Catastrophic Events versus Infectious Disease Outbreak: Distinct Challenges for Emergency Planning

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1. Introduction

Since September 11, 2001, significant attention has been directed toward the capacity of the United States health system to address a potential surge in patients following a terrorist event. The ability to manage an increase in patient volume is important not only for response to catastrophic terror activities such as bombings, but also for natural catastrophic events such as earthquakes, hurricanes, fires, or tornadoes. Such scenarios can place tremendous strain on response personnel and can quickly overwhelm limited resources. However, the type of surge capacity necessary in the wake of an infectious disease outbreak (be it a natural public health emergency or a bioterror attack) requires a different set of resources than does the capacity to handle patient surge following a catastrophic event. Unlike a catastrophic event, wherein large numbers of patients present in a short period of time, an infectious disease outbreak would likely result in a slower, yet more sustained patient surge. In addition, an infectious disease-related surge is unlikely to be limited to selected locations, undermining the ability effectively to move resources to areas experiencing a surge. Thus, unlike catastrophic surge scenarios, the surge resulting from an outbreak cannot adequately be addressed through traditional emergency planning.

2. Catastrophic Events

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Traditional concerns for disaster response following a catastrophic event have influenced most emergency response planning. Such diverse governmental agencies and think tanks as the Institute of Medicine, the Council on Foreign Relations, the United States General Accounting Office (GAO), the Congressional Research Service, the Heritage Foundation, and Trust for America's Health (supported by the Robert Wood Johnson Foundation and the Bauman Foundation) have studied the capacity to handle the influx of patients likely to occur in the wake of a catastrophic event.[1] Overwhelmingly, these reports emphasize the ability of first responders such as EMS crews, firefighters, emergency room staff, and law enforcement personnel to provide relief for large numbers of patients. The need to reflect on this type of capacity is significant as the number of emergency departments at hospitals across the country is decreasing due to the financial drain such departments often represent.[2] As a result, even as the number of emergency departments dwindle, we are becoming better prepared to meet the challenges of a surge in patients resulting from catastrophic events, thanks in large part to planning and cooperative agreements between health care facilities developed in the wake of the 9/11 terrorist attacks.

A report published by the American Hospital Association (AHA) describes model plans that have been developed for emergency preparedness following the 9/11 tragedy.[3] Problems identified during preparations for expected casualties during that tragedy include logistical and bureaucratic challenges in getting supplies to where they are expected to be most needed, certification of supplemental medical personnel, triage, and distribution of resources among regional medical centers. Unsurprisingly, planning for emergency "surge capacity" preparedness has centered on these problems. In the AHA report, hospitals describe plans to cooperate with partner medical centers in their region to allocate needed resources and supplies in the event

[1] See S. Knobler, A. Mahmoud, and L. Pray, *Biological Threats and Terrorism: Assessing the Science and Response Capabilities* (Washington, DC: Institute of Medicine National Academy Press, 2002); W. Rudman, R. Clarke, and J. Metzl, "Emergency Responders: Drastically Underfunded, Dangerously Underprepared," Report GAO-03-924 (2003); GAO, "Hospital Preparedness: Most Urban Hospitals Have Emergency Plans but Lack Certain Capacities for Bioterrorism Response" (2003); Congressional Research Service, "Bioterrorism: Legislation to Improve Public Health Preparedness and Response Capacity" (2002); L. P. Bremer and E. Meese, "Defending the American Homeland" (2002); "Trust for America's Health, Ready or Not? Protecting the Public's Health in the Age of Bioterrorism" (2003), accessed online at: http://www.healthyamericans.org.

[2] Institute of Medicine, *The Future of the Public's Health in the 21st Century* (Washington, DC: National Academies Press, 2003).

[3] AHA Section for Metropolitan Hospitals, "Proceedings for the National Symposium on Hospital Disaster Readiness" (2002).

that one of the partners must respond to a catastrophe in its area. Staffing needs (including necessary time for rest and recovery) have been considered and addressed, with bureaucratic mechanisms for the quick certification (or even pre-certification) of regional or even out-of-state medical professionals in the event of a declaration of emergency. The GAO has made similar recommendations for resource sharing and response capacity,[4] and disaster preparedness drills motivated by the events of 9/11 have focused on patient triage and the quick distribution of medications.

Catastrophic events create a need for rapid response in providing the manpower, medications, and equipment necessary to care for large numbers of casualties who present immediately. What is required in such circumstances is a capacity for movement of resources to provide sufficient medications and supplies. An increased number of health care professionals is also necessary, so that triage plans can be developed to identify how medical attention can be prioritized among large numbers of present casualties and delays in needed medical attention can be avoided. It is precisely this type of planning, grounded in lessons from past terrorist events and natural disasters, that is reflected in disaster preparedness drills and cooperative regional partnerships developed by hospitals and healthcare systems throughout the country.

3. Infectious Disease Outbreaks

While each of the programs described above has significant value, offering improved surge capacity for catastrophic emergencies, these programs fail to provide adequate preparation for potential *biological* events, or a host of natural public health emergencies involving emerging and re-emerging infectious diseases. The reason is that such emergencies pose the threat of a vastly different type of patient surge, and thus require different capacities. First, catastrophic events result in casualties that are limited to a defined location or set of locations. Tornadoes or hurricanes, for example, strike in such a way that casualties are limited to the area or areas in the path of these storms. Similarly, a bomb exploded in Oklahoma City or an airplane flown into a building in New York City does not result in casualties outside the immediate area of attack. Simultaneous attacks (for example, in New York and Washington, D.C.) may create multiple areas experiencing a surge in patients, but the surge is nonetheless limited to those areas directly attacked. Chemical attacks normally also share this feature.

However, large-scale biological terrorism or the widespread outbreak of a contagious infectious disease would result in a vastly different type of patient surge. Patient surge resulting from an infectious disease outbreak will likely be accompanied by a high risk that the disease will spread. Infectious disease outbreaks rarely involve the immediate influx of patients experienced during catastrophic emergencies. Instead, a surge in patients results from

[4] GAO, "Bioterrorism: Preparedness Varied across State and Local Jurisdictions," Report GAO-03-373 (2003).

disease propagation that is not necessarily limited by time or geographic location. For this reason, responding to the influx of patients from an infectious disease outbreak would likely require that patient care be slow and deliberate, rather than sped, so that careful attention could be paid to isolation procedures designed to deter the spread of infection.

During the SARS outbreak of 2002-2003, for example, hospital workers took steps that included the use of masks, gloves, disposable gowns, eye protection, and increased attention to hand washing and disinfection, in addition to the use of negative-pressure rooms where available, the isolation of patients, and the grouping of health workers themselves to minimize the number of individuals exposed.[5] It was only with strict adherence to these infection-control procedures that the spread of disease was controlled.[6] Failure to devote due diligence and attention to deliberate infection control procedures is dangerous, as illustrated by the recent Ebola cases in Dallas, where the less stringent protocols initially recommended were inadequate to keep the disease from spreading to nursing staff.[7] The CDC soon changed recommendations to reflect more stringent protocols, but these more intricate protocols are accompanied by additional costs.

Infection control procedures take time and care, reducing the number of individual patients to which any one health care worker might attend. Absent such careful attention, health care facilities themselves can become incubators that exacerbate the spread of disease. During the SARS epidemic, for example, the spread of the disease was greatest among health care workers. In Vietnam, more than half of the first 60 patients with SARS were healthcare workers.[8] In Canada, 77% of probable SARS cases resulted from in-hospital exposure, and in Taiwan almost 94% of SARS cases were transmitted within hospitals.[9] In developing countries that have experienced Ebola outbreaks, lack of proper sanitation, isolation, and infection-control procedures have resulted in hospitals becoming focal points for the spread of

[5] R. Wenzel and M. Edmond, "Managing SARS Amidst Uncertainty," *New England Journal of Medicine* 348, no. 20 (2003), pp. 1947-48.

[6] L. C. McDonald, A. E. Simor, I. J. Su, et al., "SARS in Healthcare Facilities, Toronto and Taiwan," *Emerging and Infectious Disease* 10, no. 5 (2004), pp. 777-81.

[7] M. McCarthy, "US Deploys Rapid Response Teams to Hospitals with Ebola Cases," *BMJ*. 349 (2014), pp. g62-66.

[8] B. Reilley, M. Van Herp, D. Sermand, and N. Dentico, "SARS and Carlo Urbani," *New England Journal of Medicine* 348, no. 20 (2003), pp. 1951-52.

[9] R. W. Grow and L. Rubinson, "The Challenge of Hospital Infection Control During a Response to Bioterrorist Attacks," *Biosecurity and Bioterror* 1, no. 3 (2003), pp. 215-20.

the disease among other patients, health care workers, and visiting family and friends.[10]

Because of the nature of casualties in an infectious disease outbreak, another phenomenon that differs from catastrophic events will likely emerge: the influx of patients would likely occur over a period of days and weeks, rather than minutes and hours. This would result in less need for the type of rapid response and capacity required for a catastrophic event, but greater need for ongoing care and treatment. During the SARS outbreak in Hong Kong, for example, the initial increase in patients was accommodated through diversion of patients into a cluster of hospitals, but the healthcare system was eventually overwhelmed by a massive increase in healthcare demand.[11]

In short, infectious disease outbreaks differ from catastrophic events in how surge occurs and whether surge is limited in time or location. Thus, significantly different considerations will be salient to response planning. Most significantly, because infectious disease outbreaks are not limited by time or location, challenges for outbreak response will reflect system-wide needs for healthcare delivery rather than location-specific needs and logistical concerns.

4. Challenges for Emergency Planning

To the extent that those concerned about surge capacity have considered the overall healthcare system, they have focused largely on the problems created by decreasing numbers of emergency departments and overcrowding within those departments. For example, consider an April 2003 GAO report assessing preparedness for a bioterror event.[12] While the report recognized the importance of basic surveillance and infection control for response efforts, it largely combined these concerns with traditional surge capacity issues surrounding immediate response, going so far as to describe its examination of hospitals on the basis of their likelihood of assuming a role as "first responders." This, in turn, has led to a focus, in the context of hospital and health system preparedness, on emergency departments, mass casualty triage planning, and the movement of resources to areas experiencing a surge in patients.

However, initial challenges during an infectious disease outbreak will be related to the timely identification of the event itself. Biological agents seldom show immediate signs of infection, but are instead characterized by symptoms that develop slowly and in ways that might be

[10] L. Garrett, *The Coming Plague* (New York: Penguin Books, 1994).

[11] C. D. Naylor, C. Chantler, and S. Griffiths, "Learning from SARS in Hong Kong and Toronto," *Journal of the American Medical Association* 291, no. 20 (2004), pp. 2483-87.

[12] GAO, "Bioterrorism."

ascribed to a number of different causes, such as the flu. Plague, for example, presents with clinical symptoms that include fever, cough, and chest pain. Initial smallpox symptoms resemble those of acute viruses such as influenza, beginning with nonspecific fever before the onset of a distinctive rash. Hemorrhagic fevers usually have an incubation period of 5-10 days before the onset of fever, myalgia, and headache, and symptoms include nausea, vomiting, abdominal pain, and diarrhea before more recognizable manifestations occur approximately five days after the onset of illness.[13]

Because of the indeterminacy of symptoms, considerable time would elapse before it is even realized that the cause of illness is more sinister than initial symptoms suggest. Indeed, clinicians involved in the SARS outbreak indicated that identification of the illness itself was their most difficult challenge—even greater than the lack of treatments or vaccines.[14] This would likely add to the spread of infection beyond the site or sites of initial release, as affected individuals interact with and expose others. Once symptoms of exposure to a biological agent begin to manifest themselves, patients are likely to begin presenting to hospitals or clinics in different areas of a city or region, or perhaps even nationwide. Should release occur in a location such as an airport, exposed individuals will likely be scattered to diverse national and international regions before symptoms begin to appear. Partly because patients are likely to present at different locations, significant time may elapse before the commonality of symptoms leads to a realization that these symptoms are connected to the spread of an infectious biological agent. This is true even when one looks at symptoms rather than diagnosis. In the anthrax cases, for example, the number of people exposed was so small in any one geographical area that recognition of a cluster of symptoms was unlikely absent prior realization of the agent's release.[15]

5. Pandemic Fears and Pandemic Communications

Perhaps the most significant challenge posed for infectious disease response planning concerns limiting unnecessary demands on an already strained healthcare delivery system. The challenge of meeting increased healthcare demand during an outbreak would likely be exacerbated by the presentation of people who have no symptoms and have not been exposed to the disease, but seek healthcare intervention because they are worried that

[13] V. Sidel and B. Levy, "Biological Weapons," in *Terrorism and Public Health*, ed. B. Levy and V. Sidel (New York: Oxford University Press, 2003), pp. 175-98.

[14] A. S. Abdullah, B. Tomlinson, C. S. Cockram, and G. N. Thomas, "Lessons from the Severe Acute Respiratory Syndrome Outbreak in Hong Kong," *Emerging and Infectious Disease* 9 (2003), pp. 1042-45.

[15] A. Reingold, "If Syndromic Surveillance Is the Answer, What Is the Question?" *Biosecurity and Bioterror* 1, no. 2 (2003), pp. 77-81.

they *may have been* exposed (the "worried well").[16] The U.S. experience with anthrax in the fall of 2001 confirms this challenge, as described in *Journal of the American Medical Association*: "Frontline clinicians faced a challenge that often was even more difficult than diagnosis of anthrax—that of excluding the diagnosis among the many worried patients with concerns about potential exposure or among those who sought care for rashes or illnesses suggestive of the diagnosis."[17]

Contemporary anxiety about infectious disease has a long history. In Europe, fears about sudden outbreaks of unclear origin go as far back as the Plague of Athens (430-426 BC), and calls for quarantine are evident in historical accounts of the Black Death (1347-50 AD), the French Pox of 1494, and American epidemics of yellow fever and cholera in the eighteenth and nineteenth centuries.[18] Nancy Tomes has described two famous bouts of "germ panic" in the U.S., the first spurred by tuberculosis and the second by the HIV/AIDS epidemic.[19] Various influenza-based panics have been evident more recently. Most relevant was the fear-induced "run" on seasonal influenza vaccine following a shortage resulting from contamination at vaccine-production facilities in Liverpool, England, and another fear-induced "run" following the October 2001 Anthrax scare, when recommendations to get vaccinated in order to reduce suspected cases presenting to doctors and emergency departments (symptoms of anthrax mimic flu in its early stages) were misunderstood to suggest that seasonal flu vaccination conferred protection against anthrax (which it did not and does not).

The most recent example of public panic in the face of infectious disease concerns Ebola. To be sure, Ebola and the fears that accompany it are hardly new. The Centers for Disease Control and Prevention counts thirty-four separate instances of Ebola since the 1976 outbreak that claimed 318 lives in Zaire.[20] "Alarm and near panic" were reported at a Sudanese hospital that same year, and the anxious neighbors of some healthcare workers who elected

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[16] T. V. Inglesby, R. Grossman, and T. O'Toole, "A Plague on Your City: Observations from TOPOFF," *Clinical Infectious Disease* 32, no. 3 (2001), pp. 436-45.

[17] J. L. Gerberding, J. M. Hughes, and J. P. Koplan, "Bioterrorism Preparedness and Response: Clinicians and Public Health Agencies as Essential Partners," *Journal of the American Medical Association* 287, no. 7 (2002), pp. 898-900.

[18] D. M. Morens, G. K. Folkers, and A. S. Fauci, "Emerging Infections: A Perpetual Challenge," *Lancet* 8 (2008), pp. 710-19; M. Honigsbaum, "Ebola: Epidemic Echoes and the Chronicle of a Tragedy Foretold," *Lancet* (2014), pp. 1740-41.

[19] N. Tomes, "The Making of a Germ Panic, Then and Now," *American Journal of Public Health* 90, no. 2 (2000), pp.191-98.

[20] Centers for Disease Control and Prevention, "Outbreaks Chronology: Ebola Virus Disease" (2015), accessed online at: http://www.cdc.gov/vhf/ebola/outbreaks/history/chronology.html.

to stay on the job during that outbreak threw stones or, in some cases, drove these workers from their homes. During Uganda's 2000-2001 outbreak, many Ebola survivors returned home to find that fearful neighbors had burned their possessions and, in some cases, their huts.[21] The same kinds of fearful reactions remain all too prevalent in the midst of the current outbreak, in which thousands of people have died in West Africa.[22]

Infectious diseases are invisible, transmissible, and often deadly.[23] When pandemics occur, people who perceive a great risk from infection must suddenly find ways to cope. The prevalence of adaptive coping responses (e.g., "keep calm and carry on") largely depends on the level of trust that people have in their *ability* to keep the disease at bay.[24] In the case of Ebola, a number of factors—including perceived severity, lack of vaccines, and open confusion about etiology and transmissibility have created an environment in which many Americans do not trust the public health system to keep them safe.[25]

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[21] J. Kinsman, "A Time of Fear: Local, National, and International Responses to a Large Ebola Outbreak in Uganda," *Global Health* 8 (2012), accessed online at: http://www.globalizationandhealth.com/content/8/1/15.

[22] B. Diallo and S. DiLorenzo, "Survivors of Ebola Face Second 'Disease': Stigma," *Associated Press*, April 27, 2014, accessed online at: http://bigstory.ap.org/article/survivors-ebola-face-second-disease-stigma; M. Diallo, "Battling Fear and Stigma over Ebola in West Africa" (2014), International Federation of Red Cross and Red Crescent website, accessed online at: http://www.ifrc.org/ar/news-and-media/news-stories/africa/guinea/battling-fear-and-stigma-over-ebola-in-west-africa-65367; S. Briand, E. Bertherat, P. Cox, et al., "The International Ebola Emergency," *New England Journal of Medicine* 371, no. 13 (2014), pp. 1180-83; "Ebola Outbreak: Thousands of Orphans Shunned," *BBC News*, September 30, 2014, accessed online at: http://www.bbc.com/news/world-africa-29424919.

[23] G. Pappas, I. J. Kiriaze, P. Giannakis, and M. E. Falagas, "Psychosocial Consequences of Infectious Diseases," *Clinical Microbiological Infections* 15, no. 8 (2009), pp. 743-47.

[24] R. S. Lazarus and S. Folkman, *Stress, Appraisal, and Coping* (New York: Springer, 1984); A. T. Beck and D. A. Clark, "An Information Processing Model of Anxiety: Automatic and Strategic Processes," *Behavior Research and Therapy* 35 (1997), pp. 49-58.

[25] R. D. Smith, "Responding to Global Infectious Disease Outbreaks: Lessons from SARS on the Role of Risk Perception, Communication, and Management," *Social Science and Medicine* 63 (2006), pp. 3113-23; G. Gonsalves and P. Staley, "Panic, Paranoia, and Public Health—The AIDS Epidemic's Lessons for Ebola," *New England Journal of Medicine* 371 (2014), pp. 2348-49.

How have public health officials tried to calm these fears? In the most recent Ebola outbreak of 2014, CDC spokespersons and other officials continually stressed that Ebola could only be contracted through contact with the bodily fluids of someone who began to exhibit symptoms of the disease. These messages, designed to avert panic and facilitate calm, were often ineffective—in part, because they were constructed largely from the viewpoint of the scientists and public health officials who promulgated them (reasonable, if somewhat dispassionate scientific estimates based on calculations of probability by experienced epidemiologists). However, these officials did not fully account for public perceptions about the dangerousness of Ebola, or the ways in which ordinary citizens perceive risk.

There is significant risk from "over-downplaying" such outbreaks. If scientists purposely downplay risk in order to buffer against the possibility of overreaction and public panic, they may inadvertently undermine the trust of the very people they are trying to help. In 1976, concerns about a potential swine flu epidemic resulted in a mass vaccination campaign that addressed public concerns about the new vaccine with particularly strong reassurances about confidence in the vaccine's safety—culminating in President Gerald Ford's being vaccinated on national television as a demonstration of personal confidence. Subsequent discontinuation of the vaccination campaign due, in part, to emergent identified risks (including Guillain-Barre syndrome) resulted in public distrust of the motives of public health campaigns that continues to be felt in the vaccination community.[26] In 2009, French officials—puzzled by the lack of uptake in an H1N1 vaccination campaign—also learned that contemporary efforts to protect public health are often confounded by a fraying of trust that happened because of prior episodes of miscommunication. In this case, public suspicions were rooted in the French government's previous minimization of the health hazards associated with fallout from the Chernobyl nuclear plant disaster more than twenty years earlier.[27]

6. A Call for Balance in Public Health Messages

For politicians and health officials, the key imperative for communicating during infectious disease outbreaks is to convey accurate and agenda-free (i.e., *trustworthy*) information while at the same time modulating the tone of their messages, lest they trigger a sense of panic that outruns the severity of the actual threat. This is a challenging task in cases like Ebola,

[26] L. B. Schonberger, D. J. Bregman, J. Z. Sullivan-Bolyai, et al., "Guillain-Barre Syndrome Following Vaccination in the National Influenza Immunization Program, United States, 1976-1977," *American Journal of Epidemiology* 110, no. 2 (1979), pp. 105-23; R. E. Neustadt and H. V. Fineberg, *The Swine Flu Affair: Decision-Making on a Slippery Disease* (Washington, DC: National Academies Press, 1978).

[27] C. Rousseau et al., "Public Media Communications about H1N1, Risk Perceptions and Immunization Behaviours: A Quebec-France Comparison," *Public Understanding Science* 24, no. 2 (2015), pp. 225-40.

since traditionally high fatality rates in Africa—coupled with gruesome symptoms described in the news and in popular books (e.g., *The Coming Plague*[28] and *The Hot Zone*[29])—provoke strong, instinctual responses aimed at avoiding the disease. In the words of one prominent psychologist, Ebola "hits all the risk-perception hot buttons."[30]

Communication about threats to public health is a dynamic process, one in which health officials must seek to understand and address public perceptions of disease risk.[31] When communication is perceived as agenda-driven (be it beneficent or not), it undermines the perceived reliability of the message and, hence, its effectiveness. For example, if outbreaks were to result in the need to "shelter in place," citizens must have confidence that this policy is not driven by an agenda that sacrifices their own interests for the sake of overall population health. If trust wears thin, people will likely flee rather than shelter. Noting the challenge of dealing with individual-level risk perceptions during the recent Ebola outbreak, an article in *Forbes* suggested that health officials made a crucial mistake by telling people "not to worry" because other conditions and hazards, such as common seasonal flu viruses, are actually more deadly. The flu comparison, the author contends, is not at all valid as "rational people know we're going to die someday. [But] people are rightly scared of things that might take us out while we're still young."[32]

When the public is confident that its concerns and interests are heard and respected, it is much less likely that panic will ensue. If the public feels that symptom etiology described by health officials can be trusted, it is much more likely that challenges posed by the "worried well" can be avoided. Effective emergency response planning for infectious diseases outbreaks, then, must include strategies for effective public communication in order to gain the public trust necessary to facilitate disease containment.

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[28] Garrett, *The Coming Plague*.

[29] R. Preston, *The Hot Zone* (New York: Anchor Books, 1994).

[30] Josh Sanburn, "The Psychology Behind Our Collective Ebola Freak Out," *Time*, October 20, 2014, accessed online at: http://time.com/3525666/ebola-psychology-fear-symptoms/.

[31] Z. Cirhinlioğlu and F. Gül Cirhinlioğlu, "Social Representations of H1N1 Influenza A (Swine Flu)," *Revija za sociologiju* 3 (2010), pp. 273-95; C. Barrelet, M. Bourrier, C. Burton-Jeangros, and M. Schindler, "Unresolved Issues in Risk Communication Research: The Case of the H1N1 Pandemic (2009-2011)," *Influenza and Other Respiratory Viruses* 7, supp. 2 (2013), pp. 114-19.

[32] Faye Flam, "Three Ways Health Officials and Doctors Fumbled in Communicating Ebola Risk," *Forbes*, November 5, 2014, accessed online at: http://www.forbes.com/sites/fayeflam/2014/11/05/three-ways-health-officials-and-doctors-fumbled-in-communicating-ebola-risk/.

7. Conclusion

Emergency response planning is a contextual project that must account for divergent circumstances and challenges resulting from different types of emergency events. Catastrophic events such as earthquakes, tornadoes, hurricanes, or terrorist bombs will present those healthcare facilities located nearest to the event with an immediate surge in patients, while having limited impact beyond the region directly affected. In contrast, infectious disease outbreaks will present a slower surge in patients, but will require a more sustained response effort—an effort whose effectiveness will depend on deliberate, methodical attention to detail (in the form of adherence to infection control procedures) rather than the emphasis on speed and movement of resources that characterizes effective response to catastrophic events. Equally important, strains on the healthcare delivery system resulting from the sustained, deliberate approaches required during outbreak response, combined with the difficulties inherent in distinguishing mundane causes of symptoms from more serious etiology of these symptom manifestations, will require special emphasis on public communication in order to avoid unnecessary demands on the healthcare system.