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Abstract

Pandemic response takes place in distributed, uncertain, and high-tempo environments. These conditions require public health agencies to rapidly generate and roll out publicly accountable responses in the face of incomplete and ambiguous evidence. To perform under these conditions, public health organizations have devised several tools to support decision making and response. This article examines two such tools that debuted during the 2009 H1N1 outbreak—the 2005 International Health Regulations and influenza pandemic planning. Relying on an international network of researchers who gained access to lead public health agencies in advance of the 2009 pandemic, this study draws on several forms of data—primary documentation, interviews, and an extended workshop with key officials—that were collected as the pandemic unfolded. With this unique dataset, we analyze the performance of the International Health Regulations and pandemic influenza plans from a "sensemaking" perspective. We find that insufficient attention to both the complexities and time horizons involved with adequate sensemaking limited the ability of both tools to fully meet their goals. To improve organizational performance during global pandemics, the sensemaking perspective calls attention to the importance of informal venues of information-sharing and to the need for decisionmakers to continually update planning assumptions.

KEYWORDS: emergency preparedness, infectious disease outbreaks, organizational decision making, regulations

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acknowledge the public health officials who agreed to participate in this research. Any errors remaining in the paper are our own.

Introduction

Following the 2003 outbreak of SARS and in anticipation of a novel influenza pandemic, the World Health Organization (WHO) led a two-pronged effort to improve international pandemic response. First, WHO completed a substantial revision of the International Health Regulations (IHR), requiring parties to the World Health Assembly to share information about suspected outbreaks in a timely and systematic manner. Second, WHO urged member countries to develop pandemic influenza plans to facilitate the transition from routine public health operations to non-routine, emergency operations. These efforts were designed to increase the capacity of those managing an unfolding pandemic by ensuring a reliable flow of information and delineating well-scripted organizational roles and responses.

A review of response efforts during the 2009 H1N1 pandemic demonstrates that neither the revised IHR nor the pandemic influenza plans were fully successful in meeting their respective goals. These shortcomings, we argue, stem from an incomplete view of the challenges of sensemaking inherent in both tools. The IHR structure rests on an assumption that formalized and validated information will be sufficient to inform responders of the nature of an emerging pandemic. In practice, sensemaking requires access to contextual information whose importance can only be ascertained during the course of a pandemic. The kinds of information collected through formal channels will necessarily be incomplete and force responders to seek other sources of information. Similarly, pandemic influenza plans assume that sensemaking during a pandemic is bounded in time and can be completed in the earliest stages of outbreak discovery. Instead, we find that sensemaking is on-going and must be continually re-evaluated in light of novel information, thereby limiting the usefulness of the mechanistic approaches employed in most plans.

Although several evaluations of the H1N1 pandemic have been written (Bell et al. 2009; Condon and Sinha 2009; Gostin 2009; Katz 2009), none call attention to the sensemaking challenges that limit the effectiveness of the IHR and pandemic influenza plans. Using data collected from interviews, observational reports, and a workshop discussing the early response to the H1N1 2009 outbreak, this paper argues that formalized efforts to address the challenges of pandemic response in distributed, uncertain, and time-pressured environments are limited by inadequate consideration of sensemaking.

Background

Overseen by WHO, the IHR specifies formal procedures for reporting outbreaks and encourages countries to develop basic surveillance capacity for detection of outbreaks. It also establishes a formal system for communicating information regarding an outbreak of international significance with signatory states. Shortcoming of the previous IHR (1969) came to light during the SARS outbreak, prompting members of the World Health Assembly to revisit those regulations. First, the IHR contained a narrow list of reportable diseases—cholera, plague, and yellow fever, leaving a vacuum of reporting responsibility around non-listed and novel diseases. Second, the 1969 regulations allowed WHO to act only in response to official notifications from member states. Because states experiencing outbreaks can sustain substantial economic losses from travel and trade restrictions, they have few incentives to report outbreaks to the international community. Thus, under the 1969 regulations, WHO, even when it had credible evidence of an outbreak, had no license to act absent official communications from the host country.

The revised IHR (2005) attempts to correct these shortcomings through several specific improvements: 1) it obliges states to notify WHO about *any* disease or health event that constitutes a potential “public health emergency of international concern” (PHEIC); 2) it allows the WHO to act independently of official country notification of an outbreak; and 3) it creates a formal system of information-sharing.¹ After 2005, a signatory country is required to report a PHEIC to WHO whenever it experiences an outbreak that meets two or more of the following criteria: 1) the public health impact of the event is serious; 2) the event is unusual or unexpected; 3) there is a significant risk of international spread; and/or 4) there is a significant risk of international travel or trade restrictions (WHO 2008). When a country reports a PHEIC, it must provide basic epidemiological information: e.g., the number of cases and deaths, clinical signs and symptoms, whether the causative agent is novel, the population at risk, laboratory test results, the scale of the outbreak, and control measures implemented. WHO may also request additional information on how the event affects the country’s infrastructure and international travel. Information contained in a PHEIC report is confidential and shared with other member states only after it has been verified by WHO.

Once an event is verified, WHO, ideally, becomes a clearinghouse for information about that event for the international public health community and the media. While WHO has no direct authority over country-level response, it uses

¹ For a discussion of the goals of the revised IHR, see Plotkin et al. (2007). For assessments of the performance of the 2005 IHR during the H1N1 2009 pandemic, see Bell et al. (2009); Condon and Sinha (2009); Gostin (2009); and Katz (2009).

verified information to designate phases of a pandemic and to generate response recommendations. It also coordinates networks of experts that can be mobilized to help host countries investigate and contain outbreaks. Thus, information gathered through IHR reporting forms the basis of WHO's messaging to and support of the larger international community during a pandemic. A key provision of the revised IHR, however, allows WHO to act on information that it has *not* received via official channels. This encourages transparency because withholding information will not necessarily prevent WHO from publicizing an outbreak.

Pandemic influenza planning efforts are the result of public health concerns stemming from the reemergence of highly pathogenic H5N1 viruses beginning in 2003 (Webby and Webster 2003).² Though many H5N1 infections have occurred in humans since 2003, there has been no sustained human-to-human transmission of the virus. However, a mutation that allowed for such transmission could result in a highly virulent global pandemic (Guan et al. 2004; Malik Peiris, deJong, and Guan 2007). In order to increase the capacity to cope with such a pandemic, WHO initiated efforts to encourage public health agencies at all levels to engage in pandemic influenza planning. This includes developing written plans and conducting preparedness exercises. Written plans provide a script that can guide decision-making during an unfolding pandemic. These plans are intended to facilitate the transition from routine to emergency operations by mapping an anticipated network of actors and providing that network with a set of response actions and capabilities. Many jurisdictions also undertake exercises to improve knowledge of response protocols and to build relationships among the community of responders. These exercises use rehearsal as a way to provide experience with non-routine pandemic operations and to expose potential weaknesses in response capacity. Both plans and exercises attempt to anticipate required organizational capacities and necessary points of coordination among actors, organizations, and sectors that do not work together on a routine basis. Given that response organizations have limited opportunities to test and refine their pandemic response structures and practices, planning documents and exercises provide an alternate mechanism for approaching levels of organizational performance that might otherwise emerge from more typical modes of organizational learning.

² A number of studies assess the current state of public health preparedness efforts, citing both accomplishments and continued shortfalls (Dausey, Lurie, and Diamond 2005; Lurie, Wasserman, and Nelson 2006; Lurie et al. 2004). While pandemic influenza planning falls under the broader rubric of public health preparedness, few studies assess pandemic influenza planning efforts specifically. The studies that do tend to focus on gaps in current pandemic planning implementation while taking for granted the existing planning logic (e.g., Gray, Trampel, and Roth 2007; Gupta, George, and Nguyen-Van-Tam 2008).

Though pandemic influenza plans vary by jurisdiction, they have a number of shared elements that derive from WHO guidance.³ One of the central mechanisms at work in current pandemic influenza plans is an explicit link between pandemic “phase”—an indication of the scope of a pandemic’s spread—and response activities and priorities. Response actions might be tied to WHO phase declarations or to similar declarations made at more proximate levels of governance. Once a new phase has been declared, pandemic influenza plans instruct responders either to ramp up or scale back response activities. Thus, given certain stimuli, written plans trigger a scripted response.

Developed with the aim of reducing the substantial complexities involved in pandemic response through careful attention to pandemic governance, both the IHR and pandemic influenza plans had a role in facilitating response to the 2009 H1N1 outbreak. At the same time, both tools fell short of their goals in supporting pandemic response. To understand the limits of formal information-sharing and planning during pandemic response, we situate our analysis in the literature on organizational sensemaking.

Theoretical Framework

Organizations involved in the management of pandemic influenza face a set of performance challenges that carry them beyond their routine operations into an uncertain arena where decisions must be made quickly with limited and ambiguous information. To set the context for our theoretical discussion, we describe three characteristics of pandemic response that call attention to both the value and the limitations of the IHR and pandemic plans.

1. *Distributed Response*: information and action are distributed across political jurisdictions, institutional boundaries, technical disciplines, geography, and time. A major coordinating challenge posed by distributed information and action is that effective response may require response institutions to operate largely independently of each other on some matters (loose-coupling), but require close alignment on others (tight-coupling).
2. *Uncertainty*: public health officials and the scientific establishment know a great deal about infectious disease. But in a pandemic response, decision-makers typically lack

³ See, for example, plans from California and New Jersey:
<http://www.cdph.ca.gov/programs/immunize/Documents/pandemic.pdf>;
<http://www.state.nj.us/health/infuenza/plan.shtml>.

important information or knowledge about the sources, vectors, and effects of diseases and the appropriate health measures to take in response. This is particularly true if the disease in question is novel (e.g., SARS or AIDS). Outbreaks can be difficult to anticipate, detect, diagnose, and track. As some questions become settled, new uncertainties can arise.

3. *High-Tempo Environments*: Because infectious diseases can spread quickly, pandemics create strong pressures for rapid action. Response institutions attempt to identify the disease and its sources, initiate containment or mitigation efforts, and quickly deploy health care and other services. Public health institutions need to adapt to swiftly changing conditions. For example, an infectious agent may become more virulent as it evolves, new clusters of disease may appear, or public health authorities may have to develop new strategies if initial efforts falter.

To cope with these challenges, current efforts to enhance pandemic response capacity have relied primarily on formalization. Formal systems, though not a panacea, can improve an organization's reliability and enhance its ability to tackle complex tasks (Stinchcombe 2001). Ideally, by creating specific roles, relationships, and authority, formalization increases organizational predictability, improving the capacity for an organization to reliably achieve certain specified goals.

The IHR and pandemic influenza planning represent the most significant efforts of the international community in attempting to improve pandemic response in the wake of SARS. The IHR is intended to create a reliable mechanism for collecting and disseminating information about outbreaks by instituting a formalized international disease reporting system. States experiencing an outbreak of international concern have a specified role—to share specific types of information promptly and officially via WHO focal points. WHO, in turn, must fulfill its role of information verification and dissemination by reporting back to member states the status of a reported outbreak using a codified language of pandemic “phases.” Pandemic influenza plans rely on formalization by articulating specific organizational roles and responsibilities and by laying out points of authority and coordination both within and among responding organizations. This formal script represents a “best guess” about how governance should function during a pandemic.⁴

⁴ For critiques of rational modes of planning, see Brews and Purohit (2007) and Mintzberg (1993). Studies that discuss alternatives to formalized or rational planning include Comfort (1994); Comfort et al. (2001); Mintzberg and McHugh (1985); and Mintzberg and Waters (1985).

Although recognition of the limits of formal organization has deep roots in organizational theory (Barnard 1938; Clarke and Perrow 1996; Landau and Stout 1979; Selznick 1949), a sensemaking perspective is particularly useful for diagnosing the shortcomings of current pandemic response tools. For Weick (1995, 2005), sensemaking takes place in a social context that is interactional and requires cognitive alignment among actors. It unfolds from a particular frame of reference that requires interpretation of the present situation in terms of past action. Actors extract cues from their environments to guide subsequent interpretation. This process of interpretation is on-going and involves developing accounts that are plausible rather than strictly true. Finally, sensemaking involves imposing meaning on one's surroundings and using this as the basis for subsequent interpretation and action. Focusing on how individuals and institutions "make sense" of unfolding events, the sensemaking literature highlights the distributed nature of information and action, the "equivocality" of situations, and the rapid and continuous character of action (Abolino, Cook, and O'Connor 2007; Muhren and Van de Walle 2009; Weick 1993, 1995, 2005; Weick and Roberts 1993; Weick, Suttcliffe, and Obstfeld 2005;).

While formal systems, plans and procedures, and sensemaking may be mutually supportive, they can also interact in negative ways to produce organizational failure (Busby and Hibberd 2004). This becomes more likely when organizations operate in distributed, uncertain, and high-tempo environments. For example, Dunbar and Garud's (2009) analysis of the Space Shuttle Columbia accident found that the "distributed" nature of knowledge and information significantly complicated the process of sensemaking. In an earlier analysis of the Space Shuttle Challenger accident, Vaughan (1997) found that the accident arose from "structural secrecy" produced by silos in NASA's organizational structure and by the decontextualization of information as it was aggregated for top-level flight readiness briefings. These studies point to the difficulty of aggregating and sharing information across institutional boundaries without losing the shared perspectives and contextual information that facilitate sensemaking. Studies of complex military operations and humanitarian emergencies come to similar conclusions about the sensemaking challenges of distributed response (Weick and Roberts 1993; Snook 2002; Stephenson 2005; Muhren and Van de Walle 2009).

Sensemaking becomes more difficult as uncertainty increases. However, the challenge is not simply the lack of information. Often, sensemakers are "primed" by different frames of references or discover conflicting cues (Dunbar and Garud 2009). The sensemaking literature stresses the "equivocality" of information environments. Equivocality—or the possibility of conflicting interpretations—is particularly problematic in distributed, high-tempo organizing because it can result in weak alignment, confusion, and in the extreme, the

collapse of sensemaking (Weick 1993).⁵ By increasing the number of possible interpretations, new sources of information can actually make situations more equivocal. Rapid-paced sensemaking is also challenging. Time and scheduling pressures can make it very difficult for decision makers and operators to align their perspectives (Weick 1993; Snook 2002). Surprise can also lead decision makers to prematurely converge on particular interpretations. In studying trans-boundary crises, Herman and Dayton (2009) find that decision makers are more likely to get “locked in” to a particular interpretation when they must react rapidly to surprising events.

In sum, distributed, uncertain, and high-tempo environments create additional challenges for sensemaking. We argue that, because the IHR and pandemic influenza plans underestimate these sensemaking challenges, each fails to adequately support decision makers’ attempts to craft effective responses. In the remainder of the paper, we examine the unintended consequences of these tools as applied during the H1N1 outbreak and analyze how efforts at formalization, in particular, have created the oversimplified view of sensemaking embedded in these tools.

Methodology

Development of Research Network

Data for this paper were collected as part of a research project funded to study pandemic response in real time. Prior to the H1N1 outbreak, project investigators developed a network of researchers across several countries. Country selection was based on three factors: 1) presumed response capacity; 2) proximity to likely sources of future outbreaks; and 3) desire for broad geographic representation. Because the project sought to assess sensemaking dynamics during a pandemic, countries were selected that had relatively high response-capacity under the assumption that low-capacity countries may be able to commit few if any resources to pandemic response, thereby limiting the ability to observe sensemaking activities. Two geographic factors drove country selection. The first was an effort to include countries that could be expected to be geographically close to the source of a future outbreak. Second was the goal of including countries in a range of geographic regions (East Asia, Europe, and North America) in order to capture variations in the style of response that might occur at this level. The research team also included regional and global public health agencies that worked at the international level.

⁵ See Zack (2007) for a distinction between uncertainty, complexity, ambiguity, and equivocality.

Once countries and regions were selected for inclusion, researchers worked to establish access to important disease response organizations in each one. Initial research based on public documents and websites allowed for the mapping of a network of responding agencies, units, and individuals who might be especially informative in providing data on the current status of pandemic response efforts. While no organization uses a consistent set of titles to describe those who manage pandemic response, titles such as “disease focal point” and “outbreak response” were helpful in guiding the identification of likely interview subjects. The research team generally targeted mid-level managers in an effort to gain access to individuals with sufficient organizational experience to be informative, but without the organizational standing that can lead to interviews that filter out information that may be politically risky to disclose. When document review did not lead to the most appropriate person within a given agency or unit, the research team would ask an initial contact if they could identify a more appropriate unit or person. In general, this reliance on snowball sampling increased the sample population both within and across agencies.

Whenever possible, the research team relied on existing professional networks to facilitate access to targeted individuals. However, many contacts were made without relying on existing professional ties. The primary mechanism of approaching likely interviewees was email and telephone. Whenever a researcher made contact with a willing interviewee, that individual was consented into the study according to the study’s human subjects protocol. Though researchers were able to gain initial access to at least one organizational representative in each targeted country and in each multi-national agency, there was considerable variation in the nature of that access. In some cases, members of the research team were ultimately invited into the targeted unit/organization.⁶ In others, access was limited to interviews that covered only the most general and formalized portrait of an organization’s response procedures and policies. In such cases, the interviews provided little additional insight over publicly accessible websites and documents.

The method of case-selection used in the study was, by necessity, generic given that access to multiple responding agencies had to be established *in advance* of knowing which, if any, outbreak might occur during the study period. The goal of this approach was to guard against both hindsight bias that can arise from retrospective analysis of events and the bias that can stem from including only a single organizational perspective in the analysis. While the establishment of the network of researchers in advance of an actual outbreak meant that the network was not specifically tailored to the H1N1 pandemic, a combination of well-

⁶ Though several members of our research team were allowed to observe agencies in our targeted network during response operations, none of the participant observation placements began until October 2009. These data, therefore, are not used in this study which focuses on sensemaking during the initial outbreak.

established and relatively new public health agencies in the three study locations were included. Because it is extraordinarily difficult to gain access to even one organization while it is involved in crisis response, the number of organizations participating in the study was comparatively large. While the sample used for this study is not representative of all high-capacity public health agencies, this approach is expected to produce less bias than *post hoc* analysis of a single organization, *post hoc* analysis of multiple organizations, or real time analysis of a single organization.

Sources of Data

Data for the study are drawn from three sources, including institutional mapping, interviews, and a workshop.

Institutional Mapping. The mapping exercise consisted of a comprehensive review of the academic and grey literature on infectious disease outbreaks. From this activity, the research team identified several major organizational actors in infectious disease surveillance, prevention, and response and produced an initial list of likely interview contacts within targeted agencies.

Interviews. Based on this mapping exercise and further snowball sampling, the research team selected thirty-four mid-level managers with responsibilities relating to the analysis and reporting of disease outbreaks. This included public health departments and ministries of health in China, France, and the United States, as well as officials from regional and global health agencies (Table 1). The goal of these interviews was to further identify a likely global infectious disease response network by learning the communication and reporting patterns provided by the actors identified in the mapping exercise.

Study researchers conducted interviews in person and over the phone in the respondents' local language, using a semi-structured interview instrument created by the research team. The interview instrument contained questions on the respondents' roles and responsibilities, sources of trusted information, and the general procedures and protocols that guide their organizations' surveillance and response activities (Appendix A).

The majority of the key-informant interviews took place prior to the H1N1 outbreak. Thus they provided only a general sense of the main actors and perspectives in a network of global infectious disease response organizations. Once the H1N1 outbreak occurred, it became clear that the team needed to speak with public health officials involved in influenza surveillance and response specifically. The team therefore quickly reviewed the interview and mapping data in order to identify influenza experts who had specific outbreak responsibilities in

responding to H1N1 influenza. Because access was extremely limited in the early days of the outbreak, the research team redirected its efforts towards the organization a workshop that would bring together public health officials to discuss on-going H1N1 response.

Table 1. Key-Informant Interviews: February 2009 to December 2009

Country and Organizational Level of Interviewees	Number of Interviews
China	
Hospital Level	3
Local/City Level	1
State/Provincial Level	6
National Level	6
Sub-Total	16
France	
Hospital Level	0
Local/City Level	0
State/Provincial Level	1
National Level	5
Sub-Total	6
United States	
Hospital Level	0
Local/City Level	2
State/Provincial Level	0
National Level	1
Sub-Total	3
Regional	
European Centre for Disease Prevention and Control (ECDC)	1
World Health Organization Regional Offices	2
Sub-Total	3
Global	
World Health Organization	4
UN High Commissioner for Refugees	1
Médecins Sans Frontières	1
Sub-Total	6
Total	34

Workshop. The research team collected data during a two-day workshop conducted in July 2009. The methods for recruiting workshop participants were somewhat unorthodox given the circumstances and timing of the H1N1 outbreak. Our original study plan included an “event-scenario” scheduled to take place in July 2009. The goal was to provide participants with a table-top exercise that would simulate a real outbreak and take them through their likely response actions. The actual H1N1 pandemic, however, struck in the Spring of 2009—right

in the middle of our interview and workshop recruitment phase. In the early days of the outbreak, our research network lost almost all contact with responding agencies, as they were inundated with the sizeable task of pandemic influenza response.

While the July workshop seemed in jeopardy for several weeks, we were ultimately able to take advantage of the summer lull in northern hemisphere H1N1 cases. This allowed several public health officials the time to leave their posts for several days. Successful recruitment to the workshop hinged primarily on the reputation of one member of the research team who was able to convince several prominent public health professionals to attend. The presence of these notable participants seemed to produce more affirmative responses, either because the presence of the notables sent a quality signal to potential participants or because the notables were themselves a draw for others in their professional community.

Unfortunately, the research team was not able to secure any participants from China. Given our goal of studying three regions—East Asia, Europe, and North America—we used our existing list of interviews in an effort to include some East Asian representatives. This produced only one participant from a Southeast Asian regional public health organization. Subsequent interviews in China and Hong Kong suggest that there were substantial differences in response strategies—i.e., use of quarantine—across regions. Thus, there may be regional perspectives regarding either the IHR or pandemic influenza plans that were not captured by the data presented here.

Ultimately, the workshop included thirteen participants, consisting of senior managers, coordinators, and epidemiologists involved in influenza surveillance and response. These were selected with the goal of having representation from provincial and national public health agencies as well as including regional and global public health agencies (Table 2).

The workshop was divided into modules that prompted participants to reflect upon each of the four following themes: 1) the initial outbreak of H1N1; 2) problems assessing the severity of the outbreak; 3) responses to the outbreak; and 4) explanations for variation seen in the outbreak response between states/provinces and countries (Appendix B). Discussions focused on the participants' perspectives regarding the management of the outbreak and the processes that helped and hindered efforts to understand crucial features of the unfolding pandemic. Because workshop participants would not consent to have the workshop recorded, a team of research assistants took minutes of the workshop that could be compared for accuracy and consistency. These minutes yielded a set of preliminary findings that were reported back to workshop participants so that they could verify the accuracy of the team's conclusions.

Table 2. Organizations Participating in the H1N1 Influenza Pandemic 2009 Workshop

Organization	Number of Participants
China	
No participants	0
France	
Institut de Veille Sanitaire	3
United States	
Centers for Disease Control & Prevention	3
LA County Department of Public Health	2
FluWiki	1
Regional	
European Centre for Disease Prevention and Control	1
EURO-WHO	1
WPRO-WHO	1
Global	
Global Outbreak Alert and Response Network	1
Total	13

To analyze the workshop data, we followed Rubin and Rubin's "responsive interviewing" approach (2005, 201). Drawing from theoretical expectations regarding pandemic sensemaking as well themes that emerged during the workshop, the research team developed a set of preliminary concepts to code and reviewed the workshop minutes to identify important topics to add to the preliminary code list. Next, each member of the study team coded a section of the minutes. The team then held a series of meetings to discuss and clarify the codes in order to resolve discrepancies and further specify code definitions (Appendix C).

Using this coding scheme, the research team hand-coded the workshop minutes. From the coded data, it was clear that the performance of both the IHR and influenza planning documents were important to participants. Thus, the team analyzed mentions of the IHR and pandemic influenza plans, paying special attention to discussions of formal versus informal information, processes of decision making, the role of uncertainty, and selection of response strategies. The research team collected no baseline demographic information on our interview respondents or workshop participants and guaranteed confidentiality for all who agreed to participate in the study.

Findings⁷

Drawing on our workshop discussions with officials involved in H1N1 response, and supplemented with interview and mapping data, this section describes key discrepancies between the expectations and practice of public health agencies during the pandemic. Workshop participants were not asked directly to comment on how helpful the IHR or pandemic influenza plans were for their on-going response efforts. However, workshop participants naturally discussed these mechanisms in light of the resources that had been devoted to their revision/development in the wake of SARS. Thus, the participants themselves led the research team to focus on these two tools, their expected contribution to pandemic response, and their shortcomings in the eyes of workshop participants who put them to use in the early days of H1N1 pandemic.

Sensemaking during H1N1

Designed to investigate organizational sensemaking, the entire workshop transcript contains relevant information about how sensemaking occurred during the Spring 2009 phase of the pandemic. We focus here on two crucial findings. First, participants repeatedly called attention to the uncertainty surrounding their sensemaking efforts. For example, one participant argued that early judgments about the first cases in the United States felt quite contingent at the time: “Now we have hindsight. But we’ve had swine cases in the U.S. [before]. And you don’t want to overreact. So it’s tricky.... Our working assessment was that this was severe.” Several participants noted that the data coming out of Mexico and the United States did not immediately trigger emergency operations in their jurisdictions. One participant quipped, “...we were in Geneva laughing about pigs in California when suddenly we had an epidemic and were all stuck on planes.” This statement illustrates that the earliest information surfacing about the outbreaks in North America did not immediately alert pandemic response officials to the emerging pandemic. Another participant pointed to the difficulty of sorting among several potential cues to isolate the most pressing outbreaks: “At the time, we were asked to look into a [possible] SARS case on a Chinese train. And this took a hell of a lot of time.... We spent quite a bit of time dealing with this, and were perhaps not as perceptive to the H1N1 outbreak.” In this case, professional attention devoted to what turned out *not* to be a case of SARS distracted this agency from noting the significance of the North American outbreak. All of these quotations illustrate that the earliest reports of H1N1 cases did not immediately or unequivocally raise alarms regarding an emerging pandemic.

⁷ Unless otherwise noted, data referenced in this section are drawn from Ansell et al. (2009).

Importantly, this sense of uncertainty was not necessarily easily or quickly resolved. Uncertainty about how severe the pandemic was, how quickly it was spreading, where it might concentrate, and how it might change over the course of spring and fall waves meant that sensemaking during this pandemic was ambiguous *and* open-ended. One participant argued that using events in North America to predict H1N1's path elsewhere was not straightforward:

It was extremely complicated to do risk assessment for countries in [our] region. The spread [of H1N1] initially would go to developed countries. So [countries in our region] needed to go to Mexico, since it looked most like [our] countries. [Our] messaging was, "what you're seeing in the U.S. may not be what you see when [H1N1] hits you. Look at Mexico." To assess "what is the severity" was and remains very difficult.

The sense of on-going uncertainty made officials sensitive to the potential that chosen response paths would prove ill-suited to the actual course of the pandemic over the coming year.

A second finding is that participants relied on multiple sources of information and personal experience to make sense of the unfolding pandemic. While case counts aggregated at the national level provided a starting point for sensemaking, participants also drew heavily on contextualized information, local data, and experience to help them interpret what the emerging case counts might imply for their respective jurisdictions. Because officials used multiple sources of information for sensemaking, they did not necessarily draw similar conclusions about the state of the pandemic despite having access to the same sources of validated information. In the following example, a participant recounts the information that led to her/his conclusion that early cases represented a full-scale epidemic:

Cases needed to be investigated. The first thing you think about is lab error. You need to sort out an investigation. Find out there's no pig contact and that the two viruses were not related to each other: accidentally discovered, no pig contact, not [epidemiologically] related. I thought, OK, this is a problem....What triggered it for me was when we got the second virus that was not related to the first.

However, another participant, in looking for evidence of an epidemic, argued that her/his agency had little local evidence to support global-level conclusions about the pandemic:

There's a toolbox for looking for pandemic indicators. We couldn't find it. If it's so severe, why doesn't [our location] have it? We went into emergency operations mode, but on the other hand, we were conflicted. We were listening to reports, reading reports, but thinking: "If it's not [here], then where the hell is it?" It was really hard to get motivated when we hadn't had a death, hadn't had a hospitalization.

These quotations show that the validated information circulating about the pandemic was only a piece of the information that public health officials relied upon to guide their own judgments about the state of the pandemic. The importance of contextualized information for sensemaking is further illustrated in the discussion of participant criticisms of the IHR below.

International Health Regulations (IHR)

In discussing the IHR, workshop participants responded to both its reporting and dissemination functions [see background section above]. Workshop participants lauded both US and Mexico's compliance with IHR reporting requirements (Table 3). For example, one participant argued, "There is no question in my mind that the IHR are working [with respect to country compliance]." Though workshop participants noted ambiguity in the IHR forms—something that could create confusion about when to report a PHEIC—such confusion did not arise in this case (Table 3).

The preponderance of comments regarding the IHR focused on weaknesses in its dissemination function, specifically with respect to timing, content, and equity (Table 3). Participants noted delay on the part of WHO in posting information about the outbreak and a perceived unwillingness of WHO to share validated information quickly. Participants implied that the problem of timing was tied to the need to validate information. Interview data collected prior to the outbreak foreshadowed this problem. Several respondents pointed out that no one wants to be responsible for reporting inaccurate information (Personal interview, March 11, 2009; Personal interview, March 26, 2009; Personal interview, April 2, 2009; Personal interview, April 13, 2009). Thus, emphasis on formal, validated information in practice means that organizations at each level will take time to validate the information they are required to formally report.

Table 3. Summary of Workshop References to IHR and to Formal and Informal Communications

	# of Mentions	# of Individuals Expressing View
Positive or Neutral Mentions of IHR System		
Compliance with formal IHR reporting	6	4
Defense of WHO provision of validated information	2	1
Discussion of IHR reporting procedures	2	2
<i>Total Positive or Neutral Mentions of IHR information-Sharing System</i>		7
Negative Mentions of IHR System		
Difficulty in following IHR reporting or response guidelines	3	2
Reliance on non-IHR/WHO information sources	7	6
Time delays in WHO circulation of IHR data	3	3
WHO failure to share validated information	1	1
IHR role in slowing flow of information during pandemic	1	1
IHR role in reducing the amount of contextual information circulated	1	1
Problem of uneven notification of H1N1 outbreak across countries	2	2
Problems with WHO information-sharing, leading to the development of alternate international information-sharing arrangements	1	1
<i>Total Negative Mentions of IHR Information-Sharing System</i>		17
Endorsements of Informal Communication and Criticism of Non-IHR Formal Communications		
Use of informal channels of communication	5	4
Advantages of informal channels of communication (when compared to formal)	1	1
Problems with formal channels of communication	3	3
<i>Total Endorsement of Informal Communication and Criticism of Non-IHR Formal Communication</i>		8
Use of and/or Need for Formal (Non-IHR) Communications Systems and Criticism of Informal Communication		
Use of formal (non-IHR) channels of communication	1	1
Need for more timely, verifiable information	2	2
Formal systems should avoid transmitting “hunches”	1	1
<i>Total Use of and/or Need for Formal (Non-IHR) Communications</i>		4

The perspective offered in the interviews was confirmed during the H1N1 outbreak. For example, even though WHO’s Event Information Site is explicitly designed to share information about emerging outbreaks, most participants

reported finding out about the outbreak through the U.S. Centers for Disease Control and Prevention's (CDC) publication, *Morbidity and Mortality Weekly Report*. One workshop participant defended WHO's timing by arguing that WHO *must* validate information before publicly releasing it or risk its future credibility as a reliable source of information (Table 3). Noting the problem of validation requirements, another participant felt that the IHR system has actually slowed down the pace of information exchange during this pandemic when compared with past experience, arguing that "The information is not flowing as easily as it did because of IHR. We waste so much time and effort in duplicating work."

A second concern regarding the IHR's dissemination function centered on information content. Workshop participants noted that they rely heavily on contextual information for sensemaking during a pandemic. One participant provided an illustration: "If you know that the CDC is increasing its [pandemic] level, then you know something is happening." Another argued that crucial details regarding cases were not available to guide containment efforts that might limit the spread of the disease:

We in [specific geographic region] had this clear idea of containment...but we needed to know what was going on in the U.S. What's the background rate on respiratory infections in travelers? What does it mean? How many do you have to test? Who has symptoms? We had no idea about viral shedding and how many hours/days you would be asymptomatic.

An interesting pattern emerged during the workshop that further highlights the importance of contextual information for sensemaking: participants who were generating data that were formally shared were more likely to feel confident about their sensemaking processes than participants who were recipients of the formally circulated information. This finding suggests that those who had access to information *before* that information passed through formal channels might have been using a richer data set.

Though basic, validated information (e.g., case counts) was circulating through formal channels during the pandemic, participants noted that critical contextual information needed for sensemaking was hard to access. Given the lack of timely, contextualized information reported by WHO, almost all workshop participants, including some within WHO itself, reported seeking non-IHR sources of information in the early days of the outbreak (Table 3). Participants found that seeking out these additional sources of information increased the workload they faced during the pandemic. One participant explained:

There are more and more formal networks that are established. I have to get the real story from behind the scenes. Two countries [names omitted to protect confidentiality] ...wouldn't tell certain things on the conference calls. Then, I have to call them and say, "What's going on?" So that is duplicating work. The more formalized, the more work I have to do after the fact.

According to our participants, contextual information was typically only available through informal channels. They argued that information gleaned through informal networks was often richer than that circulating in the established, formal networks. When comparing the two types of information sources, participants found the latter "sterilized." One participant argued that the richer, contextual information was hard to get during the H1N1 outbreak if one did not have informal ties to CDC officials who would share such information off the record. This left officials in several countries wondering if the outbreak in North America was severe enough to trigger their own national pandemic response. Another participant indicated that WHO was more likely to provide equal access to such information before the IHR was revised:

Pre-IHR, the WHO was exchanging pre-verified information...During [SARS] there was equal access and exchange of information. Post-SARS, there was not equal access. Only certain people had access. What was coming out of WHO was a table with numbers, and that was it.

Workshop participants, in critiquing the IHR, highlighted a problem of equity in that access to informal information networks is uneven (Table 3).

Though the workshop produced considerable consensus about IHR shortcomings in providing timely, contextualized, and equitably shared information, some points of disagreement did emerge. First, a handful of statements from the workshop indicated that formal mechanisms were not totally superfluous (Table 3). Specifically, some participants noted that validated information was needed to counter rumor and unsubstantiated hunches. Second, participants disagreed over the worth of case counts for understanding the nature of the outbreak: some participants argued that case counting was time consuming with little benefit, while others found case counting helpful for sensemaking, at least in the early stages of an outbreak. Overall, however, most participants relied on informal communications mechanisms and lamented the time consumed in attempting to use formal systems during the pandemic.

Pandemic Influenza Plans and H1N1 2009

Although participants were never asked directly about pandemic influenza plans or planning, they independently raised the topic for discussion twenty-seven times. Almost all discussion of written plans included criticism regarding their inflexibility and faulty starting assumptions. Participants were less united in their views about the usefulness of preparedness exercises.

Workshop participants' discussion of written plans tended to be negative and pointed to a lack of flexibility in written plans. The most frequent critique of the written plans was their use of H5N1 influenza as the assumed source of the next pandemic (Table 4). This meant that plans contained incorrect assumptions about the probable geographic origins and likely severity of an outbreak. Participants found the response options contained in their plans inappropriate for the novel influenza virus that did emerge. For example, one participant, in trying to explain one organization's early response efforts, said, "We weren't prepared for something different [from H5N1]. We had our bird flu plan. But what is this? Has it shifted? We were so H5N1-focused that there was some indecision about where to go."

The problem of written plans was not just that they failed to provide relevant guidance for responding to the H1N1 outbreak. Participants also found that the very existence of pandemic influenza plans created extra work for them in crafting an appropriate response. Specifically, some participants argued that they came under political pressure to follow the pandemic influenza plans as written (Table 4). Thus, not only did responders have to construct their responses rapidly without adequate decision support, they also had to explain why they were diverging from the scripts set out in written plans. Participants were frustrated by the presence of an irrelevant plan that functioned to limit their discretion in crafting an appropriate response. One participant characterized this quandary thus:

Technically, if we were going by the book, we would have [initiated a plan-prescribed response] in the first week...we had to improvise and were unable to give explanations. Being stuck in [the plan] just signaled our lack of...I don't know. In this case, we tried to go by the book. It was a political decision.

Workshop participants indirectly pointed to a fundamental flaw in written plans that undermined their utility. Written plans assume that pandemic response happens in well-delineated, linear stages where the process of characterizing a pandemic happens quickly and comes *before* initiating a response. Working from this assumption, written plans script several possible response scenarios that could be initiated in light of a given set of stimuli. During the H1N1 pandemic,

however, debate about severity of the influenza strain continued throughout the pandemic. As a consequence, officials initiated response actions in spite of considerable uncertainty about the pandemic and had to reassess those strategies in light of subsequent information. While written plans assumed that sensemaking would be completed before officials would designate response strategies, participants indicated that they were actually pursuing sensemaking and response in parallel during the pandemic.

Table 4. Summary of Workshop References to Influenza Plans and Planning

	# of Assessments	# of Individuals Expressing View
Positive Assessments of Influenza Plans		
Acknowledgment of reliance on plans during H1N1	1	1
Plans based on past experience can be useful	1	1
Plans contain “some” evidence-based guidelines	1	1
Plans can be improved for future use	1	1
<i>Total Positive Individual Expressions about Plans</i>		4
Negative Assessments of Influenza Plans		
Plans were too specific (e.g., assumed high severity H5N1 outbreak originating in East Asia)	4	3
Plans assume that responders will face no uncertainties in characterizing the pandemic	1	1
Plans create political pressure to respond “by the book” even when plan assumptions were incorrect (constraining professional discretion in crafting a response)	1	1
Plans do not recognize the need for adaptation as a pandemic unfolds	4	3
Responders ignore plans	2	2
Plans of limited usefulness in guiding response	2	2
Guidance in plans is not evidence-based	3	3
<i>Total Negative Individual Expressions about Plans</i>		15
Positive Assessments of Influenza Preparedness Exercises		
Preparedness exercises helpful	1	1
Simulation exercises helpful	1	1
<i>Total Positive Individual Expressions about Preparedness Exercises</i>		2
Negative Assessments of Influenza Preparedness Exercises		
Influenza preparedness exercises drained resources from other public health priorities – not cost effective	1	1
Preparedness exercises based on unrealistic planning assumptions	2	2
<i>Total Negative Individual Expressions about Preparedness Exercises</i>		3

In spite of the considerable criticism that workshop participants had for written plans, some focused their concerns on plan users rather than plan content or structure. Participants reported that responders forgot they had plans and never consulted them, while others suggested that responders or their political superiors viewed pandemic influenza plans as “written in stone,” making them unwilling to accept the logic of straying from the plans as written. One participant argued that responders should view pandemic influenza plans as a rough heuristic for response rather than a specific, step-by-step set of response instructions (Table 4). One hopeful comment regarding written plans centered on the problem of the evidence-base for influenza mitigation. Specifically, one participant noted that the current evidence-base is weak and suggested that future advances in the science of influenza mitigation will necessarily improve the utility of written plans (Table 4). These comments suggest a lack of consensus among public health officials about the purpose of written plans.

Although approximately eighty percent of the statements about pandemic influenza plans during the workshop were negative, statements about “planning exercises”⁸ were more evenly divided (Table 4). Two participants argued that attending exercises or event scenarios was helpful in that it introduced them to actors with whom they might have to work during a pandemic. Such initial introductions made it easier to coordinate with non-routine counterparts (for example, school superintendents) during the H1N1 pandemic. On the other hand, one participant found exercises to suffer from unrealistic assumptions similar to those in written plans. Another participant argued that the benefits of exercises did not outweigh their costs, particularly when one considered how the emphasis on planning drained resources from other essential public health work (Table 4).

Discussion

The IHR and pandemic influenza plans both constitute formal mechanisms to cope with the distributed, uncertain, and high-tempo environments that characterize pandemic response. Each was only partially successful during the 2009 H1N1 outbreak. The IHR attempts to solve the problem of distributed sensemaking by creating a formalized information-sharing system. This system works well for collecting information from those discovering an emerging pandemic. And yet, our findings suggest that the effort to create a formal system where all countries report data in a single format has created an information-

⁸ To keep written plans and the organizational processes undertaken to simulate some aspect of pandemic response distinct, we refer to the former as “plans” and the latter as “preparedness exercises.” Practitioners typically made this distinction simply by referring to “plans” versus “planning,” as reflected in our data.

sharing system that circulates radically decontextualized data. Moreover, the IHR attempts to address the problem of uncertainty by ensuring that circulated data is validated. This is important for the integrity of the information system. However, in practice, validation may happen too slowly for the pace of pandemic response. Public health officials, even those from within WHO, reported turning to other information sources to create plausible accounts of the unfolding H1N1 pandemic. This suggests the IHR did not serve as a reliable source of timely information for those attempting to respond.

The problem is not simply a matter of redesigning the IHR system in an attempt to collect more contextualized information. First, it is hard to conceive of the generalized form that could be written *ex ante* to adequately capture appropriate contextualized information. Second, more than simply overlooking the circulation of informal information, our findings suggest the IHR might actively impede it. The IHR's emphasis on validated information may make public health experts reluctant to share hunches and impressions outside of a trusted network of colleagues. Here, the formalization of the reporting process may have displaced a less formal pattern of information-sharing across the international public health infrastructure in which participants did not have to go "on record" in order to consult with other health officials. WHO, a source of contextualized information in prior outbreaks, may have ceded an important role in the move to formalization. A second way in which the IHR might have slowed the flow of contextualized information is by creating the perception among reporting organizations that, once they had formally reported a PHEIC, they had fulfilled their responsibilities to the international community. Thus, while the IHR might raise confidence in the accuracy of information shared in the formal network, it also may slow down the pace at which pertinent, informal information becomes available. This increases the problem of uneven access to informally shared, contextual information.

Pandemic influenza plans and exercises address the distributed character of pandemic response by articulating and rehearsing the likely organizational forms that will emerge to manage a crisis. By mapping the capacities needed for pandemic response, it is likely that plans helped organizations confirm staffing requirements and necessary response functions. Our data include no specific criticism of this function of written plans and support the view that planning exercises were useful in providing insights into the organizational forms likely to emerge during a pandemic.

However, plans are designed to address the uncertainty and pacing of pandemic response by creating response scripts that are triggered once predicted criteria have been met. Workshop participants indirectly revealed that they expected written plans to increase their confidence in the merits of chosen response options and bolster their credibility with political officials and the public

as they publicized and defended their decisions. In fact, written plans had the opposite effect: those who tried to follow the written scripts felt ill-at-ease about their mitigation strategies as they began to perceive important differences in the pandemic as scripted and the actual pandemic they faced. Those who either never used plans or quickly scrapped them were pressed to justify “off-plan” actions to the public and political officials.

It is tempting to suggest that these problems are caused by the failure of written plans to adequately predict the parameters of the next pandemic and to assume that, with better forecasting, written plans might perform as intended. Instead, we argue that following plans written for specific pandemics may actually undermine valuable sensemaking. In this case, plans constructed around H5N1 influenza may have primed responders to perceive a severe pandemic and lengthened the time it took them to come to grips with the pandemic they actually faced. Instead of appreciating the *on-going* uncertainty involved in drawing *cues* for sensemaking and the requirement to act on *plausible* accounts of unfolding events, written plans suggest that sensemaking can be completed definitively and that response efforts will mechanistically follow.

In addition, most plans were tied to universal assessments of the pandemic, i.e., phase levels that, as they occurred, would be reported by WHO. In practice, we find that sensemaking for pandemics is rooted in assessments of local circumstances that may deviate in crucial ways from universal accounts of unfolding events. The CDC appears to have come to grips with this aspect of pandemic response when it replaced its early recommendation for school closures in the United States with guidance that suggested local actors should decide when school closures might be effective. The mechanistic, linear, view of pandemic response embodied in written plans vastly oversimplifies the actual process of sensemaking described by our informants and formally articulated by Weick (1995, 2005). Pandemic influenza plans leave little room for uncertainty and, therefore, decouple sensemaking from response. In reality, response options, once chosen, are likely to require continual adjustment as new information clarifies features of the pandemic. If one takes seriously this aspect of pandemic response, pandemic influenza plans might have to be constructed very differently in order to remain relevant during actual pandemics.

Limitations of this study stem from the difficulty of gaining access to organizations currently responding to a pandemic. First, by trying to create a network of researchers that could view response from multiple locations, the research team had to begin its work in advance of any known outbreak. We attempted to build good coverage by including organizations located in East Asia, Europe and North America, but were not designing our research network with specific knowledge of the H1N1 outbreak to guide us. Once the outbreak began, we faced a second difficulty of maintaining access while responders were

overwhelmed with actual response. Thus, the organizations represented in our study do not make up a representative sample of the organizations involved in the response to the H1N1 pandemic. However, we were able to gather data from international, national, and subnational responders, ensuring that we understood an important potential source of variation in response across the network. In addition, we feel that a larger study population would not invalidate our findings since we report here on findings that were significant sources of concern for workshop participants and were not tied to the perspective of a single organization. With a larger study population, we might have found a longer list of concerns and might be able to speak to how such concerns varied with location—both geographic and organizational—within the response network.

Conclusion

A sensemaking approach emphasizes the on-going interpretation of cues as responders confront the challenges of distributed, uncertain, and high-tempo environments. Therefore, it is ideally researched through real-time observation of decision making as it unfolds in different institutional locations. While the conclusions of this study are ultimately limited by the difficulty of gaining real-time access to a representative sample of response organizations during the H1N1 pandemic, these limits are relative rather than absolute. Even given the limitation noted above, the sample did include variation in both level (local, provincial/state, national, regional, and international) and geographic region (Europe, North America, and Southeast Asia) and should capture some important sources of variation in response. A larger study population might have provided further insight into the generality of our findings, but it is unlikely that they would have diluted the emphasis that a number of response organizations placed on the limits of the IHR and pandemic influenza planning. Our study also faced difficulty in gaining real-time access to responders overwhelmed by the actual response. However, our workshop was held soon after the first wave of the H1N1 pandemic when the details of the initial outbreak were still fresh in responders' minds and initial response efforts were on-going. If anything, we suspect that additional real-time observation would have accentuated our findings about the challenges of working in distributed, uncertain, and high-tempo environments.

The formal response efforts analyzed here only partially address the problems of sensemaking during distributed, uncertain, high-tempo events. Specifically, the study finds that current emphases on formal reporting and the institutional level of information-sharing may have weakened critical informal communications flows. A decrease in informal information-sharing might slow the rate at which public health officials come to understand the nature of an

emerging pandemic. In addition, we find that pandemic planning created a false sense of preparedness through an overly scripted set of response options and a fundamental mischaracterization of sensemaking as unambiguous and time-limited. The study highlights the problem of on-going sensemaking and the critical role that contextualized information plays in pandemic response. While more systematic research is necessary to devise remedies to the noted shortcomings of the IHR and pandemic influenza plans, the paper closes with several recommendations.

One approach for encouraging informal information-sharing would be to create an online forum dedicated to discussions of pre-validated information that would function independently of the IHR. Such a site might require pre-registration and professional affiliation to ensure a level of professionalism among those posting. However, the goal of the site would be to allow individuals to post information without formally representing their institutions. Such a site might be overseen by a board drawn from multiple institutions to reduce the impacts that the politics of any specific organization might have on website content. The CDC's "Epi-X" is a forum that has many of these properties in that it allows information-sharing regarding potential outbreaks to occur among public health officials designated by participating public health agencies. However, we suggest one significant departure from Epi-X. Specifically, Epi-X deals with the problem of rumor by creating a site that is secure in order "to protect the sensitive nature of the preliminary information it provides."⁹ This presents a potential problem in that security may be breached. It also can create the impression that the government is withholding relevant information from the public. An alternative would be to create a site that is intentionally open to the public. While such a site would restrict posting to the professional public health community with the option of posting anonymously, the intentional transparency would eliminate the need to maintain and justify security. One potential model for such a site is ProMed, an email list system open to all that collects and makes available information on emerging disease in order to enhance early warning.

Certainly, there may be risks in creating an open forum to discuss pre-validated information during an emerging pandemic. Our respondents expressed concern about the negative consequences of allowing rumor to lead public health agencies and the public astray during a pandemic. Epi-X's secure system is based on this very concern. Thus an important component of any open forum for information exchange regarding potential outbreaks would be to carefully frame that information as provisional. For instance, a site that was titled "Justahunch.gov" would send a markedly different signal when quoted in the media than a site that projected a more official, expert capacity. Certainly any

⁹ Information about the forum is available at: <http://www.cdc.gov/epix/>.

effort to construct a site that would allow for the circulation of pre-validated information should be sensitive to the risks of generating disruptive rumors. Given the existence of sites like ProMed, which was created in 1994 (Mitchell 1997; Woodall 2001), it may be possible to assess such risks before launching a site with the properties discussed here. A less formal approach would be to attempt to reinstate a norm of informal information-sharing among colleagues. This approach, however, would not ensure equal access to any valuable sensemaking that such networks produced.

Ideally, future pandemic influenza planning should retain its current capacity to create pre-crisis links across organizations and jurisdictions and continue to provide a comprehensive list of basic pandemic response functions. At the same time, pandemic influenza plans should increase their focus on contingency and actual sensemaking processes. Specifically, written plans could include scenarios that illustrate how responses might differ across pandemics of varying types. The content of the scenarios might prove less important than the manner in which their combined presentation illustrates the problem of tailoring response to a poorly understood pandemic. Plans should also encourage decision makers to weigh local cues against those being presented at the formal, international level to highlight the importance of understanding the parameters of a pandemic in a given local context. Finally, plans should make explicit the need for on-going review of agency decisions in order to evaluate those decisions against new information and encourage public communication of evolving response efforts. Such improvements would increase the extent to which pandemic influenza plans support the ability of responding agencies to create “emergent strategies” in the face of a pandemic.

This study highlights the importance of sensemaking practices that resist easy formalization. Any revisions of the IHR or pandemic influenza planning are subject to unintended consequences. Thus, we argue for improvements that, ideally, would retain the respective strengths of the IHR and pandemic plans. Future response efforts should be designed with a sensitivity to the distinction between those aspects of pandemic response that lend themselves to formalization from those that do not in an effort to increase crucial sensemaking capacity.

Appendix A: Infectious Disease Response Interview Protocol

Unit-of-Analysis: the organizational unit

Sampling: initial identification of units identified using websites and public documents; follow-up (snowball) sampling with other units or organizations identified during the initial interviews.

Unit:

Person Interviewed:

Position of Interviewee in Unit:

Date of Interview:

INTRODUCTION

Overall goal of the interviews: [About the [place of authorship] study...We are trying to understand how organizations respond to infectious disease outbreaks....]

We would like to ask you some questions about how your unit relates to other groups, both within your own organization and in other organizations. We are interested in both the formal (e.g., official) and the informal relationships between units. We also want to know how these relationships work and how they influence how you make decisions as a unit. We would also like to know about how relationships between units can facilitate or hinder effective response and decision making—about when they work well or poorly.

We are asking you, as a representative of your unit, about relationships between units. But we know that sometimes key relationships may be quite informal and really represent relationships between friends or colleagues (and not units per se). So answer as best you can in terms of unit-to-unit relationships. But we are also interested in your thoughts about how your own personal relationships (as opposed to unit-to-unit relationships) might affect response.

GENERAL INFORMATION

What are the main responsibilities of your unit with respect to infectious disease response?

Prompt for major sources of variation: by ID/agent type; by location of origin; by WHO/national phase structure.

Follow up: Are there other organizations that basically perform these same functions? At different governmental levels? Internationally?

TYPES OF RELATIONSHIPS

What sorts of activities does your unit carry out when you hear of information of sufficient concern?

Prompt for more “then who does what?” questions.

REPORTING RELATIONSHIPS

In this section, I want to ask you some questions about the reporting relationships that your unit may have...

How do you stay current on trends and issues arising in your field?

During an infectious disease outbreak, is your unit required to officially report information to or to confer with any other group within or outside your organization?

From where - or what organizations - does your unit get reports during a suspected or real infectious disease outbreak?

When you think of those specific sorts of reports, what are some issues with them, like ambiguities or uncertainties, that would prevent your unit from acting effectively?

What is the basis of these reporting requirements? (law, memorandum of understanding, strategic planning, operational protocols, etc.)

Are there particular thresholds or criteria that must be met before these official reporting requirements are met?

Does the unit ever experience ambiguity in deciding whether or when to officially report to other units?

Follow up: What kinds of factors contribute to this ambiguity?

Do you find the timing of reporting information is sensitive to your unit's ability to confirm certain information or to gather enough information to confirm that something serious is happening?

Follow up if unclear: [In other words, does the unit ever feel that it must delay the transmission of information until it has more certainty about the situation Or rush out information before you were really certain of it?]

How does the unit function internally to make decisions about when and how to report to other units? For example, do you have meetings where you deliberate about the timing of reporting? If so, what factors enter into your discussions?

Are you ever concerned about the political fallout of reporting information that might later be disconfirmed?

Here I am also interested in what is reported to other units, and how that is decided.

Are official reporting relations affected, at all, by personal working relationships between units?

Are any of the reporting requirements that apply to your organization new and untested? If so, do you anticipate that it will be difficult to follow them? Can you give examples and explain why they might be hard to implement?

How do you typically learn of changes in protocols, guidance, and other such standards?

ADVICE RELATIONSHIPS

Now, I want to focus on what kinds of relationships your unit (or you personally) might use to get advice to help you make decisions...

Does your unit routinely consult other units when you need advice about an infectious disease outbreak?

Follow up if unclear: I expect the advice you seek must depend on the character of the disease outbreak, but are there particular units that you routinely look to for advice and consultation?

Are these advice relationships built more on official institutional connections between the units (e.g., the formal responsibilities of each unit) or on the informal social networks that have developed?

If you think back to times that you have sought advice from other units, what is the character of the advice you were seeking? For example, were you primarily seeking specialist advice? Or looking for a second opinion to validate your own interpretation of the situation? Or looking for contrasting perspectives? Or perhaps trying to build up common interpretations of situations across units?

Is it necessary to be cautious or discreet about seeking out advice for the fear that you might disclose information that might trigger concern or negative organizational behaviors? If so, how do you tend to manage these situations?

Do you find that you are continually seeking outside advice or does your need for advice vary a lot with the kinds of outbreaks and the stage of the outbreak?

OTHER INFORMATIONAL RELATIONSHIPS

You probably have other kinds of informational relationships that are neither official reporting requirements nor advice relationships. For example, perhaps you routinely receive or seek information from specific units, which you find useful or necessary....

We can list a set of general sources of information. Could you indicate for each how common it is for you to seek information from these sources?

Universities: (very often; fairly often; once in a while; rarely; never)

Laboratories: (ditto)

Medical Specialists: (ditto)

Military (ditto):

International Organizations: (ditto)

Private Corporations: (ditto)

Counterparts in other Countries: (ditto)

Counterparts in other Organizations (ditto)

Generally, when you are seeking such information, are you commonly trying to work through existing contacts or relationships? Or are you more commonly seeking information from sources with which you have not had any prior contact?

When you seek information from these sources, are you often concerned about controlling the flow of information to these external sources? For example, do you find it necessary to be circumspect about the reasons why you are seeking information or is it necessary to disclose some of the details of the situation?

OPERATIONAL RELATIONSHIPS

Beyond the official reporting requirements we already talked about, we expect that your unit must engage in operational coordination with other units during an outbreak...

What other units or organizations do you commonly work with during an outbreak?

What makes these operational relationships easy or difficult? For example, is communication difficult during operations? If so, why?

Do you find that information flows freely between units during operational coordination? Do you ever find that other units are less than forthcoming about the critical information that you feel is necessary to successfully coordinate? If so, what are the factors that prevent the free-flow of information?

On the other hand, are there factors that encourage the free-flow of information between units?

Are there organizations on which you rely for information or for operational support that have not been able to fulfill their formal response role to your organization or that you anticipate might not be able to in the future? What are the factors that impede their ability to fulfill their formal role?

PLANNING FOR OUTBREAK RESPONSE

We are interested in how organizations involved in outbreak response prepare for their roles, especially knowing that some aspects of any given outbreak are extremely hard to predict.

Do planning efforts (protocols, exercises, drills, etc.) help establish the relationships that are likely to be called upon during a real outbreak?

Overall, do you feel that planning efforts improve your organization's ability to respond effectively in an outbreak?

GENERAL CONCLUDING THOUGHTS

As you can tell from our questions, we are very interested in how information flows and communication works during an infectious disease outbreak. We are trying to understand how the flow of information might affect the ability of governments to effectively respond to infectious disease outbreaks.

Beyond what we've just talked about, do you have any other thoughts about how information flows during an outbreak?

Do threat, agent, location or other specific protocols your unit has ever conflict with more general ones or with certain aspects of your unit's mission? In what specific ways?

To what degree do you think effective action in your area of response is a function of the skill and judgment of a single or small group of individuals/commanders?

Appendix B: Questions to Guide Workshop Modules

WORKSHOP STRUCTURE

This is a discussion-based workshop exercise divided into the following four modules:

Module 1: Initial Outbreak

Module 2: Severity Assessment

Module 3: Response

Module 4: Response Variation

Each module begins with a facilitator posing a series of questions or observations to the participants. These questions or observations are designed to stimulate conversation in the subject area emphasized in the specific module. The facilitator will ask individual participants for information and encourage interaction among the participants. In some cases, the facilitator may follow up on specific issues and ask questions not listed in the situation manual.

WORKSHOP GUIDELINES

This is an open collegial environment. You should feel comfortable sharing your observations, insights, and opinions, both professional and personal.

Proceedings will not be audio or video recorded. Observers will take notes on the proceedings throughout the workshop.

Respond based on your knowledge of events and actions, especially as they pertain to your jurisdiction.

There is no “hidden agenda,” nor are there any trick questions.

Module 1: Initial Outbreak

Key Issues and Questions

As best you can recall, how did your organization/unit learn about the outbreak? We are especially interested in what you knew early on, when you knew it, and what your sources were for this information.

Once you learned about the outbreak, what additional information did you seek out to get your bearings?

Module 2: Severity Assessment

Key Issues and Questions

As best you can recall, what was the initial working assumption that your organization/unit made about the severity of H1N1?

Did your organization/unit reassess that initial assumption at any time?

If so, what was the timing when you began to reassess your view of the severity of H1N1 and what were the sources of information that led to that reassessment?

Module 3: Response

Key Issues and Questions

What uncertainties did your organization/unit face in selecting steps to respond to the H1N1 outbreak?

What were the mitigation strategies that your jurisdiction (county, state, country) adopted to address the outbreak?

What mitigation strategies did you consider but not adopt?

After implementing one or more mitigation strategies, did you change course? If so, what prompted the change in approach?

Module 4: Response Variation

Key Issues and Questions

What explains variation in country (state/county) responses?

We assume that all the decision-makers had access to roughly the same information about the outbreak. Given that, what are some likely explanations for why mitigation strategies varied so much from one country (county or state) to the next?

Appendix C: Final Coding List for Workshop Minutes

- Contextual/Informal information
- Validated/Formal information
- Disease severity
- Reference to experience
- Judgment call
- Formal network
- Informal network
- IHR
- Information gaps
- Interventions
- Plans/planning
 - intention to use
 - limitations of
 - merits of
- Political pressure
- Public messaging
- Sensemaking
- Transparency
- Choice point
- Uncertainty expressed

References

- Abolino, S., R. Cook, and M. O'Connor. 2007. "Sensemaking, Safety, and Cooperative Work in the Intensive Care Unit." *Cognition, Technology & Work* 9:131-137.
- Ansell, Chris, Ann Keller, Art Reingold, et al. 2009. Workshop Minutes, Global Infectious Disease Response Workshop on H1N1, July 19-21, Berkeley, California.
- Barnard, C. I. 1938. *The Functions of the Executive*. Cambridge: Harvard University Press.
- Bell, D. M., I. B. Weisfuse, M. Hernandez-Avila, C. del Rio, X. Bustamante, and G. Rodier. 2009. "Pandemic Influenza as 21st Century Urban Public Health Crisis." *Emerging Infectious Diseases* 15:1963-1969.
- Brews, P. and D. Purohit. 2007. "Strategic Planning in Unstable Environments." *Long Range- Planning* 40: 64-83.

- Busby, J.S. and R.E. Hibberd. 2004. "Artefacts, Sensemaking and Catastrophic Failure in Railway Systems." 2004 IEEE International Conference on Systems, Man, and Cybernetics, 6198-6205.
- Clarke, L., and C. Perrow. 1996. "Prosaic Organizational Failure." *American Behavioral Scientist* 39:1040-1065.
- Comfort, L. 1994. "Self-Organizing in Complex Systems." *Journal of Public Administration Research and Theory* 4: 393-410.
- Comfort, L., Y. Sungu, D. Johnson, et al. 2001. "Complex Systems in Crisis: Anticipation and Resilience in Dynamic Environments." *Journal of Contingencies and Crisis Management* 9 (September): 144-158.
- Condon, B. J. and T. Sinha. 2009. "The Effectiveness of Pandemic Preparations: Lessons from the 2009 Influenza Epidemic." Working Paper No. 1, International Federal of Red Cross and Red Crescent Societies Disaster Law Working Paper Series.
- Dausey, David J., Nicole Lurie, and Alexis Diamond. 2005. "Public Health Response to Urgent Case Reports." *Health Affairs Web Exclusive* (August 30): W5-412 - W5-419.
- Dunbar, R. L. and R. Garud. 2009. "Distributed Knowledge and Indeterminate Meaning: The Case of the Columbia Shuttle Flight." *Organization Studies* 30: 397-421.
- Gostin, L. O. 2009. "Influenza A (H1N1) and Pandemic Preparedness under the Rule of International Law." *Journal of the American Medical Association* 301(22): 2376-2378.
- Gray, G. C., D. W. Trampel, and J. A. Roth. 2007. "Pandemic Influenza Planning: Shouldn't Swine and Poultry Workers Be Included?" *Vaccine* 25 (May 30): 4376-4381.
- Guan, Y., L.L.M. Poon, C. Y. Cheung, et al. 2004. "H5N1 Influenza: A Protean Pandemic Threat." *Proceedings of the National Academy of Sciences* 101 (May 25): 8156-8161.
- Gupta, R. K., R. George, and J. S. Nguyen-Van-Tam. 2008. "Bacterial Pneumonia and Pandemic Influenza Planning." *Emerging Infectious Diseases* 14 (8): 1187-1192.
- Hermann, M.G. and B.W. Dayon. 2009. "Transboundary Crises through the Eyes of Policymakers: Sense Making and Crisis Management." *Journal of Contingencies and Crisis Management* 17(4): 233-241.
- Katz, R. 2009. "Use of Revised International Health Regulations during Influenza A (H1N1) Epidemic, 2009." *Emerging Infectious Diseases* 15:1165-1170.
- Landau, M. and R. Stout, Jr. 1979. "To Manage is Not to Control: Or the Folly of Type II Errors." *Public Administration Review* 39(2): 148-156.
- Lurie, N., J. Wasserman, and C. Nelson. 2006. "Public Health Preparedness: Evolution or Revolution?" *Health Affairs* 25 (July/August): 935-945.

- Lurie, Nicole, Jeffrey Wasserman, Michael Stoto, et al. 2004. "Local Variation in Public Health Preparedness: Lessons from California." *Health Affairs Web Exclusive* (June 2): W4-341 - W4-353.
- Malik Peiris, J. S., Menno D. de Jong, and Yi Guan. 2007. "Avian Influenza Virus (H5N1): A Threat to Human Health." *Clinical Microbiology Review* 20 (April): 243-267.
- Mintzberg, H. 1993. "The Pitfalls of Strategic Planning." *California Management Review* 36: 32-47.
- Mintzberg, H. and A. McHugh. 1985. "Strategy Formation in an Adhocracy." *Administrative Science Quarterly* 30(2): 160-197.
- Mintzberg, H. and J.A. Waters. 1985. "Of Strategies, Deliberate and Emergent." *Strategic Management Journal* 6(3): 257-272.
- Mitchell, P. 1997. "ProMED-mail: Outbreak Intelligence or Rash Reporting?" *Lancet* 350:1610.
- Muhren, W. and B. Van de Walle. 2009. "Sensemaking and Information Management in Humanitarian Disaster Response: Observations from the TRIPLEX Exercise." Proceedings of the 6th International ISCRAM Conference—Gothenburg Sweden, May 2009.
- Plotkin, B.J., M. Hardiman, F. Gonzalez-Martin, and G. Rodier. 2007. "Infectious Disease Surveillance and the International Health Regulations." In *Infectious Disease Surveillance*, eds. N.M. M'ikanatha et al. Malden: Blackwell Publishing.
- Rubin, H.J. and I.S. Rubin. 2005. *Qualitative Interviewing: The Art of Hearing Data, Second Edition*. London: Sage Publications.
- Selznick, P. 1949. *TVA and the Grassroots*. Berkeley: University of California Press.
- Snook, S. 2002. *Friendly Fire: The Accidental Shootdown of U.S. Blackhawks over Northern Iraq*. Princeton: Princeton University Press.
- Stephenson, M. 2005. "Making Humanitarian Relief Networks More Effective: Operational Coordination, Trust, and Sense Making." *Disasters* 29(4): 337-350.
- Stinchcombe, Arthur L. 2001. *When Formality Works: Authority and Abstraction in Law and Organizations*. Chicago: University of Chicago Press.
- Vaughan, D. 1997. *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA*. Chicago: University of Chicago Press.
- Webby, R. J. and R. G. Webster. 2003. "Are We Ready for Pandemic Influenza?" *Science* 302: 1519-1522.
- Weick, Karl E. 1993. "The Collapse of Sensemaking in Organizations: The Mann Gulch Disaster." *Administrative Science Quarterly* 38(4): 628-652.
- Weick, K. 1995. *Sensemaking in Organizations*. Sage Publications.

- Weick, K. 2005. "Managing the Unexpected: Complexity as Distributed Sensemaking." In *Uncertainty and Surprise in Complex Systems: Questions on Working with the Unexpected*, eds. R.R. McDaniel and D.J. Driebe. Berlin: Springer.
- Weick, K. and K. H. Roberts. 1993. "Collective Mind in Organizations: Heedful Interrelating on Flight Decks." *Administrative Science Quarterly* 38(3): 357-381.
- Weick, K., K.M. Suttcliffe, and D. Obstfeld. 2005. "Organizing and the Process of Sensemaking." *Organization Science* 16(4): 409-421.
- Woodall, John P. 2001. "Global Surveillance of Emerging Diseases: The ProMED-mail Perspective." *Cadernos de Saúde Pública* 17(Suplemento): 147-154.
- World Health Organization. 2008. *International Health Regulations (2005)*, 2nd ed. Geneva: WHO Press.
- Zack, M.H. 2007. "The Role of Decision Support Systems in an Indeterminate World." *Decision Support Systems* 43: 1664-1674.