). Participants were recruited until no new relevant knowledge was elicited during the interviews (i.e., thematic saturation).

The Institutional Review Board of the Johns Hopkins Bloomberg School of Public Health determined that this study did not constitute human subjects research.

3. Results

Bolstered by a review of published literature, we analyzed key informant comments to identify and synthesize themes that could inform a future epidemic recovery model. We categorized findings into five broad thematic categories, detailed below and distilled into Table 2, with illustrative quotes.

3.1. Operating definitions

When defining epidemic recovery in their own words – what is it exactly and how does it come to be – interviewees often observed that the context matters and that definitions are subject to contestation.

**Definitional tensions exist between recovery as a goal of returning to baseline or seizing the opportunity to improve:** Some interviewees defined recovery as returning to normal, to steady state operations, or to an earlier baseline, while others spoke of “adaptation,” “building back better,” and preparing for subsequent waves or crises through better planning, healthcare, and community education. The transformative capacity of epidemics was captured in comments that no one should “waste a good crisis” (i.e., learning and improvement should follow), epidemics can produce an “entirely new normal,” and an epidemic is a transition to a new stage of history, rather than a bounded event. Because epidemics and their aftermath are subject to human intervention, what constitutes “recovery,” argued an interviewee, is a political question: e.g., a government could claim post-epidemic recovery has occurred once the immediate crisis resolves, and still not address societal dysfunctions amplifying a pathogen’s human effects. Trends in human losses often reveal underlying structures in need of reform.

**The importance of context to the emergence, spread, and resolution of an epidemic may defy a one-size-fits-all definition for recovery:** Interviewees were quick to note that an epidemic is a complex, organic, and dynamic event in which politics, social sphere, culture, health systems, human biology, and pathogen converge. As a result, what recovery looks like and feels like may be different from one major outbreak to another. A bad influenza outbreak may produce mortality at the extremes of life, explained an interviewee, but “when it’s over, it’s over.” Such a situation contrasts with the 2014–2016 Zika outbreak, in which some women infected during their pregnancies are now raising children with neurological deficits; full recovery is not possible. Recovery, too, may be something easier to distinguish or call out if an epidemic has been expansive and affected a lot of people. When nonessential services that were put on hold resume, supply chains become predictable again, and healthcare providers turn to more routine demands, then recovery may seem more remarkable than in less disruptive epidemics.

**Epidemic experiences in high-income countries differ significantly from those in low- and moderate-income countries, producing divergent recovery “ideals”:** Multiple informants observed that pre-epidemic social, political, and economic conditions calibrate community expectations around post-epidemic recovery. Per one interviewee, higher-income countries “have zero tolerance for risk” compared to lower-income counterparts; as a result, the presence of a

Table 1  
Characteristics of subject matter experts interviewed on the topic of post-epidemic recovery (Nov 2019 to Feb 2020).

#	Discipline/Issue Expertise	Professional Arena(s)			Geographic Scope		Operational Epidemic Experience	
		Research	Practice	Policy	US	Global	Yes	No
1	Public Health – community resilience, national security	X			X	X		X
2	Public Health – emergency management, infectious diseases, ethics		X			X	X	
3	Public Health – risk management, measurement/modeling, community resilience	X			X		X	
4	Public Health – emergency management, infectious diseases	X	X		X	X	X	
5	Public Health – emergency management, disaster recovery		X		X		X	
6	Medicine – microbiology, infectious diseases		X			X	X	
7	Medicine – infectious diseases	X	X		X		X	
8	Medicine – infectious diseases, tropical diseases	X		X	X		X	
9	Veterinary Medicine – one health	X				X		X
10	Nursing – public health, emergency management		X			X	X	
11	Geography – disaster recovery, measurement/modeling	X			X			X
12	Sociology – infectious diseases, one health, economics	X				X		X
13	Psychology – disaster recovery, community resilience	X			X			X
14	Economics – disaster recovery, public health emergency management			X	X		X	
Portion of Interviewees Demonstrating Characteristic		9 (.64)	6 (.43)	2 (.14)	9 (.64)	8 (.57)	9 (.64)	5 (.38)

**Table 2**  
Illustrative quotes for major themes and sub-themes emerging in key informant comments on modeling post-epidemic recovery.

Operating Definitions	
Definitional poles for epidemic recovery are “return to baseline” and “seize moment to improve.”	“There’s a real tension between the needs of public policy, which is always partial – having a partial view and being partial to particular interests – and the needs of social welfare, which might make things better.” – Key Informant 12
Diverse contexts for an epidemic’s emergence and resolution defy a one-size-fits-all recovery definition.	“Some epidemics could be severe enough to reshape history; recovery would thus entail building a community or society anew.” – Key Informant 9
Epidemic recovery “ideals” differ across low-, moderate-and high-income countries.	“In Liberia, a quarter of the healthcare workforce was lost [during the Ebola outbreak], but people just keep going – that says something about people’s expectations about what happens in their lives ... In North America and Europe, we tend to have an easier time recovering from most things ... But in LMICs, returning to a level where routine services can be provided is infinitely more difficult and takes much longer.” – Key Informant 6
Response Prioritized	
Urgent “life and limb” matters take precedence, casting a shadow over recovery.	“If there is a large-scale event where there are limited resources, how could someone <i>not</i> respond and just wait for recovery?” – Key Informant 1
Marginalized people’s prolonged recoveries generate less social attention than the acute response.	“It’s fickle and people give money to what’s visible and painful and where they think they can have an impact. Unless you have an outbreak that generates empathy, there isn’t much you can do.” – Key Informant 2
Though overlapping, epidemic response and recovery both need resources, plans, and workforces.	“To be fair, we have a lot more data on what resources are needed for an acute event. Every recovery is different, and so it’s difficult to project what will be needed. Plus, in the midst of the acute event, the population will not tolerate you saying that you are limiting resources for the after event.” – Key Informant 8
Politics/Economics	
Competing policy aims may emerge with an epidemic’s resolution: e.g., stopping spread, growing economy.	“When I’ve worked with people from governors’ offices to secretary of public health, to a county school superintendent – they all have the challenges of reaching an inflection point of doing the job they were hired for that hasn’t gone away and doing the job that has emerged because of an incident.” – Key Informant 14
Response, recovery, and steady state work compete for scarce resources, leading to trade-offs.	“When there is an outbreak or an epidemic, it can be new and overwhelming, so resources are rechanneled to deal with it from public health departments. And if they involve a lot of ill persons, then healthcare systems are often short of funds, so they reprogram money to be able to deal with it. But when the acuteness is over ... there aren’t any recovery funds, even when recovery can go on for two, three, ten times longer.” – Key Informant 8
Leadership in epidemic recovery includes intangibles like making sense of trauma and fostering hope.	“There is a much longer secondary recovery period that is about people fully adapting to what the outbreak has meant and what has changed.” – Key Informant 6
Epidemic recovery involves social learning: e.g., conducting after action analysis, evolving systems.	“A not-so-great thing that happens after an outbreak is people critique the institutions that responded, but no one

**Table 2 (continued)**

	talks about what regular people did, and reinforcing what communities and people did is great.” – Key Informant 2
Distinctive Features	
Able to spread far and last long, epidemics differ from natural disasters in recovery challenges.	“When that wind whips up in a wildfire, and it moves the embers, then you get a much larger area, and it exponentially grows but eventually it will burn itself out. That’s not the case with a virus, because it can go worldwide, and it only takes one person getting on a plane and the exponential impact is enormous.” – Key Informant 11
Invisible and lingering biothreats can generate much fear, anticipatory anxiety, and antisocial behavior.	“In a natural disaster your worst day was yesterday versus in an epidemic it might be two months from now – It’s impossible to predict.” – Key Informant 10
Given its unique vulnerability in large outbreaks, the health sector is a priority infrastructure for renewal.	“There is a sense of exhaustion once the emergency starts to scale back. So if you are going to use the same people to deal with the acute and also deal with the somewhat more chronic that trails on, [then] you are going to have responder fatigue.” – Key Informant 8
Model Considerations	
A non-medicalized view of epidemic recovery sees a complex, nonlinear process involving many domains.	“We tend to medicalize the response, push for better vaccines, better PPE, focusing on reducing cases and severity, and improving health system responses. I hear senior leadership talk about fear, etc., but every call I’m on is still about how long it will take to deliver a countermeasure – not family separation, food shortages, etc.” – Key Informant 10
Determinants and outcomes for epidemic recovery depend upon extant inequities and social unit examined.	“So, if you start to look at the cascading impacts of it all – on low-income communities of color – you are going to have quite a differential recovery in different places. And the wealthy are going to be fine, and anyone who isn’t of an elite class is going to suffer.” – Key Informant 11
Utility derives from answers that the model provides certain end users: e.g., policy, operations, research.	“What are the long-term implications of short-term decision making?” – Key Informant 13

vaccine-preventable infection like polio would be unacceptable in most industrialized countries, while such diseases may be viewed as unremarkable in endemic countries. Additionally, in resource-poor countries experiencing protracted periods of crisis, low confidence in public institutions, and limited capacities for social service provision, community members might simply resign themselves to coping without government aid. In this vein, competing threats to public health – particularly in fragile states or those with significant burdens of endemic and epidemic disease – could complicate efforts to prioritize recovery activities following a major outbreak.

**3.2. Response prioritized**

Interviewees explained that, in contrast to the acute response phase, the post-epidemic period is vastly under-rated and under-resourced.

**Urgent “life and limb” matters take precedence and evoke empathy, while recovery issues trail off into obscurity:** To explain why epidemic response and recovery receive uneven attention, interviewees noted the high stakes of the crisis period: an insufficient epidemic response can result in more sickness, death, and disruption – highly visible, readily communicated impacts. Recovery is under-addressed, because funds are applied to an acute, emergent problem when life itself is threatened. Informants described that the constant enumeration of cases and death elevate the problem of epidemic



response, commanding the focus of energy and eliciting an emotional response. By comparison, the post-crisis period is largely invisible, and people readily forget that survivors may have lingering needs. Recovery has no “spokesperson” comparable to a leader who inspires communities and mobilizes a response in a crisis. Often, a dearth of political will to direct funds and other material resources proactively further impedes long-term, holistic recovery. Too, by the time the crisis phase is ending, the individuals who served in response capacities are often exhausted and grappling with burnout making it especially difficult to conceive of continuing the level of work needed for a robust post-epidemic recovery.

**Recovery is not problematized the same as response because the prolonged recoveries of marginalized people generate less social attention:** How society assigns value to people on a differential basis, some interviewees noted, explains the lack of available energy for recovery. The people mostly heavily affected by epidemics, whose impacts are likely to be protracted, are those to whom society routinely turns a blind eye. Marginalized individuals and underserved communities are often without voice or political influence, and as a result, their struggles are not addressed to the extent genuinely needed. Further, an interviewee explained, there exists a disconnect between the focus of elites upon high-profile outbreaks and the “everyday public health emergencies” such as moldy housing, unclean water, and food deserts that people with limited means often face.

**Overlapping realities, response and recovery both need resources, planning and workforces; yet, only response capabilities are developed:** Principally a medicalized process, epidemic response rests on the shoulders of skilled public health and healthcare workforces who strive to interrupt disease transmission and treat infected individuals. Stretching beyond urgent lifesaving, the post-epidemic recovery phase – many interviewees noted – does not have a comparably coordinated, well-resourced, and skilled workforce, that can deal with the protracted and diverse needs of affected communities (e.g., economic restart of businesses, social service provision to afflicted individuals and families). Moreover, as one informant noted, affected communities may expect responders to help them become whole again, but responders do not have the requisite skills and they eventually leave. Interviewees argued for a post-epidemic recovery “system” with a dedicated workforce, including social and behavioral experts, that could operate in tandem with the response, while thinking ahead and on a longer time-horizon.

### 3.3. Politics/economics

According to research subjects, recovery post-epidemic involves questions of effective governance – how are collective tradeoffs weighed, scarce resources applied, traumatized communities soothed, and institutional missteps remedied?

**Public health measures to control epidemics often carry concomitant trade-offs:** Several interviewees acknowledged the challenges associated with implementing certain public health interventions without disrupting livelihoods. One informant observed that the economic consequences of major epidemics could persist long after incidence and mortality subside, citing losses of income and benefits due to unemployment and business closures, erosion of supply chains for high-demand commodities, and lost revenue for key industries such as tourism and hospitality. On the other hand, long-term sequelae associated with infection could impede worker productivity or result in higher lifetime healthcare costs even after individuals recover, suggesting the primacy of public health interventions at the outset. The inherent tension between disease mitigation and economic well-being thus demands that post-epidemic recovery strategies include deliberative efforts to ensure that allocations of funds, resources, and investments align closely with community needs and priorities.

**The process of allocating scarce public resources requires communities to consider complex trade-offs between response, recovery, and steady state activities:** One informant remarked,

“Often, in the planning cycle for an unknown occurrence, the issue of what to do in the recovery phase gets much less focus because ... you want first and foremost to protect life and limb.” Dedicated pools of money such as the United States’ BioShield Special Reserve Fund or the World Bank’s Pandemic Emergency Financing Facility, for example, are primarily intended to support outbreak response activities. However, comparable funding mechanisms simply do not exist for post-epidemic recovery, despite considerable social, economic, and political costs. As a result, communities must make hard choices around how best to support long-term recovery while mitigating crises at hand with limited available resources. Noting that “it’s easy to fall down the hole of spending money fixing things that are broken,” an informant pointed out that during the 2015–2016 Zika epidemic, increased public spending on mosquito remediation diverted funds from critical programs for routine immunization in some places.

**From a humanistic standpoint, post-epidemic recovery entails making sense of mass trauma, fostering hope, and advancing community resilience:** Effective crisis leadership is instrumental in restoring the social fabric of communities following an epidemic. Given that timelines for full recovery likely exceed the length of most elected officials’ terms in office, adopting measures for long-term community revitalization could prove politically unpalatable. Nevertheless, one informant recommended that leaders of affected communities adhere to three principles: directly and visibly communicating with the public while also acknowledging unknowns; collaboratively developing strategies to sustain essential day-to-day operations; and coordinating recovery efforts across a broad array of stakeholders and sectors. Several informants further noted the importance of sustaining public trust in institutions, beginning with leaders’ efforts to elicit cooperation with prescribed mitigation measures. From a psychosocial perspective, effective leadership and empathetic crisis communication are essential to facilitating recovery from mass trauma and to advancing community resilience.

**Taking both a moral and a managerial vantage point, post-epidemic recovery is a process of social learning: i.e., conducting after action analysis, improving operations, and evolving systems:** Finally, systems for accountability dovetail with effective crisis leadership as catalysts of post-epidemic recovery. Efforts to institutionalize best practices and lessons learned during an epidemic – for example, through after-action analysis – not only enhance readiness for future crises but may also provide opportunities for affected communities to name harms experienced during the outbreak and assign responsibility for missteps in response.

### 3.4. Distinctive features

Disaster recovery models can inform epidemic recovery study and planning; yet, as key informants noted, certain aspects of infectious disease threats require greater weighting in frameworks regarding their resolution.

**Recovery from epidemics is distinct from natural disasters due to an epidemic’s potential to produce effects over wide areas for a long time.** The scale and scope of epidemics present distinguishing features noted by informants. Natural disasters tend to be contained to a geographic area and present a more acute threat (e.g., a hurricane makes landfall, causes damage for a short time, and then recedes). On the other hand, epidemics can span the globe, with illness and death eventually occurring far from the place where the pathogen and its effects first emerged. Epidemics have fuzzy starts and stops. Depending upon the nature of the pathogen and the response, the health effects can linger, growing over time before resolving. One informant drew the analogy between epidemics and wildfires: both can persist for some time, threatening to spark effects in new places; however, unlike wildfires which are more contained geographically, epidemics can spread across oceans causing international crises.

**Involving an invisible and lingering threat, an epidemic can**

**generate much fear, uncertainty, anticipatory anxiety, and anti-social behavior.** Without predictable cues as to its beginning and end, explained interviewees, an epidemic can prompt people to wonder just how long disruptions to daily life will last. Epidemics' protracted nature can exacerbate the stress of uncertainty, erode trust in institutions, and adversely affect mental health; deliberate epidemics can especially tear at a community's social fabric. Unlike a hurricane, tornado, or other natural disaster where communities of individuals come together, an epidemic represents a situation in which any individual could become infected and threaten others, thus producing fear and weakening social cohesion. Individuals may avoid places where contagion has spread and/or perceive certain groups of people as risky and to be avoided, especially already marginalized groups. Such stigma can create social isolation, disrupt treatment seeking, and contribute to unequal experiences of recovery.

**The health sector is a priority infrastructure for renewal, given its unique response role and vulnerability.** The primary damage in a natural disaster is obvious in the form of collapsed buildings or damaged roadways. Informants noted that – by contrast – the physical infrastructure in an epidemic remains intact; damages and adaptations are less visible to the naked eye. When HIV/AIDS emerged, it transformed the delivery of health services, including blood supply screening and isolation units. Now that the disease is manageable, HIV/AIDS health units have closed and most care is delivered in the outpatient setting. Human impacts of a major outbreak exist below the surface, even while hospital and health departments are still standing. Caring for infected individuals and working to prevent more infections, practitioners remain vulnerable themselves, especially when no effective vaccine exists. They also face the prospect of exhaustion and burnout given protracted, high-stakes work. Healthcare facilities, too, may experience blows to reputation and revenue, if associated with contagion. Preserving workforce wellbeing and bolstering resilience to future outbreaks by engaging in an effective course correction process were recovery priorities for informants.

### 3.5. Model considerations

An adequate model of post-epidemic recovery, interviewees proposed, would extend beyond strictly medical matters, specify the unit of interest, capture differing trajectories, and be fit for purpose.

**In shedding a medicalized view, one sees epidemic recovery as a complex, nonlinear process involving many domains – political, economic, socio-cultural, infrastructural, and human health.** Following a major outbreak, many systems must resume a desired level of functioning. A recovered health sector can meet demands for routine services, provide ongoing care for afflicted persons, and work toward resilience. Processes of psychosocial repair after having experienced illness, caring for the sick, and/or living in an environment of fear and uncertainty, may involve resources beyond those associated with the physical rebound from infection. The promptness with which supply chains and commerce resume operations matters, so that businesses and the livelihoods they support remain vital into the future. Recovery involves a retuning of everyday work, play, and worship rhythms, and a restart of interrupted cultural practices such as funerals, or in some cases, lasting shifts in social values and habits. Government missteps during the response require resolution, and successes, celebration and replication. This holistic approach to epidemics would imply, an interviewee argued, that early warning systems should monitor for emergent biological threats and the social variables that generate a broader vulnerability to an epidemic's adverse effects.

**Determinants and outcomes for post-epidemic recovery depend upon what social unit is being considered - e.g., individual, family, institution, sector, community:** As interviewees noted, the rate at which an individual or neighborhood fully recovers from an epidemic's physical and psychological effects may be out of synch with the larger community's return to pre-epidemic states of functioning or

advancement to a greater vitality. In the instance of a Hepatitis A outbreak, cases of infection can disappear in a city, and homeless persons can still be vilified as disease vectors. Rather than proceed evenly (i. e., at the same pace and along similar pathways), epidemic recovery may unfold differently for distinct people and communities. Socio-demographic factors - e.g., age, sex, race, ethnicity, income, location, legal status, education - determine an individual's or group's vulnerability to an outbreak's impacts, as well as access to resources for regaining their footing. The endpoints of these trajectories depend on broader, macro-level measures taken to revitalize economies, strengthen policies and governance systems, and restore social order after an epidemic – and vice-versa. As such, a model of community recovery should identify potential feedback loops and modes of interaction between these social units as an epidemic waxes and wanes.

**The utility of an epidemic recovery model will depend upon the answers it provides for different end user groups (e.g., policy, operations, research):** One interviewee noted that “a model for model's sake” has limited practical utility. To begin, however, an epidemic recovery model can ease people out of a response mindset, to consider in an orderly way what should follow the crisis state. Clarifying the model's purpose, a key informant noted, is important: is it meant to describe an actual recovery process, predict the course of a future recovery, or prescribe a course of action for an effective recovery? For many subjects, the ultimate value of a post-epidemic recovery model lies in its ability to articulate actionable steps toward desired outcomes. Ideally, it should enable users to chart pathways toward desired recovery endpoints or correlates; identify both proximal and distal roadblocks to full recovery; pinpoint leverage points for enhancing recovery efforts; and/or identify emergent properties and behaviors within community systems that could accelerate or impede progress. Some informants felt that no single model could capture the course of every post-epidemic recovery process, given the “it depends” factor: e.g., is the disease's mortality rate high or low, is the spread of contagion narrow or expansive, how strong is the health sector's response, does an effective vaccine exist? Others suggested that a model should be flexible: broad enough to identify common considerations in high-, middle-, and low-income settings alike, yet allowing decision-makers to ensure that recovery efforts are culturally appropriate, operationally feasible, and context-specific.

## 4. Discussion

Given that post-epidemic recovery represents a research and policy issue where systematically gathered data and interpretative framework (s) are lacking, expert judgments can serve as a north star to guide efforts at closing the gaps (Butler et al., 2015; Colson and Cooke, 2018). Representing diverse disciplines and sectors, our key informants (1) shared operating assumptions about the meaning of/means for post-epidemic recovery; (2) explained why the epidemic recovery period is invisible, neglected, and/or lacking a robust workforce; (3) outlined challenges within larger governance and economic systems that bear on post-epidemic recovery; (4) identified attributes of the post-epidemic period that confound disaster recovery models; and, (5) proposed what an adequate epidemic recovery model would need to consider.

### 4.1. Engagement with research on natural disaster recovery

Comparing key informant observations with learnings from the mature field of disaster recovery research suggests some potential parameters for epidemic recovery modeling as well as points of convergence. To begin, the study of natural disaster recovery has evolved from an initial focus on immediate and apparent damages that equated recovery with the rebuilding of physical surroundings, to a much more comprehensive treatment of disaster impacts and of integrated efforts to make communities whole again – politically (e.g., faith in institutions), economically (e.g., competing financial priorities), socially (e.g., social

cohesion), environmentally (e.g., natural mitigation), and emotionally (e.g., sense of safety) (Arendt and Alesch, 2014; Johnson and Hayashi, 2012; Lindell, 2013; Monteil et al., 2020; Philips and Neal, 2007; Smith et al., 2018; Tierney and Oliver-Smith, 2012). Similarly, our key informants argue for a holistic model of post-epidemic healing, rather than a purely biomedical one; they cite, for instance, the greater psychological, social, and economic costs and, hence, the complex recovery challenges that arise with the fear of contagion.

Although warning against a medicalized definition of epidemic recovery, interviewees still want added scrutiny of the health sector due to its heightened vulnerability (especially human resources) in a major outbreak. Reflecting this, an epidemic recovery model can benefit from the natural disaster literature's holism and from the health systems-strengthening literature's emphasis on sector resilience in high-, middle-, and low-income settings. Health systems research suggests that success of disaster recovery efforts depends on sector capacities to absorb and adapt to the impacts of rapid onset crises, and to evolve to meet the demands of post-crisis environments (Blanchet et al., 2017; Kruk et al., 2015). Given that epidemic effects are most severe in low-income countries – which typically have weak capacity to deliver routine health services – the health systems-strengthening scholarship can help accommodate epidemic recovery thinking in applying to a spectrum of diverse geographies, resource levels, and governance structures.

Interviewee comments resonate with other major findings in the study of natural disaster, such as knowing multiple futures are possible post-disaster: on one end, transforming society, and the other, replicating the status quo (Fernandez and Ahmed, 2019; Kim and Olshansky, 2014). Where communities ultimately fall on this continuum depends in large part on how competing social aims, economic interests, and/or political powers play out: get back to how things were even though vulnerability to a future disaster remains (e.g., rebuild in a flood zone) or make systemic improvements (e.g., turn formerly occupied floodplains into green fields and build affordable housing elsewhere) (Arendt and Alesch, 2014; Smith et al., 2018; Tierney and Oliver-Smith, 2012). Key informants, too, highlighted that the post-epidemic process entails complex trade-offs, as in scarce public resources being carved up among response, recovery, and steady state needs, and that people waver in defining post-epidemic recovery as a return to baseline or a chance to evolve.

Natural disaster theorists have moved away from early recovery models marked by fixed phases, predictable milestones, and uniform progression (Rubin, 2009). Instead, they have envisioned post-disaster recovery as a non-linear, multi-level process that can unfold unevenly, depending on an affected group's socio-demographics and the unit of analysis under study: e.g., household, neighborhood, community, sector, region (Arendt and Alesch, 2014; Finucane et al., 2020; Johnson and Hayashi, 2012; Monteil et al., 2020; Tierney and Oliver-Smith, 2012). After a major flood or hurricane, an affected city may seemingly be back to normal. Yet, specific neighborhoods may still be lacking critical services and individual families still reeling from financial and psychological effects. Disaster researchers note, too, that event severity can influence the cadence and quality of recovery (Philips and Neal, 2007). Similarly, study informants cautioned that a one-size-fits-all model for post-epidemic recovery may be impossible because “it depends.” An epidemic is a very organic event in which elements of culture, the social sphere, politics, health systems, human biology, and pathogen are integrally related.

The study, policy, and practice of natural disaster recovery reinforce the need for certain elements in a model of epidemic recovery and potentially speed a model's development. At the same time, the key informants called out the need for any epidemic recovery modeling exercise to be mindful of the idiosyncrasies and complexities of a biological incident.

#### 4.2. Implications for community recovery from COVID-19

The course of the COVID-19 pandemic is still unfolding. Recovery is highly desired, but consensus about what that means and how to get there seems lacking. In their commentary on post-epidemic recovery, the study informants called out dilemmas and unsettled questions that seem prescient, when applied in the current context: Are medical and/or economic indicators alone sufficient to gauge if a community has really recovered from the pandemic, or should indicators for things like social connectedness and solidarity and/or psychological stability and growth after trauma also be included (South et al., 2020; Jewett et al., 2021; Yong, 2021)? Can a city or country claim that the pandemic is “over” for its residents, when specific communities and social groups are still struggling (Corbie-Smith et al., 2021; Baral, 2021)? Does or should recovery from the pandemic equate with a return to the familiar rhythms of life before the SARS-CoV-2 virus emerged or a fundamental reconfiguration of society so as not to have the same thing happen again (Carlson and Phelan, 2020; Loewenson et al., 2021; UN, 2020)?

In the U.S., pandemic recovery – judging from news reports and official statements – has been to date conceptualized largely in terms of falling case numbers, hospitalizations, and deaths; the number of vaccinations administered at state and national levels; and the resumption of educational, social, and commercial routines (National Governors Association & Association of State and Territorial Health Officers, 2020). Rare is the vision of pandemic recovery in a more holistic and transformative sense, as in the case of the *Hawai'i State Commission on the Status of Women* (2020). This state body sees the process as a chance to advance sustainable livelihoods, strengthen the state's social infrastructure (i.e., childcare, education, and health care), protect the state's natural ecology, and repair historical harms and intergenerational trauma due to sexism and racism.

The trajectory of the COVID-19 pandemic in the U.S. illustrates the scale at which holistic recovery efforts must proceed, as well as the levels of coordination, stakeholder involvement, and investment of human, social, and financial capital that this undertaking will undoubtedly demand. These efforts must also consider how the health and economic burdens of COVID-19 have disproportionately harmed marginalized communities, particularly lower-income communities of color (Alcendor, 2020; Corbie-Smith et al., 2021). Concomitantly, the benefits of vaccination, remote working arrangements, pandemic relief loans to businesses, and other measures intended to alleviate these burdens have not been equitably distributed among the communities hit hardest by the pandemic (Gould and Shierholz, 2020; Hamel et al., 2021; Heeb, 2021). Thus, recovery plans must necessarily center transformation, taking care to ensure that restorative efforts do not simply refabricate the starting conditions that gave rise to the inequitable impacts of COVID-19 (Schoch-Spana et al., 2021).

Post-pandemic recovery will likely proceed at varying timelines across different settings and communities, depending on the unique social and structural factors modulating the trajectories of local COVID-19 epidemics. A robust model of epidemic recovery that accounts for these factors, articulates the relationships between them, and centers input and evidence from the hardest-hit populations, could help decision-makers at all levels navigate the process of restoring and transforming their communities.

#### 4.3. Building upon this initial inquiry – first next steps

Beginning prior to reports of the SARS-CoV-2 virus, overlapping with the pandemic's earliest days, and being read now as people grapple with the meaning and means for COVID-19 recovery, this study lays important groundwork in the development of an urgently needed recovery model. As the key informants have suggested, an adequate model must be fit for purpose: Researchers would benefit from a pandemic recovery model that guides increasingly sophisticated efforts to explain and predict restoration/transformation patterns and help contribute to a



much-needed PHEP evidence base (Khan et al., 2015; Savoia et al., 2009, 2017). Coming with more operational needs, policymakers and programmatic heads would benefit from a framework to inform recovery metrics.

Orchestrating recovery from a catastrophic event like the COVID-19 pandemic is a core governmental competency. To exercise this capability, decision makers require useful and validated metrics to measure and monitor – and correct course, when needed – the processes by which communities become whole again (American Planning Association, 2014; Schwab, 2014). As of now, no authoritative model and metrics for a holistic, transformative recovery from the COVID-19 pandemic exist. To fill this major gap in pandemic governance, we plan to develop a set of recovery indicators (Pan American Health Organization, 2018). The central research question for this follow-on project is: “By what measures could public sector decision makers, at the local level, know that their coordinated efforts to facilitate COVID-19 recovery are working for the socially vulnerable individuals and communities who have been hit the hardest by the pandemic?”

To develop a framework for identifying and defining indicators, we will use insights from this formative study and an empirical exploration of COVID-19 recovery efforts that are underway, in planning, and/or hoped for in select U.S. jurisdictions. Given the pandemic’s totalizing effects on community life, we will interview key informants using an eclectic sampling frame and touching on wide-ranging issues. Anticipated interviewees include elected/appointed officials (county/municipal), sector heads (e.g., mental health, emergency management, social services, education), long-range planners (e.g., disaster recovery, economic development), business leaders, and heads of community- and faith-based organizations with roots in racial/ethnic minority communities. Topics include wealth (e.g., lost jobs, shuttered businesses), human development (e.g., interrupted education), mental health (e.g., healthcare worker burn out, complicated grieving), physical health (e.g., “long-haul” effects), civic institutions (e.g., safety net demands), social capital (e.g., isolation, political polarization), spirituality (e.g., interrupted in-person worship), and culture (e.g., financially stressed museums).

We will gear the thematic analysis of key informant interview data toward identifying candidate indicators and grouping them into domains, and then, use a Delphi method to iterate, integrate, and validate a final set of indicators. In this instance, the Delphi approach is appropriate given that its key purpose is the aggregation of informed judgment on real-world matters that are largely unexplored, difficult to define, and/or future oriented (Hasson et al., 2002; Khan et al., 2019). Populated using earlier inclusion criteria, the Delphi panel will evaluate indicators according to their importance (i.e., a priority for returning to/achieving a holistic state of wellbeing post-pandemic) and actionability (i.e., under the control of a public sector leader).

## 5. Conclusion

The ongoing pandemic, recent struggles to contain Ebola in West and Central Africa, and annual efforts to combat seasonal influenza demonstrate clear alignment between the moral, political, and public health imperatives to invest in post-epidemic community recovery. The physician Donald Berwick (2020, p. 225) recently wrote that “when the fabric of communities upon which health depends is torn, then healers are called to mend it. The moral law within insists so. Improving the social determinants of health will be brought at last to a boil only by the heat of the moral determinants of health.” Dedicated scholarship around an epidemic recovery process that is holistic and transformative comprises an important first step toward fulfilling these imperatives. At the same time, the COVID-19 pandemic has made most urgent the need for a practical roadmap for communities to follow in revitalizing themselves after immense physical, psychological, and financial suffering and in strengthening resilience to future infectious disease emergencies.

## Credit author statement

Monica Schoch-Spana: Conceptualization, Methodology, Investigation, Formal Analysis, Writing – Original Draft, Writing – Review & Editing, Supervision. Sanjana Ravi: Investigation, Formal Analysis, Writing – Original Draft, Writing – Review & Editing. Elena Martin: Investigation, Formal Analysis, Writing – Original Draft.

## References

- Alcendor, D.J., 2020. Racial disparities-associated COVID-19 mortality among minority populations in the US. *J. Clin. Med.* 9 (8), 2442. <https://doi.org/10.3390/jcm9082442>.
- Arendt, L.A., Alesch, D.J., 2014. *Long-term Community Recovery from Natural Disasters*, first ed. CRC Press.
- Baral, P., 2021. Health systems and services during COVID-19: lessons and evidence from previous crises: a rapid scoping review to inform the United Nations research roadmap for the COVID-19 recovery. *Int. J. Health Serv.* 8 <https://doi.org/10.1177/0020731421997088>, 20731421997088.
- Berwick, D.M., 2020. The moral determinants of health. *J. Am. Med. Assoc.* 324 (3), 225–226. <https://doi.org/10.1001/jama.2020.11129>.
- Blanchet, K., Nam, S.L., Ramalingam, B., Pozo-Martin, F., 2017. Governance and capacity to manage resilience of health systems: towards a new conceptual framework. *Int. J. Health Pol. Manag.* 6 (8), 431–435. <https://doi.org/10.15171/ijhpm.2017.36>.
- Butler, A.J., Thomas, M.K., Pintar, K.D., 2015. Systematic review of expert elicitation methods as a tool for source attribution of enteric illness. *Foodb. Pathog. Dis.* 12 (5), 367–382. <https://doi.org/10.1089/fpd.2014.1844>.
- Carlin, E.P., Machalaba, C., Berthe, F.C.J., Long, K.C., Karesh, W.B., 2019. *Building Resilience to Biothreats: an Assessment of Unmet Core Global Health Security Needs*. EcoHealth Alliance.
- Carlson, C.J., Phelan, A.L., 2020. A choice between two futures for pandemic recovery. *Lancet Planet Health* 4 (12), e545–e546. [https://doi.org/10.1016/S2542-5196\(20\)30245-X](https://doi.org/10.1016/S2542-5196(20)30245-X).
- Charmaz, K., Bryant, A., 2011. Grounded theory and credibility. In: Silverman, D. (Ed.), *Qualitative Research*. SAGE, pp. 291–309.
- Colson, A.R., Cooke, R.M., 2018. Expert elicitation: using the classical model to validate experts’ judgments. *Rev. Environ. Econ. Pol.* 12 (1), 113–132. <https://doi.org/10.1093/reep/rev022>.
- Corbie-Smith, G., Wolfe, M.K., Hoover, S.M., Dave, G., 2021. Centering equity and community in the recovery of the COVID-19 pandemic. *N. C. Med. J.* 82 (1), 62–67. <https://doi.org/10.18043/ncm.82.1.62>.
- COVID Impact Survey, 2020. <https://www.covid-impact.org/results>.
- Erwin, P.C., Brownson, R.C., 2017. Macro trends and the future of public health practice. *Annu. Rev. Publ. Health* 38, 393–412. <https://doi.org/10.1146/annurev-publhealth-031816-044224>.
- Fernandez, G., Ahmed, I., 2019. “Build back better” approach to disaster recovery: research trends since 2006. *Prog Disaster Sci* 1, 100003. <https://doi.org/10.1016/j.pdisas.2019.100003>.
- Finucane, M.L., Acosta, J., Wicker, A., Whipkey, K., 2020. Short-term solutions to a long-term challenge: rethinking disaster recovery planning to reduce vulnerabilities and inequities. *Int. J. Environ. Res. Publ. Health* 17 (2), 482. <https://doi.org/10.3390/ijerph17020482>.
- Gibson, P.J., Theadore, F., Jellison, J.B., 2012. The common ground preparedness framework: a comprehensive description of public health emergency preparedness. *Am. J. Public Health* 102 (4), 633–642. <https://doi.org/10.2105/AJPH.2011.300546>.
- Global Facility for Disaster Reduction and Recovery, 2020. *Disaster Recovery Framework Guide*. March. <https://www.gfdrr.org/sites/default/files/publication/DRF%20Guide.pdf>.
- Gould, E., Shierholz, H., 2020. Not Everybody Can Work from Home: Black And Hispanic Workers Are Much Less Likely to Be Able to Telework. March 19. Economic Policy Institute. <https://www.epi.org/blog/black-and-hispanic-workers-are-much-less-likely-to-be-able-to-work-from-home/>.
- Haerberer, M., Tsovala, S., Riley, P., Cano-Portero, R., Rexroth, U., Ciotti, M., Fraser, G., 2020. Tools for assessment of country preparedness for public health emergencies: a critical review. *Disaster Med. Public Health Prep.* 1–11 (Advance online publication).
- Hamel, L., Lopes, L., Kearney, A., Sparks, G., Stokes, M., Brodie, M., 2021. KFF COVID-19 vaccine monitor: June 2021. KFF. June 30. <https://www.kff.org/coronavirus-covid-19/poll-finding/kff-covid-19-vaccine-monitor-june-2021/>.
- Hasson, F., Keeney, S., McKenna, H., 2000. Research guidelines for the Delphi survey technique. *J. Adv. Nurs.* 32 (4), 1008–1015.
- Hawai'i State Commission on the Status of Women, Department of Human Services, 2020. *Building bridges, not walking on backs: a feminist economic recovery plan for COVID-19*. <https://humanservices.hawaii.gov/wp-content/uploads/2020/04/4.13.20-Final-Cover-D2-Feminist-Economic-Recovery-D1.pdf>.
- Heeb, G., 2021. Businesses owned by blacks, latinos less than half as likely to be approved for loans than whites, fed says. *Forbes* (April 15). <https://www.forbes.com/sites/ginaheeb/2021/04/15/businesses-owned-by-blacks-latinos-less-than-half-as-likely-to-be-approved-for-loans-than-whites-fed-says/>.

- Herring, A., 2016. Sociology of disaster. In: Bobrowsky, P.T. (Ed.), *Encyclopedia of Natural Hazards*. Springer. [https://link.springer.com/referenceworkentry/10.1007/978-1-4020-4399-4\\_326](https://link.springer.com/referenceworkentry/10.1007/978-1-4020-4399-4_326).
- Horney, J., Carbone, E.G., Lynch, M., Ji, C.S., Jones, T., 2021. How public health agencies use the public health emergency preparedness capabilities. *Disaster Med. Public Health Prep.* 15 (1), 1–2. <https://doi.org/10.1017/dmp.2019.133>.
- Horney, J., Dwyer, C., Aminto, M., Berke, P., Smith, G., 2017. Developing indicators to measure post-disaster community recovery in the United States. *Disasters* 41 (1), 124–149. <https://pubmed.ncbi.nlm.nih.gov/26987566/>.
- Horney, J., Dwyer, C., Chirra, B., McCarthy, K., Shafer, J., Smith, G., 2018. Measuring successful disaster recovery. *Int. J. Mass Emergencies Disasters* 36 (1), 1–22. <http://www.ijmed.org/articles/737/>.
- Institute of Medicine, 2015. *Healthy, Resilient, and Sustainable Communities after Disasters: Strategies, Opportunities, and Planning for Recovery*. <https://www.nap.edu/catalog/18996/healthy-resilient-and-sustainable-communities-after-disasters-strategies-opportunities-and>.
- Jewett, R.L., Mah, S.M., Howell, N., Larsen, M.M., 2021. Social cohesion and community resilience during COVID-19 and pandemics: a rapid scoping review to inform the United Nations research roadmap for COVID-19 recovery. *Int. J. Health Serv.* 51 (3), 325–336. <https://doi.org/10.1177/0020731421997092>.
- Johnson, L.A., Hayashi, H., 2012. Synthesis efforts in disaster recovery research. *Int. J. Mass Emergencies Disasters* 30 (2), 212–239.
- Khan, Y., Brown, A.D., Gagliardi, A.R., O'Sullivan, T., Lacarte, S., Henry, B., Schwartz, B., 2019. Are we prepared? The development of performance indicators for public health emergency preparedness using a modified Delphi approach. *PLoS One* 14 (12), e0226489. <https://doi.org/10.1371/journal.pone.0226489>.
- Khan, Y., Fazli, G., Henry, B., de Villa, E., Tsamis, C., Grant, M., Schwartz, B., 2015. The evidence base of primary research in public health emergency preparedness: a scoping review and stakeholder consultation. *BMC Publ. Health* 15, 432. <https://doi.org/10.1186/s12889-015-1750-1>.
- Kim, K., Olshansky, R.B., 2014. The theory and practice of building back better. *J. Am. Plann. Assoc.* 80 (4), 289–292. <https://doi.org/10.1080/01944363.2014.988597>.
- Kossakowski, F., 2020. Why People Are Taking More Coronavirus Risks as the Pandemic Drags on. *PBS News Hour*. July 29. <https://www.pbs.org/newshour/health/caution-fatigue-and-the-stress-behind-living-through-a-pandemic>.
- Kruk, M.E., Myers, M., Varpilah, S.T., Dahn, B.T., 2015. What is a resilient health system? Lessons from Ebola. *Lancet* 385 (9980), 1910–1912. [https://doi.org/10.1016/S0140-6736\(15\)60755-3](https://doi.org/10.1016/S0140-6736(15)60755-3).
- Lindell, M.K., 2013. Recovery and reconstruction after disaster. In: Bobrowsky, P.T. (Ed.), *Encyclopedia of Natural Hazards*. Springer Netherlands, pp. 812–824.
- Loewenson, R., D'Ambruso, L., Duc, D.M., Hjerremann, R., Lichuma, W., Mason, E., Nixon, E., Rudolph, N., Villar, E., 2021. Equitable recovery from COVID-19: bring global commitments to community level. *BMJ Glob Health* 6 (1), e004757. <https://doi.org/10.1136/bmjgh-2020-004757>.
- Martinez, D., Talbert, T., Romero-Steiner, S., Kosmos, C., Redd, S., 2019. Evolution of the public health preparedness and response capability standards to support public health emergency management practices and Processes. *Health Sec.* 17 (6), 430–438. <https://doi.org/10.1089/hs.2019.0076>.
- Monteil, C., Simmons, P., Anna Hicks, A., 2020. Post-disaster recovery and sociocultural change: rethinking social capital development for the new social fabric. *Int. J. Disaster Risk Reduct.* 42, 101356. <https://doi.org/10.1016/j.ijdrr.2019.101356>.
- National Governors Association, Association of State and Territorial Health Officers, 2020. *Roadmap to Recovery: A Public Health Guide for Governors*. <https://www.nga.org/wp-content/uploads/2020/04/NGA-Report.pdf>.
- Nelson, C., Lurie, N., Wasserman, J., Zakowski, S., 2007. Conceptualizing and defining public health emergency preparedness. *Am. J. Publ. Health* 97 (Suppl. 1), S9–S11. <https://doi.org/10.2105/AJPH.2007.114496>.
- Nelson, C., Lurie, N., Wasserman, J., Zakowski, S., Leuschner, K.J., 2008. Conceptualizing and Defining Public Health Emergency Preparedness. RAND Corporation. [https://www.rand.org/pubs/working\\_papers/WR543.html](https://www.rand.org/pubs/working_papers/WR543.html).
- Pan American Health Organization, 2018. *Health Indicators: Conceptual and Operational Considerations*. <https://www.paho.org/en/documents/health-indicators-conceptual-and-operational-considerations>.
- Pan American Health Organization, 2017. *World Health Organization Regional Office for the Americas, and the Global Facility for Disaster Reduction and Recovery. Health sector recovery*. <https://reliefweb.int/report/world/disaster-recovery-guidance-series-health-sector-recovery>.
- Phillips, B.D., Neal, D.M., 2007. Recovery. In: Waugh Jr., W.L., Tierney, K. (Eds.), *Emergency Management: Principles and Practice for Local Government*, second ed. ICMA Press.
- Public Safety Canada, 2019. *Emergency Management Strategy for Canada: toward a Resilient 2030*. <https://www.securepublique.gc.ca/cnt/rsrscs/plbctns/mrgncy-mngmnt-strtyg/mrgncy-mngmnt-strtyg-en.pdf>.
- Rao, L., McNaughton, M., Osei-Bryson, K., Haye, M., 2009. The role of ontologies in disaster recovery planning. *AMCIS 2009 Proceed.* 713. <https://core.ac.uk/download/pdf/301344193.pdf>.
- Rose, D.A., Murthy, S., Brooks, J., Bryant, J., 2017. The evolution of public health emergency management as a field of practice. *Am. J. Publ. Health* 107 (S2), S126–S133. <https://doi.org/10.2105/AJPH.2017.303947>.
- Ryan, G.W., Bernard, H.R., 2003. Techniques to identify themes. *Field Methods* 15 (1), 85–109. <https://doi.org/10.1177/1525822X02239569>.
- Rubin, C.B., 2009. Long term recovery from disasters – the neglected component of emergency management. *Article 46 J. Homel. Secur. Emerg. Manag.* 6 (1). <https://journalistsresource.org/wp-content/uploads/2012/10/jhsem.2009.6.1.1616.pdf>.
- Savoia, E., Massin-Short, S.B., Rodday, A.M., Aaron, L.A., Higdon, M.A., Stoto, M.A., 2009. Public health systems research in emergency preparedness: a review of the literature. *Am. J. Prev. Med.* 37 (2), 150–156. <https://doi.org/10.1016/j.amepre.2009.03.023>.
- Savoia, E., Lin, L., Bernard, D., Klein, N., James, L.P., Guicciardi, S., 2017. Public health system research in public health emergency preparedness in the United States (2009–2015): actionable knowledge base. *Am. J. Public Health* 107 (S2), e1–e6. <https://doi.org/10.2105/AJPH.2017.304051>.
- Schoch-Spana, M., 2020. An epidemic recovery framework to jumpstart analysis, planning, and action on a neglected aspect of global health security. *Clin. Infect. Dis.* <https://doi.org/10.1093/cid/ciaa486>. Advance online publication.
- Schoch-Spana, M., Brunson, E., Hosangadi, D., Long, R., Ravi, S., Taylor, M., Trotochaud, M., Veenema, T.G., on behalf of the Working Group on Equity in COVID-19 Vaccination, 2021. *Equity in Vaccination: A Plan to Work with Communities of Color toward COVID-19 Recovery and beyond*. Johns Hopkins Center for Health Security. [https://www.centerforhealthsecurity.org/our-work/pubs\\_archive/pubs-pdfs/2021/20210209-CommuniVax-national-report.pdf](https://www.centerforhealthsecurity.org/our-work/pubs_archive/pubs-pdfs/2021/20210209-CommuniVax-national-report.pdf).
- Schwab, J. (Ed.), 2014. *Planning for post-disaster recovery: next generation*. American Planning Association.
- See reopening plans and mask mandates for all 50 states, 2021. June 30. *The New York Times*. <https://www.nytimes.com/interactive/2020/us/states-reopen-map-coronavirus.html>.
- Smith, G., Martin, A., Wenger, D.E., 2018. Disaster recovery in an era of climate change: the unrealized promise of institutional resilience. In: Rodriguez, H., Donner, W., Trainor, J.E. (Eds.), *Handbook of Disaster Research*. Springer International Publishing, pp. 595–619.
- Smith, G.P., Wenger, D., 2007. Sustainable disaster recovery: operationalizing an existing agenda. In: Rodriguez, H., Quarantelli, E.L., Dynes, R.R. (Eds.), *Handbook of Disaster Research*. Springer, pp. 234–257.
- South, J., Stansfield, J., Amlöt, R., Weston, D., 2020. Sustaining and strengthening community resilience throughout the COVID-19 pandemic and beyond. *Perspect. Publ. Health* 140 (6), 305–308. <https://doi.org/10.1177/1757913920949582>.
- Stoto, M.A., Nelson, C., Savoia, E., Ljungqvist, I., Ciotti, M., 2017. A public health preparedness logic model: assessing preparedness for cross-border threats in the European region. *Health Secur.* 15 (5), 473–482. <https://doi.org/10.1089/hs.2016.0126>.
- Tierney, K., Oliver-Smith, A., 2012. Social dimensions of disaster recovery. *Int. J. Mass Emergencies Disasters* 30 (2), 123–146.
- Tsipursky, G., 2020. Bad News about the Pandemic: We're Not Getting Back to Normal Any Time Soon. July 18. *Scientific American*. <https://www.scientificamerican.com/article/bad-news-about-the-pandemic-were-not-getting-back-to-normal-any-time-soon/>.
- United Nations, 2015. *The Sendai Framework for Disaster Risk Reduction 2015–2030*. <https://www.unisdr.org/files/43291sendaiframeworkfordrren.pdf>.
- United Nations, 2020. *UN Research Roadmap for the COVID-19 Recovery: Leveraging the Power of Science for a More Equitable, Resilient and Sustainable Future*. <https://www.un.org/en/pdfs/UNCOVID19ResearchRoadmap.pdf>.
- United Nations Office for Disaster Risk Reduction, 2012. *Guidance Note on Recovery – Pre-disaster Recovery Planning*. <https://www.undrr.org/publication/guidance-note-recovery-pre-disaster-recovery-planning>.
- United States Department of Health and Human Services, Centers for Disease Control and Prevention, 2012. *Principles of Epidemiology in Public Health Practice*, third ed. <https://www.cdc.gov/csels/dsepd/ss1978/SS1978.pdf>.
- United States Department of Homeland Security, 2009. *Planning Guidance for Recovery Following a Biological Incident*. Security. <https://www.hsdl.org/?view&did=10515>.
- United States Department of Homeland Security, 2012. *Key Planning Factors for Recovery from a Biological Terrorism Incident*. Summer. [https://www.fema.gov/sites/default/files/documents/fema\\_biological-incident-kpf.pdf](https://www.fema.gov/sites/default/files/documents/fema_biological-incident-kpf.pdf).
- United States Department of Homeland Security, 2016a. *National Disaster Recovery Framework*. June, second ed.. [https://www.fema.gov/sites/default/files/2020-06/national\\_disaster\\_recovery\\_framework\\_2nd.pdf](https://www.fema.gov/sites/default/files/2020-06/national_disaster_recovery_framework_2nd.pdf).
- United States Department of Homeland Security, 2016b. *Recovery Federal Interagency Operational Plan*. August, second ed.. [https://www.fema.gov/sites/default/files/2020-07/Recovery\\_FIOP\\_2nd\\_aug2016.pdf](https://www.fema.gov/sites/default/files/2020-07/Recovery_FIOP_2nd_aug2016.pdf).
- United States Department of Homeland Security, January 2017. *Biological Incident Annex to the Response and Recovery Federal Interagency Operational Plans*. [https://www.fema.gov/sites/default/files/2020-07/fema\\_incident-annex\\_biological.pdf](https://www.fema.gov/sites/default/files/2020-07/fema_incident-annex_biological.pdf).
- World Bank Group, 2020. *Gender Equality and Women's Empowerment in Disaster Recovery*. Disaster recovery guidance series. <https://openknowledge.worldbank.org/handle/10986/33684>.
- World Health Organization, 2016a. *International Health Regulations (2005)*, third ed. <https://apps.who.int/iris/bitstream/handle/10665/246107/9789241580496-eng.pdf?sequence=1>.
- World Health Organization, 2016b. *Joint External Evaluation Tool: International Health Regulations (2005)*. <http://www.who.int/iris/handle/10665/204368>.
- World Health Organization, 2019. *Thematic Paper on the Status of Country Preparedness Capacities: Background Report Commissioned by the Global Preparedness Monitoring Board (GPMB)*. [https://apps.who.int/gpmb/assets/thematic\\_papers/tr-2.pdf](https://apps.who.int/gpmb/assets/thematic_papers/tr-2.pdf).
- Wulff, K., Donato, D., Lurie, N., 2015. What is health resilience and how can we build it? *Annu. Rev. Publ. Health* 36, 361–374. <https://doi.org/10.1146/annurev-publichealth-031914-122829>.
- Yong, E., 2021. What happens when Americans can finally exhale? May 21 *Atlantic*. <https://www.theatlantic.com/health/archive/2021/05/pandemic-trauma-summer/618934/>.