

## *Disasters, Catastrophes, and Worse*

### *A Scalar Taxonomy*

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#### **Introduction**

For the last ten years I have been ruminating about terrifying events that afflict both communities and the practices and ethical commitments of healthcare professionals. The line of thought began with the collapse of the World Trade Center and the subsequent appearance of weaponized anthrax. I was, at the time, on sabbatical as a visiting Senior Scholar at the American Medical Association. Around me, as scores of researchers and clinicians pondered the issues posed by the new terrorism, I began to discern troubling problems in the way disaster triage had been understood.<sup>1</sup> Four years later, Hurricane Katrina challenged us with the paralysis and isolation of a medical center. There were accusations of euthanasia.<sup>2</sup> Three years after Katrina, I found myself working in Galveston, Texas, as Hurricane Ike devastated the city, disabling its many hospitals and clinics. All through the decade, infectious diseases—SARS in China and Canada, avian flu in the Far East, and H1N1 swine flu in Mexico—forced us to consider the possibility of a deadly global pandemic. And, finally, the earthquake, tsunami, and nuclear reactor failures in northern Japan synergistically shook our confidence in the very idea of “disaster preparedness.”

By themselves, these recent insults—along with other historical examples—suggest that there are many species of

calamity, and perhaps, depending on the affliction, a multiplicity of ethical issues and effective responses. In researching and writing about such episodes, it occurred to me that there might be a systematic way of cataloguing disasters, catastrophes, and worse, marking the increasing levels of gravity. The goal here is to show how, as each threshold is crossed, organizational priorities must change. Whereas this essay draws on and reformulates some elements of my previous work, it builds on these by essaying a more perspicuous representation of the terrain. Three questions are considered at each level. First, in what ways can a community’s healthcare resources be overwhelmed by calamity on that scale? Second, for each level of affliction, what strategies should be considered in marshaling a response? And third, what are the distinct ethical issues that can be anticipated for each scenario?

The brief analysis set out in the subsequent discussion is not offered as comprehensive. The scalar taxonomy, the associated management strategies, and the pertinent ethical issues are here offered as a contribution to systematic reflection on medical ethics in extremis. There is more to be said.

As a general background, we first describe the everyday clinical queuing used to allocate medical resources to patients. This familiar procedure, together with the concepts used to describe it, are the backdrop for what follows. Bearing in

mind the ordinary, we can consider the elements that are lost as patient needs wax and as clinical capacity wanes. At four successive points, resources become inadequate to meet needs that were earlier satisfied. Effective clinical practices are defeated as the scale of calamity widens, and, at each juncture, the philosophy and organization of healthcare must evolve. Four ordered fallback positions are described, each a response to the overwhelming of healthcare resources in a previous configuration. Whereas the first two are widely understood and relatively unproblematic, the two others, which are occasioned by rare events, are less adequately anticipated.

The four-level scalar taxonomy provides a framework—a conceptual scheme—for systematic thinking about calamity. This is not an empirical study, nor, except for its overall organization, is it offered as something original. Much of what follows is taken for granted by experienced doctors, clinicians in the military, public health officials, and disaster management personnel. This essay is offered in the conviction that, depending on what horrors the future holds, a comprehensive understanding of the conditions that can require organizational adaptation in healthcare could be, for clinicians, the most important element of disaster preparedness.

### **Background: Level 0, Ordinary Practice in Clinical Healthcare**

On a typical day in the emergency department, the task of queuing prospective patients falls to a triage nurse with responsibility for initial interviews and assessments. Following an examination, those with serious needs can generally get to see a doctor at once, even as others must wait. The lady with crushing chest pains receives attention before the football player with an injured ankle, even if he showed up first. Allocating care

on the basis of need is consistent with medicine's clinical orientation, is consummately fair under the circumstances, and is easily understood.

From a broader perspective, one can see, on one side of the triage nurse, what I have called the "burden of patient need": a stream of medically treatable conditions flowing in through the hospital door. On the other side is the institution's "carrying capacity": the finite institutional resources that can be brought to bear on the treatable conditions in the waiting room. Poised between these two elements is the triage nurse, choreographing their engagement. When things go well—which is most of the time—patients showing up at a hospital will receive what they need—although perhaps not as soon as they would like—and the hospital goes about its job of preventing death and disability insofar as good clinical practices can make it so. If hospitals have a constituting rule—a prime directive—it is, I would argue, "No technically avoidable bad outcomes." I assume this to be the default norm of organized healthcare. As we shall see, circumstances can require that it be set aside.

The stream of medically treatable conditions can be mapped along three scales. The first is *rate*. How many prospective patients are coming into the system per unit of time? The second scale is *urgency*. Many medical conditions can be conceived as arriving with a countdown timer. Although most ailments are self-limiting—the patients are stable or can be expected to get better on their own—urgent conditions require timely care. Too much delay and the countdown timer rings: a patient dies, suffers loss of function, or deteriorates to the point of requiring more care than would otherwise have been needed. Each of these is a bad outcome that, but for the delay, might have been avoided. The third scale is *complexity*. What resources—time, staff,

equipment, space, supplies, and so on—are required to improve a patient’s prospects? Taken together, these three factors—rate, urgency, and complexity—define the burden of patient need. The size of a hospital’s responsibility is a function of the rate, urgency, and complexity of the treatable conditions that present. Usually, the hospital’s resources will be equal to its responsibility to meet the needs of patients. Clinical triage reconciles the burden of patient need and the hospital’s carrying capacity as these two elements engage each other.

### **Level 1, Patient Surges and Staff Shortages: Diversion**

Perhaps the two most common disruptors of ordinary clinical practice are temporary staff shortages and sudden patient surges.<sup>3</sup> Both of these can overwhelm a hospital’s carrying capacity. What hospitals will then require is a backup plan, a fallback position. As often as several times a month, some medical centers will call a “code red,” close their doors, and go to “divert” or “bypass.” If health-care facilities have an everyday duty to be open to the needs of incoming patients, surges and staff shortages can justify closing the hospital doors. Ambulances will be redirected to other regional medical centers, halting or slowing the influx of new patients until the imbalance is corrected. Despite delays in treatment, the goal is still to ensure that all patients get what they need, that is, that bad outcomes are prevented insofar as medical and nursing skills can make it so.

Here we can distinguish between a region’s carrying capacity and the carrying capacity of a single medical center. Although a patient surge or staff shortage can compromise the functioning of a single hospital, not much is lost if the regional carrying capacity—the total capacity of all hospitals in the area—remains equal to the region’s burden of

patient need. Assuming the patients who are turned away are not in urgent need of treatment, and (to reinforce the same point) that the additional time needed to transport patients to a nearby hospital will not result in death, loss of function, or deterioration, the collaborative sharing of responsibility among separate hospitals can, by itself, augment the functionality of a community’s health-care resources. Beyond the single clinic’s responsibility to care for its patients, a community’s hospitals arguably share a collective responsibility to care for patients within a common catchment.

The bare possibility of such disruption creates an antecedent obligation to formulate collaborative agreements among regional hospitals. Generally, the closing of a hospital’s doors would be ethically problematic absent a grounded expectation that other less-burdened institutions were standing ready to manage the overflow.

### **Level 2, Disasters: Triage**

Whereas triage, as sketched, is implemented today in everyday clinical practice, the quite different progenitor strategy emerged on the battlefield two centuries ago. The practice of rationally prioritizing very large numbers of wounded originated in Napoleonic France. The strategy was exported by British and American doctors working alongside French physicians at the “casualty clearing stations” of World War I.<sup>4</sup> From a clinical perspective, war is the mass production of wounds. Like war, civilian disasters—tsunami, earthquakes, industrial accidents, and so on—can also cause mass casualties. But this larger influx of prospective patients is not a mere patient surge calling for diversion. Rather, a “disaster” (as I will use the term) is a large-scale disruptor that creates a burden of patient need that exceeds the region’s clinical carrying capacity. Diversion fails as a fallback position just because the other

medical centers are overwhelmed too. We need a second backup plan.

Disaster triage is the second fallback position, one that relies on rapid initial assessment—90 seconds is the standard—and a dynamic tagging process that registers and continues to monitor the urgency and complexity of injuries. Those presenting for care are characteristically assigned to one of three categories. Think of the injured as falling along a bell-shaped horizontal scale, with the most seriously injured (the black-tagged expectant patients) toward the right of the central bulge and the least seriously injured (the green-tagged walking wounded) toward the left. Disaster triage reduces hospitals' clinical responsibility by lopping away patients at both ends: those at the right, who will more likely die even if treated, and those at the left, who will more likely live even if not treated. Life-saving resources allocated to those two groups are, arguably, wasted: the green-tagged patients don't need the resources, and the black-tagged patients are less likely to benefit from them. In the thick of disaster, clinicians must narrow their focus to the red-tagged casualties in the middle: those who will likely live if treated but likely die if not treated.<sup>5</sup> And within this middle group, priority goes to those whose conditions are the most urgent and the least complex. I am told that a patient with an otherwise fatal sucking chest wound can be stabilized in seconds with a piece of plastic wrap.

At bottom, disaster triage is the solution to a mathematical problem. As with the field of public health, disaster triage specifies what clinicians must do to save the maximum number of lives. This shift in focus, from the patient to the population, palpably transforms the ethical landscape.

Consider that, in a disaster, it is no longer an option to prevent every technically avoidable death. The resources

aren't there. Professional attention and responsibility must now shift from the individual patient to the collectivity of those in need. In an emergency department, those with the most life-threatening injuries will receive prioritized attention. But in a disaster, some of those same patients—patients who perhaps could have been saved on an ordinary day—will be black-tagged and set aside, even as less seriously injured patients are treated. For some clinicians, it will still be tempting to accede to the everyday moral imperative to accord more time and attention to the worst off. But in a disaster, these understandably compassionate responses will increase the ultimate sum of avoidable fatalities. This is too high a price.

Consider also that it can seem obligatory—noble and heroic—to persevere despite exhaustion. But now recall that doctors and nurses cannot function indefinitely without sleep. For incident commanders, it is essential to adjust the utilization of human resources to a level that is sustainable for the anticipated duration of the crisis. Accordingly, clinicians must be ordered to rest and must comply with such orders when they are issued, notwithstanding the evident needs of the wounded. To fail in this is to risk the broad erosion of staff functionality, possibly as early as the 16-hour mark.<sup>6</sup>

These departures from well-entrenched norms will be extremely difficult for some clinicians, and perhaps impossible for others.<sup>7</sup> Many will require counseling and support if they are to discharge what may be new and unfamiliar obligations. Others will have to contend with post-traumatic stress injuries following the unanticipated violation of professional norms that, until then, had informed their practical identities.

Disasters call for a distinct ethical paradigm, one within which emergent responsibilities fly in the face of

everyday moral intuitions. Compassionate attentiveness—so much the pride of medicine—must give way to firm professionalism and 90-second assessments, both of which are critical when clinical triage is overwhelmed regionally. It is, I would argue, obligatory for clinicians to talk through these issues comprehensively, regularly, and well in advance of the insult, as an essential element of nursing and medical education.

### **Level 3, Physical and Medical Catastrophes: Forced Abandonment and Redeployment**

Drawing on the concepts introduced previously, one can distinguish between a region's everyday carrying capacity—the largest burden of patient need that can be managed on an unproblematic day—and its disaster-level carrying capacity—the much larger burden that can be managed regionally when the black-tagged and green-tagged patients are essentially set aside. In many studies of preparedness, disaster triage is as far as the analysis goes. (Who gets the ventilators?) But events can conspire to overwhelm regional carrying capacity even when it is augmented in this way.

In order to function at full disaster-level capacity, hospitals must retain the following:

- 1) The ability to assess all incoming prospective patients
- 2) The ability to monitor and attend red-tagged patients whose essential treatments are being delayed, and to treat those selected for immediate attention
- 3) A sufficient staff, not drawn away by injury or illness, competing obligations, or exhaustion
- 4) A functional hospital infrastructure, not compromised by damage or contamination

- 5) Cooperation by prospective patients and their families, even when treatment is being denied or delayed

It is common to list strategies that can tweak capacity: Empty as many beds as possible, sending well-enough patients home. Add additional beds. Assemble supplies for ease of use. Summon supplementary healthcare workers: dentists, veterinarians, hospice nurses, retired clinicians, and volunteers. Set up reception areas and decontamination showers outside of the hospital. Use the hallways, parking areas, lobbies, lawns, rooftops, and so on, for patient care. Increase security staff to keep order and protect physical facilities. Call out the National Guard if needed to prevent a riot. Prepare to evacuate casualties to distant centers should the opportunity arise.

But these may not suffice to preserve the functionality of medical centers. On the scale of societal afflictions, catastrophe is the successor to disaster. As used here, "catastrophe" refers narrowly to the collapse of a previously functional healthcare institution.<sup>8</sup> Just as surges and disasters call for new ways of conceiving organizational and professional responsibility, so too can the catastrophic collapse of a medical center. There are two types of disruptors that can bring about catastrophe: physical and medical. We consider these two insults separately.

#### *Physical Insults*

To fix the idea, imagine the clinical response after an earthquake and ongoing aftershocks have caused structural damage to a large medical center. Occupied sections of the buildings are on the brink of toppling and fires have started. Nearby hospitals are similarly compromised. For a real example, consider the events at New Orleans' Memorial Medical Center following Hurricane Katrina.<sup>9</sup> The protective sea walls had failed, and the

waters from Lake Ponchartrain and the city's sewers had flooded the low-lying area where the hospital stood, inundating its lower floors. Isolated and damaged by the flood, the hospital lost electricity and plumbing. Missing were lights, elevators, toilets, running water, refrigeration, air conditioning, pagers, telephones, ventilation, and electrically powered medical devices. Temperatures in the building soared in the New Orleans heat. Toilets overflowed. Katrina had crippled the hospital's capacity to care for its patients, and, even worse, the building may have become a health hazard.

The catastrophic failure of a functioning hospital generates two successive dilemmas, both of which can be anticipated. The first quandary strains the dedication of clinicians as the situation deteriorates. Ethically, when, if ever, are healthcare personnel at liberty to leave? The ready answer would be "When all patients have been evacuated." But, as happened in New Orleans, it had been authoritatively announced that evacuations were not to be expected.<sup>10</sup> What to do then? One answer would be that healthcare professionals are obligated to remain at their posts until the last patient dies or is evacuated. They must do this regardless of the burdens and risks of remaining on duty, regardless of the futility of the efforts they might make on behalf of the remaining expectant patients, and regardless of other obligations they may have or could take on.

Although further discussion is called for, it is not clear that such heroism is obligatory or even wise. At some point doctors and nurses will have done everything they can reasonably be expected to do. It would be wrong to fault them for not doing more. Although a healthcare professional should then be free to leave, locating that point may be one of the hardest ethical decisions in healthcare.

So let us suppose there is a line beyond which there is no duty to remain and that, for clinicians at some gravely crippled medical center, it is reasonable to judge that the line has been crossed. Healthcare professionals could then properly conclude that they were at liberty to leave. But now, having undertaken to withdraw, clinicians would face a second horrific dilemma: they can abandon their black-tagged patients to die unmedicated and unattended, or they can euthanize them before leaving themselves. There is no third option.

This second quandary emerges from the collision of two salient medical norms: the prohibition against abandoning patients and the prohibition against killing them. When it is (1) impossible to evacuate patients and (2) dangerous and futile to remain with them, one of these two norms must give way. Whereas there is a broad consensus in healthcare professions on the ethical impermissibility of both abandonment and euthanasia, there are, so far as I can determine, almost no discussions on how these norms should be prioritized when, as here, they conflict. The problem surely merits further analysis.<sup>11</sup>

Catastrophe (as defined here) can occur without there having been a disaster. During Katrina, the same forces that made it difficult to leave Memorial Medical Center also prevented new patients from getting there. The hospital collapsed without there having been an onrush of patients. Likewise in Galveston, the inpatients on the island were evacuated to other medical centers hours before Hurricane Ike disabled the island's hospitals. It was many months before clinical practices could return to normal. Nonetheless, after the storm passed, hospital administrators of the University of Texas Medical Branch hospitals in Galveston fired several hundred clinicians and, in letters to "unsponsored" patients (those unable to cover medical treatment),



firmly renounced responsibility for their care: "We regret to inform you that [your] UTMB physician will be discontinuing his/her professional relationship with you due to the devastation caused by Hurricane Ike."<sup>12</sup> Chemotherapies were halted and scheduled procedures were canceled, all without arranging for alternative follow-up elsewhere. In effect, these patients were abandoned, but not by their doctors. It is not clear that these draconian measures were licit. The issues raised for Texas and for organized healthcare generally have yet to be studied.

### *Medical Insults*

Up to now we have been considering physical damage to hospitals. But medical disruptors can also be catastrophic, as when an epidemic illness or biowarfare attack is sufficiently lethal, infectious, and difficult to treat. An inundation of sick people can exceed the number of patients that can be assessed, stabilized, and monitored, which are essential tasks even if the goal is merely to evacuate the casualties. It will be worse if healthcare professionals are succumbing to whatever hazards are present, especially if the nature of the agent is obscure and it is frighteningly unclear what protection is required. It will be worse if hospitals are damaged or contaminated, if large crowds of casualties and loved ones are assembling there, if many of those awaiting care are infectious or unruly, and if those outside believe that essential resources are being hoarded inside. In the worst case, hospitals become health hazards. The effort to make one's way through the crowds, seeking clinical care in a pandemic catastrophe, may be fraught with grave and avoidable risk. At some point the hospital's doors must be closed and the crowds of prospective patients and accompanying loved ones kept away from the facility.

In a *medical catastrophe*, the pressing needs of so many prospective patients reach a level that compromises the very institutions we have created to deal with them. It is not enough to lop away even more of the injured, not enough to process the selected ones with greater efficiency. Rather, the problems we face may be built into the hospital-centered paradigm of healthcare.

The skilled attention hospitals can give to a handful of patients with inhalational anthrax cannot be offered to thousands of them. During a catastrophe, hospitals cannot serve as the primary locus of healthcare. Accordingly, regional hospitals must close their doors well before they reach disaster-level capacity, diverting prospective patients and redeploying staff and supplies to peripheral emergency healthcare venues. As with the earlier decision to leave black-tagged patients behind, the community decision to shut down a region's hospitals will be as difficult as it is consequential.

Although the details will depend on the specific challenge, here is a sketch of catastrophe-level healthcare: healthcare without hospitals.

First, we should be emulating the Israelis, who, concerned about biowarfare, have implemented a strategy called "shelter in place." During a terrorist attack, it may be better for people to remain where they are. If an invisible deadly plume is passing over my city, I am at greater risk if I move about and safer if I stay put, especially in a windowless room or closet with the door shut, with a radio, a phone, and food and water.<sup>13</sup> Despite the commonsense view that a possibly serious illness demands a trip to the hospital, people must be helped to understand the requirement that they stay put. During the H1N1 swine flu outbreak in 2009, the normally bustling streets of Mexico City were virtually deserted. A fear of fatal illness will keep people at home, at least for a while.

Second, we should be designating neighborhood locations as peripheral healthcare venues, with supplies, decontaminating showers, floor space, and robust communication links. Instead of attracting the ill to medical centers, it is better if help is available nearby: at a school, a fire station, a pharmacy, a neighborhood clinic, a cafeteria, or a hotel. If casualties are staying put, medical outposts can support house calls and home care. Radio can be used to provide general advice to home caregivers. Key goals are to eliminate crowds and reduce travel, thereby preventing infection and cross-contamination. The closing of medical centers is likely to limit the therapeutic options that are available. Although hospitals can function as regional coordination centers, they should resume patient care only when it is known they can operate safely and effectively. This may take some time.

Third, we should be considering how to assign healthcare personnel to peripheral healthcare venues if and when a “code black” is called. Perhaps the most heartening aspect of the World Trade Center attack was the public spiritedness it exposed. Clinicians will register for emergency duty, and ordinary citizens will learn to serve as volunteers. Above all, people need to know where to go if, as is likely, hospitals are to be avoided.

All that said, the range of patients who can be helped by clinicians is likely to be a small fraction of those in serious need. The details of a community’s response will depend on the nature and severity of the insult and the clinical resources that are available. One supposes that the scale of human loss will be inversely proportional to a community’s preparation.

I have been told that, during the battle of Stalingrad, Soviet officials stored the city’s food supply in a single warehouse. The Nazis blew it up, causing terrible starvation. Had the Soviets dispersed the food supply, much suffering would

have been averted. Military doctors have long known that the scattering of vital resources creates a more robust system.

#### **Level 4, Mega-Pandemics: Social Distancing and Logistics**

Although even a mild pandemic can be devastating to those it affects (e.g., the 1957–1958 Asian flu took about 70,000 U.S. lives), such outbreaks are unlikely to strain regional carrying capacity. The more deadly 1918 Spanish flu took place before the advent of ventilators and antivirals. Like typical seasonal influenzas, about 30 percent (about 33.75 million) of the U.S. population contracted Spanish flu, and, of those, more than 2 percent (675,000) died, a far greater mortality rate than the typical seasonal flu.<sup>14</sup> By comparison, an equally severe insult with today’s much larger population would sicken more than 90 million Americans and kill nearly 2 million. Fatalities would be expected to occur in waves over many months. As hellish as this would be, such a pandemic might be managed by disaster triage, redeployment of healthcare resources, and reduction of human-to-human contact (social distancing). Much will turn on the simplicity and efficacy of treatment.

And yet there is an even worse scenario that cannot be ruled out, one that will take us to the next level. As used here, a “mega-pandemic” would have four defining characteristics. It would be extremely contagious, it would have a very high mortality, it would be global (ruling out emigration and evacuation as strategies for avoiding infection), and it would be, as a practical matter, untreatable. In effect, all of those felled by such an illness would be black-tagged.

Among present-day illnesses, it is worth considering avian flu. Globally, this H5N1 virus has had a devastating impact on domestic and wild bird populations. A building that houses many



thousands of healthy chickens today may contain only a small number of sick and dying fowl tomorrow: all the rest would be dead. Since 2003, the World Health Organization has tracked laboratory-confirmed human cases of avian flu.<sup>15</sup> As of August 2, 2011, 563 human cases had been diagnosed in 15 countries, from Indonesia to Egypt. Of the 563 cases, 330 (59%) were fatalities. So far in 2011, 24 (51%) of the 47 patients diagnosed since January have died. Although the virus rarely moves from birds to humans, and even more rarely from person to person, there are well-understood mechanisms that could augment its infectiousness to the point at which it could spread among us like a cold. Even now there are only two antivirals that are effective against current forms of the virus, and some researchers worry about emergent resistance. There are no vaccines. To be sure, there are reasons to believe that avian flu is *not* likely to erupt pandemically into the human population, and, even if it does, it is not likely to retain the same virulence it has had with birds. So, as a thought experiment, we will assume an outbreak with 30 percent morbidity (the same as a seasonal flu) and 51 percent mortality (what WHO is now seeing). Such a pandemic could be expected to kill about 15 percent of the U.S. population, or more than 45 million. Globally, the death toll would be more than one billion. In its scale, its infectiousness, and its resistance to treatment, such an outbreak would be comparable to the fourteenth century's Black Death.

It would be hard enough to prepare for the 2 million fatalities caused by a latter-day Spanish flu. But although the implications of a vastly larger mortality rate must surely strain the conceptual foundations of those with responsibility for disaster preparedness, it is difficult to see how that unwelcome possibility can be ruled out. Were we to have to face a mega-pandemic, it will not be enough

to close hospitals and redeploy clinical resources. Without effective treatments and vaccines, it may be difficult to accept that medicine is virtually powerless against the scourge. There would, however, be one remaining role for clinicians.

Although it is rarely mentioned, research should be a residual hospital responsibility during medical catastrophes and mega-pandemics, carried out even after the facility is closed to patient care. A small number of research subjects could be admitted. Until we know which treatments are effective, head-to-head trials should be routinely used to inform clinical practice. Generic protocols for on-the-fly investigations—possibly under the waiver of informed consent for emergency research—should be submitted to institutional review boards (IRBs) *well before the disease manifests itself*. IRBs may not be functioning after a pandemic hits, and the lack of IRB approval does not need to be an obstacle to research. Staff should be assigned to monitor which treatment strategies are working, and the results should be disseminated broadly and quickly.

If the idea of a catastrophe introduces us to the possibility of healthcare without hospitals, the idea of a mega-pandemic (as defined previously) introduces us to the possibility of healthcare without clinicians. What can we do when all patients are black-tagged? Even if hospitals shut their doors when it becomes evident that a region's disaster-level carrying capacity is going to be overwhelmed, and even if there are no implementable treatments at hand, we would not then be without resources. Social distancing at the necessary scale can save many lives, but only if we plan for it. What we will need, in order to hunker down in our homes for weeks on end, are functional electrical, plumbing, and communications systems and the delivery of food and pharmaceuticals in ways that do not require us to come into contact with one another.

Although somewhat complicated, such arrangements are feasible. Accordingly, the likely heroes of that horrific time will not be clinicians but will be those who keep the water and electricity flowing, those who deliver medications and groceries to our doors and driveways when it has become too perilous to shop for ourselves, and those who keep the networked pipelines of food and medicine functional during the waves of infection. Also among the heroes would be the men and women who can gather the dead. Those found to be immune to a newly virulent H5N1, or those who have recovered from it, may have to be pressed into service, a necessity that presents unexplored ethical, legal, and social issues. Can we compel those who have recovered from the illness to serve their communities in these ways? Can we condition offers of experimental treatment on a willingness to serve if a research subject recovers? Certainly if effective vaccines and antivirals become available, the men and women who are playing critical roles at the pandemic battlefield have a powerful claim to be placed at the head of the line.

In addition to medicine, law, and public policy, the teams who plan for disaster must include experts in public utilities and logistics. If social distancing is the only tool left to us, our ability to reduce mortality will be a function of how long we can hold out at home. For most of us, our ability to sequester ourselves at home will depend on the effectiveness of delivery systems that have never been developed on the necessary scale. We cannot now know how infectious and how lethal the evolutionary descendants of avian flu (and other scourges) will be, nor whether there will be effective vaccines and antibiotics in the worst cases. We do know that infectious illnesses are less likely to spread if people stay away from each other, and that our ability to remain sequestered will be enhanced if food and pharmaceuticals are made

available without having to leave our homes to forage for them.

## Epilogue

Beyond the familiar staff shortages and patient surges, and even beyond disaster, healthcare personnel and institutions may have to contend with less well understood catastrophes, both physical and medical, and, finally, with mega-pandemics, which we haven't seen in centuries. Each of these creates its own moral universe with unique dilemmas and norms. Within each, it is possible for healthcare professionals and communities to act with consummate responsibility. But a necessary condition for doing so is a clear understanding of the context, its demands, the distinctive ethical issues that are likely to arise, and the organizational and normative strategies required by the occasion.

In the face of uncertainty about the future, one cannot help but recall the official laments following Katrina: that no one could have foreseen that a major hurricane could cause the sea walls to fail and that the ensuing floods would doom much of New Orleans. Quite the contrary—the handwriting had been on the wall for some time.

It can be deeply disquieting to think through these hellish possibilities. But the duty to do so is a part of the responsibility for preparedness.

## Notes

1. Those early efforts gave rise to Kipnis K. Overwhelming casualties: Medical ethics in a time of terror. In: Moreno J, ed. *In the Wake of Terror: Medicine and Morality in a Time of Crisis*. Cambridge: MIT Press; 2003:95–107. The present work owes much to suggestions from Griffin Trotter, Ron Bontekoe, and Laura Specker Sullivan.
2. I explore the ethical issues raised by Katrina in Kipnis K. Forced abandonment and euthanasia: A question from Katrina. *Social Research* 2007; 74:79–100.

3. There are some other conditions that can temporarily disrupt clinical practice.
4. Winslow GR. *Triage and Justice*. Berkeley: University of California Press; 1982.
5. The single exception would be healthcare or rescue personnel who, if treated, could be returned to life-saving duty *within the period of scarcity*. As a practical matter, it is useful if the walking wounded attend to the needs of expectant patients.
6. Landrigan CP, Rothschild JM, Cronin JW, Kaushal R, Burdick E, Katz JT, et al., for the Harvard Work Hours, Health and Safety Group. Effect of reducing interns' work hours on serious medical errors in intensive care units. *N Engl J Med* 2004;351:1838–48. Cited 10 Oct 2011.
7. Durham TW, McCammon SL, Allison EJ Jr. The psychological impact of disaster on rescue personnel. *Annals of Emergency Medicine* 1985; 14(7):664–8.
8. Note that this clinically focused definition is narrower than the broader social conception of catastrophe developed by E. L. Quarantelli. See Quarantelli EL. *Catastrophes are Different from Disasters: Some Implications for Crisis Planning and Managing Drawn from Katrina*; 2006 June 11; available at <http://understandingkatrina.ssrc.org/Quarantelli> (last accessed 7 Oct 2011).
9. There are several pertinent discussions of the events at Memorial Medical Center. See Deichmann RE. *Code Blue: A Katrina Physician's Memoir*. Bloomington: Author House; 2006; Meitrodt J. For dear life: How hope turned to despair at Memorial Medical Center. *New Orleans Times-Picayune* 2006 Aug 20–24; available at <http://www.vendomeplace.org/press082006memorialhospital.html> (last accessed 5 Aug 2011); see note 2, Kipnis 2007; and Fink S. The deadly choices at Memorial. *New York Times Magazine* 2009 Aug 30:28; available at <http://www.nytimes.com/2009/08/30/magazine/30doctors.html> (last accessed 5 Aug 2011).
10. Meitrodt 2006 and Deichmann 2006 (see note 9) recount such an announcement early Thursday morning, the fourth day after Katrina's landfall.
11. The general form of the problem is ably set out in Swann SW. Euthanasia on the battlefield. *Military Medicine* 1987;152:545–9. I have proposed a practical approach in Kipnis 2007 (see note 2).
12. Del Bosque M. Storm over UTMB. *Texas Observer* 2009 Mar 20; available at [http://findarticles.com/p/articles/mi\\_7757/is\\_200903/ai\\_n32205529/?tag=mantle\\_skin;content](http://findarticles.com/p/articles/mi_7757/is_200903/ai_n32205529/?tag=mantle_skin;content) (last accessed 5 Aug 2011).
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