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CHAPTER

HOW VULNERABILITIES AND CAPACITIES SHAPE POPULATION HEALTH AFTER DISASTERS

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LEARNING OBJECTIVES

- Describe some of the ways that natural and human disasters affect the health of urban populations.
- Identify antecedent social, political, and environmental factors that can influence how a population responds to a disaster.
- Discuss the value and limits of epidemiological and anthropological insights into the consequences of disasters.
- Compare and contrast the health and social impact of Hurricane Katrina and the September 11 attack on the World Trade Center.

Several recent high-profile natural disasters (e.g., the southeast Asian tsunami of 2004 and the Gulf Coast hurricanes in the United States of 2005) and terrorist events (e.g., the September 11, 2001, terrorist attacks and the March 11, 2004, Madrid train bombings) have heightened awareness of disasters as important determinants of population health and have resulted in a concomitant increased interest in the consequences of disasters. Although the sporadic nature of lay and scientific reporting about high-profile disasters may suggest that these events are episodic and rare, general surveys of the U.S. population suggest that individual exposure to disasters is quite high and that approximately 10 percent of the U.S. population will experience a disaster during their lifetime.^{1,2} Comparable international data suggest that since the mid-1980s, hundreds of millions of individuals worldwide have been affected by disasters, be it in the form of terrorism, famine, forced relocation, or political violence.³ These figures suggest that although definitions of disasters and the approaches used to study them may be quite disparate,⁴ disasters have been and remain a relatively common piece of the human experience.⁶ Despite the mental and physical health burden that disasters exact,⁷ academic and public health interest in disasters remains episodic at best and in many cases falls along disciplinary lines. Public health perspectives on disasters have typically centered on a medical model of disaster preparedness and generally less on the broader issues of why some populations appear to suffer greater health consequences of disasters than others.

Our objectives for this chapter are largely theoretical and conceptual. We suggest that greater attention to the social-ecological determinants of the postdisaster context may prove useful in understanding why some populations suffer more than others and that such an approach reveals unique insights for prevention and intervention. We also suggest that data collection and analysis methods that combine qualitative and quantitative methods and are informed by different disciplinary perspectives are critical in identifying factors that promote or undermine health in the postdisaster setting. We then outline a conceptual model that is useful for understanding the underlying determinants of population health in the postdisaster setting. The model calls attention to the underlying vulnerabilities and capacities that influence health and well-being, which we illustrate by drawing examples from the disaster literature and through three case studies. We conclude by examining the unique impact of disasters on the world's growing urban population.

SOCIAL AND ECONOMIC DETERMINANTS OF HEALTH AFTER DISASTERS

Socioecological perspectives on the determinants of population health suggest that factors at multiple levels of influence contribute to individual and population health.⁸ These may include macrolevel historical and political factors, mesolevel factors such as social networks, and microlevel factors such as race/ethnicity.^{9,10} Within this paradigm, it has been suggested that the determinants of population health may usefully be conceptualized as either vulnerabilities (e.g., poor aggregate socioeconomic status) or

capacities (e.g., natural resources) and that population health reflects the interplay between underlying vulnerabilities and capacities and intermittent stressors (e.g., disasters) and protective factors (e.g., delivery of aid or other material resources).¹¹

We suggest that social determinants at multiple levels of influence are also likely to influence health and well-being in the postdisaster context. This is a position close to that taken by geographers and anthropologists to explain why disasters occur; indeed, Hoffman and Oliver-Smith⁴ explicitly define a disaster as "a process leading to an event that involves a combination of a potentially destructive agent from the natural or technological sphere and a population in a socially produced condition of vulnerability." Consistent with this approach and seemingly developed in parallel, public health practitioners have also identified a range of social-ecological factors that predict the severity of impact on health and well-being across disaster settings. This consistency of approaches is exemplified by the work of Blaikie et al.¹² whose comprehensive model of the factors leading to disaster builds off the work of Hewitt.¹³ Briefly, Blaikie et al.'s model calls attention to multiple layers of influence, including history, class, resources, power, as well as aspects of the built environment and the interaction of these factors with a hazard. Hazards, or the physical agent of the disaster (e.g., flood, fire, etc.), are but one part of the equation producing disasters. Disasters are produced when a hazard intersects with existing vulnerabilities, which as stated earlier, are generated through a range of factors. This model can be usefully extended to include the health and well-being of populations in the postdisaster setting.

The social-ecological model can also be usefully extended to include not just vulnerabilities but also capacities, which are protective social and ecological features. Such a framework may be useful in the postdisaster context. This view encourages the researcher to identify underlying population-level factors that act as constants in promoting or eroding health and well-being in the pre- and postdisaster setting. A wide range of factors may be considered as underlying vulnerabilities, such as the paucity of material resources (e.g., low income) available to a given human population or the presence of a natural tectonic fault line that predisposes a population to earthquakes. Conversely, examples of underlying capacities may include social capital, abundant availability of natural resources, high levels of contributions to public goods, or a dispersed and effective informal safety net. However, the intermittent stressors that interact with existing vulnerabilities and capacities include the closure of a large employer or a hazard; these are inevitable events whose occurrence is neither frequent nor predictable. Protective events, such as the opening of a new school or an increase in group cohesiveness due to the success of a local sports team, also occur intermittently. Importantly, these intermittent influences, which interact with the underlying conditions, shape health at any particular moment in ways that are not necessarily amenable to standard epidemiological analyses.

Although this perspective is relatively new in our thinking about the consequences of disasters, the suggestion that we can understand population health as the outcome of trade-offs between population vulnerabilities and capacities is not novel. Nor is the idea that understanding the social and ecological conditions of the affected imperative to

understanding how and why populations vary in their capacities and vulnerabilities. Diverse academic disciplines have long considered the factors that determine or covary with vulnerability.^{14, 15} Still others have postulated that vulnerability can include genetic and biological vulnerability at the individual level¹⁶ and social vulnerability at the group level.¹⁷ In the study of disaster preparedness, it has long been recognized that certain populations are also more vulnerable to the effects of disasters than others,¹⁸ and detailed case studies, often carried out by anthropologists,⁴ have shown that multiple layers of history, ecology, and culture overlap to produce and augment existing group-level vulnerability.

Virchow, a physician-anthropologist, reports in his mid-nineteenth century writings an ethnomedical description of several Bavarian villages in which he makes precisely the same distinction between population-level vulnerabilities and capacities. He uses extensive ethnographic observation to understand population-level variability in these two factors. For instance, after a lengthy ethnographic account of the settlement and living conditions in several villages, he notes "the untoward conditions of social life in [these villages] are offset to a great extent by the beneficial influence of the elevation of the land and the formation of the soil, and that [as a result] this poverty-stricken . . . population, which faces death by starvation every single year of crop failure, shows a mortality rate almost as low as that prevailing in the best countries of the old world."¹⁹ A high level of poverty, which acts as a population-level vulnerability, is countered by the ecological positioning of the area, a capacity that accounts for the low levels of mortality. Clearly, in many cases, vulnerabilities and capacities do not necessarily represent separate dimensions but rather ends of a spectrum, and in most cases, the lack of a specific capacity may represent a specific population-level vulnerability.

Although the full range of vulnerabilities and capacities that may influence population health after disasters is broad and locally specific, we have elsewhere made an attempt to delineate some of the general elements that might influence postdisaster consequences.²⁰ These elements include geography and history, demographic and political structures, community wealth and asset holdings, and aspects of the built environment and formal and informal social environments.

As underlying factors, geography and history contribute to outcomes of disasters in several ways. First and most obviously, some areas are naturally more at risk than are others. In these areas, the risk of recurrent disasters is virtually unavoidable, and the exigencies of geography then highlight the fact that there is likely no solution for the total elimination of these disasters. Geography also plays an important role in structuring the postdisaster response. News of a disaster event in isolated communities may take far longer to reach aid agencies or the media (as in the case of the Darfur famine of 2004–2005) than it might after disasters in more readily accessible locations. Similarly, the ability of agencies to provide aid may well be limited in geographically distant or difficult locales. For example, it took more than a week for domestic and international aid efforts to reach some victims of the devastating 2005 earthquakes in the Kashmir region that killed an estimated 80,000 people.²¹

Historical processes also influence the postdisaster outcome, particularly as related to historical-political relationships. As Olsen and colleagues²² point out, many of the most disaster prone countries worldwide are in areas that are of little security interest to the United States or other developed countries and therefore receive minimal emergency funding. Colonial historical relations also influence responses and therefore postdisaster consequences. In an interesting recent example, the 7.5 magnitude earthquake that hit Mozambique in February 2006 was notably benign in part due to building codes imposed on the country by Portugal during the colonial period.²³ Political structures and systems of governance establish the parameters (e.g., taxation, federal-state relations) that shape many of the other contextual factors influencing health after disasters. For example, analyses of state failures such as those that have occurred in Liberia and Somalia and which often precede or predispose to disasters show that these events are far more likely to occur in partial as compared to fully democratic regimes.²⁴ Similarly, postdisaster response may be influenced by political structures and governance, as we describe in more detail later.

Even within areas that share geographic, historical, and political structures, the level of community wealth acts as a local vulnerability or a capacity. There is an abundance of research in public health demonstrating that aggregate community socioeconomic status is associated with health, independent of individual socioeconomic position. Community socioeconomic status encompasses multiple domains, including high rates of poverty and unemployment and lower education and income levels.²⁵ Empirically, low community socioecological status (frequently also referred to as community deprivation) is a determinant of health outcomes, including health-related behaviors, mental health, infant mortality rate, adult physical health, coronary heart disease, and mortality even after accounting for individual-level factors.²⁶ Low community socioeconomic status may affect residents' health through two primary mechanisms: (a) by limiting the availability of salutary resources that may be beneficial to residents' well-being and (b) through psychosocial stress accompanying a chronic shortage of essential resources.²⁷ These social mechanisms also explain how community socioeconomic status may influence health in the disaster context. After disasters, when both formal and informal resources are limited, societies with a priori fewer resources are less likely to have access to salutary resources such as health and social services or food reserves. Consistent with this line of reasoning, Norris et al.²⁸ showed that individuals who lived in developing countries and presumably had fewer protective resources were at far greater risk of experiencing poor health outcomes in the postdisaster setting than those living in the United States. They report in their meta-analysis that 78 percent of the samples from developing countries showed signs of postdisaster impairment compared with 25 percent of the samples from the United States.

The physical environment is perhaps one of the most obviously central features of context to postdisaster recovery. Structures like buildings, bridges, and other infrastructure may be vulnerable to natural or human-made disasters and may directly influence the postdisaster context and the severity of the disaster consequences. For example,

features of the physical environment can be immediately linked to fatality rate after disasters as seen in the recent earthquakes of comparable magnitude in Kobe, Japan, in 1995 and Bam, Iran, in 2003 that were associated with 5,200 and 26,000 deaths, respectively.^{21, 29} Much of this difference was attributed to the different quality of buildings; Japanese buildings had been reinforced to cope with earthquake tremors, but much of the Iranian city of Bam collapsed with the earthquake, killing thousands of residents.³⁰ Clearly, given that more than half of the global population is or very soon will be living in urban settings, this has important consequences for health and well-being in postdisaster settings.²⁸ This rapid urbanization creates tremendous challenges in part because many urban dwellers will be living in slums, which are likely loci of multiple physical vulnerabilities.³¹

Culture, which coexists with these elements, is likely to be an important element structuring postdisaster outcomes. Culture, defined as beliefs or rules of behavior that are passed on from one individual to another by some form of social learning,³² may influence individual and community responses to disasters as well as the health consequences thereafter, such as health-seeking behavior, mental health experiences, and the provision of resources by dominant groups. Because members of groups often, by definition, share norms and beliefs, groups of people will likely experience, react, and respond in very different ways to the same disaster event. Among this set of beliefs, some researchers have suggested that differing and culturally specific norms related to fatalism may alter both pre- and postdisaster responses.³³ Some evidence to support this claim has been shown through interviews with survivors of Hurricane Andrew. There is also the possibility that expressions of posttraumatic stress disorder and other mental health morbidity may vary by ethnic or cultural group.³⁴ Despite culture's seemingly important role, few studies analyze the role of culture in the postdisaster milieu. These limitations reflect, in part, a lack of ethnography used in the immediate postdisaster context¹⁴ and difficulties in measuring shared norms and beliefs. Additionally, cooperation and the capacity to mobilize or create informal political or social groups may be a critical resource in the postdisaster situation. For instance, in rural Tanzania, a local vigilante group was instrumental in enforcing a ban on intervillage trading to reduce the spread of cholera, and in another situation, they successfully cooperated to defend a large amount of rice left roadside after a rice-bearing truck crashed (B. Paciotti, personal communication, April 14, 2006). Such widespread cooperation, which varies quite dramatically between cultures and groups,^{35, 37} could have a substantial impact in the postdisaster setting where many other salutary resources are limited.

The complexity of the determinants of population health after disasters suggests it is unlikely that any single disciplinary perspective or framework will afford us the tools to fully understand how the determinants of population health interrelate to shape the health of populations. An interdisciplinary approach that simultaneously capitalizes on epidemiological rigor and anthropology's "radically contextualizing" roots has the potential to draw on quantitative and qualitative methods that can be complementary and help us to understand the etiology of the health consequences of these events. For example, the

social autopsy approach, which integrates multiple levels of causation, was used to explore the underlying causes of differential health outcomes following the Chicago heat wave. This approach could begin to assess whether vulnerabilities and capacities act in isolation or interact at the individual and community levels with cultural, socioeconomic, and global political and historical forces to produce specific health outcomes after a disaster. Thus, the epidemiologic focus on categorical health outcomes can be augmented by historical and ethnographic data that can link the consequences of disasters to declining tax revenues, poor and myopic government planning, racial discrimination, and high rates of individual- and community-level poverty.

We use here three relatively recent disasters as case studies to illustrate the roles of vulnerabilities and capacities acting and interacting across multiple levels as well as the value of adopting a historical, cross-cultural, social science perspective. First, we examine the social determinants in influencing health and well-being in two similar crises resulting from political rather than environmental events. Next, we explore the social determinants of outcomes following Hurricane Katrina and the events of September 11, 2001. In each case, we draw on various data sources to highlight underlying vulnerabilities and capacities and attempt to show how these influences produce and reproduce differential outcomes within and between populations.

HUMANITARIAN CRISES IN ANGOLA AND THE BALKANS

In the postconflict periods following the political crises in Angola³ and the Balkans,⁴ health outcomes varied markedly between these two countries. In both cases, political instability led to large-scale population displacement and social unrest, and the displaced peoples were almost entirely reliant on food assistance. Despite these similarities, the prevalence of undernutrition in the Kosovar population (one of the many ethnic groups within the Balkans) remained at approximately 2 percent throughout the crisis, whereas the prevalence of undernutrition in Angola increased throughout the crisis from 2.3 percent to 15 to 21 percent. Why did the prevalence of undernutrition increase by nearly tenfold in the Angola case, whereas there was no detectable increase in the levels of undernutrition in the Balkans? In both cases, large numbers of people were affected by violent political instability that brought about disastrous consequences for the provision of government and social services, and both resulted in substantial opportunity costs. To the wage earner in the Balkans, the disaster brought with it lost wages. To the farmer in Angola, the disaster brought unplanted crops or harvests consumed by rebel forces or internally displaced people.⁵

At least three key differences in population vulnerabilities and capacities emerge, which likely account for the vastly different health consequences observed in these humanitarian disasters. In the case of Angola, humanitarian aid was in short supply. The UN's 2002 calls for humanitarian assistance repeatedly fell short of their mark, with only 30 percent of the appeal being funded during critical periods of the crisis.⁶⁻⁸ One report expressed surprise and dismay, noting that "it is alarming . . . that the UN Consolidated Inter-Agency Appeal (CAP) has so far met with a very poor response

from the international donor community, despite the emergency having been branded as the worst crisis in the world at present."⁴³ Emergency aid that did appear often was unable to be efficiently transferred to those most in need, in large part because of the large number of land mines placed by the opposition UNITA forces. In the Balkans, international aid agencies were able to take preemptive action and to reach locations, and thus continue to deliver vital aid in the postcrisis period. The UN assessment was that "overall, the international community has been successful in preventing acute [nutritional] wasting, among the Kosovan refugees."⁴⁴

At the community and individual level, these two populations differed considerably in overall wealth. In the Balkans, which lacked the extreme poverty found in Angola, this enabled wealth redistribution and therefore acted as a population-level capacity, whereas in Angola low levels of wealth disallowed redistribution, and social networks were powerless to assist those in need. Further, household food insecurity assessments identified critical shortfalls in food in Angola, but this was not necessarily the case in the Balkans. Subsequent assessment showed that a large number of Albanian households (another ethnic group within the Balkans) had family members living either abroad or outside the conflict area who were sending remittances that were critical for protecting households from food insecurity.⁴⁰ Yet, in the Angola case, because few households had family living outside the conflict area, few people received remittances, and lacking such safety nets, shocks to the households were not successfully buffered. These patterns suggest that variation in health outcomes in the postdisaster period are linked to global variation in international aid and perhaps to global migration patterns, which enable individuals to relocate and send remittances, thereby diminishing the negative impact of decline in social services during a conflict period.

To put this in the context of our conceptual model, privileged political positions and global migration patterns are likely underlying capacities to the extent that they facilitate emergency aid donations and the ability of individuals to redistribute resources through remittances. This later point may be particularly salient in light of the rapidly urbanizing global community and the hypothesized reduction in informal safety nets that are expected to accompany this shift. Some have hypothesized that formal safety networks will emerge to take over the functions of informal safety nets, but the available evidence from sub-Saharan Africa does not support any clear urban bias in the availability of formal safety nets.⁴⁵ As in the Angola example, urbanization may be associated with limited formal and informal safety nets, which in the post-postdisaster setting erodes health and well-being. Preexisting health conditions, in this case undernutrition, also contribute to a reduced capacity to effectively respond in the context of markedly increased stress. Thus, these cases illustrate how during and after a disaster, individual, community, and global forces interact to position populations along distinct tracks that lead some to stable or improved health and others to poor health outcomes.

HURRICANE KATRINA

Hurricane Katrina was a category 3 hurricane when it hit the Gulf Coast of the United States on August 29, 2005. Despite sufficient warning and officials at all levels being

“acutely aware of Katrina and the risk it posed,” the storm contributed to more than 1,800 deaths, billions of dollars of damage, and the displacement of between 700,000 and 1.2 million people.⁴⁶ Austin⁴⁷ provides an excellent overview that mixes historical reports with current ethnography to illustrate how power, resources, and geography created vulnerabilities in the region even before Hurricane Katrina hit. In addition to the preexisting geographic and power vulnerabilities, socioeconomic vulnerabilities already existed at both the state and individual level; the three states (Louisiana, Alabama, and Mississippi) that bore the burden of the storm were among the poorest in the United States,⁴⁸ a fact that has implications for the citizenry and the level of support available in crisis situations. Groups with preexisting vulnerabilities were predicted to be differentially affected by the storm, and media coverage and preliminary reports suggested poverty and race were key predictors of risk of damage to material and physical resources.

Two separate reports confirm this general assessment but offer a more nuanced perspective.^{46,49} An examination of census tract data reveals that the overall population living in areas considered damaged by Federal Emergency Management Agency (FEMA) criteria were disproportionately black (45.7 percent vs. 26 percent black in nondamaged areas). Damaged areas also had a higher proportion of individuals living in rental homes (45.7 percent vs. 30 percent in nondamaged areas) and greater percentages of people living below the poverty line (20.9 percent vs. 15.3 percent in nondamaged areas) and who were unemployed (7.6 percent vs. 6.0 percent in nondamaged areas). Death reports also show that elderly white individuals were at the highest risk of death. To be sure, there were also areas with considerable damage that disproportionately comprised individuals who were white and wealthy, yet the statistical patterns reveal deep social divides. These patterns of differential impact have significant implications for current and future health consequences.⁵⁰ More than 500,000 people are estimated to have an unmet need for mental health services when the number of medical professionals is near its nadir. In addition to the health impact of depression and other common mental disorders, depression is associated with hypertension, heart disease, and diabetes. Mental health outcomes are also expected to give rise to increased rates of substance use and abuse. Further, consistent with our model, the impact of these health outcomes is unlikely to fall equally on all. Some evidence, for instance, suggests that African Americans are less likely than other racial/ethnic groups to seek care for mental health morbidities such as posttraumatic stress disorder following disasters.⁵¹ Higher rates of poverty and lower rates of health insurance, which will be amplified by the reduced availability of social services, may also undercut attempts to rebuild physical and mental health and economic well-being.⁵²

Hurricane Katrina therefore exacerbated preexisting vulnerabilities. Although in many cases effective governance or formal safety networks can act as population-level capacities and serve to attenuate, protect, or eliminate negative health effects experienced as a result of population-level vulnerabilities, this was largely not the case with Hurricane Katrina. In the case of Katrina, the governmental response was described as “uncoordinated” and “hampered by ineptitude, lack of leadership and bureaucratic turf wars across all levels of government.”⁵³ Consequently, despite being warned that the

storm would be disastrous, the governmental response lagged, and the primary response did not occur until two days after Katrina landfall.⁵⁴ Part of this delay was due to confusion at multiple levels within the government. Local governments believed that the federal government would take primary responsibility and the lead, but the federal government believed that in disaster situations, “the role of the federal government is not and should not ever be that of a first responder.”⁵⁴ Rather, FEMA believed “states have the primary responsibility for emergency preparedness and response in their jurisdictions,”⁵⁴ although planning exercises simulating a disaster of this magnitude led to the conclusion that an event of the magnitude of Katrina would require first-line federal response.

Others noted that FEMA was unable to actually carry out its job because of changes in the department’s structure, and increasing amounts of energy focused on being prepared to deal with terrorist strikes. Part of the poor response also appears to have stemmed from a limited appraisal of how other similar humanitarian crises have unfolded in the other parts of the world, representing a Western-centric public health model. Thus, despite an awareness that large numbers of individuals would be evacuated (this assumption was built into simulation exercises), governmental responses seemed to contain little information on how to handle mass displacement of the population. There is a voluminous literature from foreign refugee crises that would have been helpful in planning such a response.⁵⁵ Nieburg et al. point out that one of the primary lessons from such foreign refugee crises is to have sufficient water and appropriate food on hand to feed large numbers of displaced individuals; this is a lesson that was apparently not learned on several prior occasions in which the Superdome was used as a shelter.⁵⁶

Although in this case the formal response was delayed, informal safety nets quickly emerged. The notion that postdisaster behavior is marked by widespread deviance, including looting, panic, and extreme psychological dysfunction, is referred to as the disaster myth.⁵⁷ In contrast to the disaster myth, empirical research on population behavior in the postdisaster setting rarely conforms to that predicted by the disaster myth model. Rather, behavior is often highly prosocial, calm, and rational. In his ethnographic account of helping behavior during Katrina, Ethridge⁵⁸ describes the emergence of “leaderless” prosocial behavior in a group of individuals temporarily occupying a high school. Group consensus emerged over a range of behaviors and tasks, and many norms temporarily fell by the wayside. For instance, age hierarchies broke down, and youth played a critical role in fetching supplies, in part because older individuals were incapacitated by infections on their extremities (due to limited facilities for bathing). Again, this case study documents how multiple lines of evidence reveal multiple layers of vulnerabilities and capacities that interact to amplify the deleterious impact of disasters on vulnerable populations.

SEPTEMBER 11, 2001, TERRORIST ATTACKS ON NEW YORK CITY

The New York City (NYC) metropolitan area is the largest and most densely populated metropolitan area in the United States.⁴³ Although estimates of population size

vary depending on the areas selected as boundaries of the metropolitan area, approximately 15 million people live in the vicinity of NYC in the tristate area of New York State, New Jersey, and Connecticut. Perhaps as a result of the preeminent role played by NYC in national discourse, the attacks on the World Trade Center (WTC) were perceived as an attack on the United States. The attacks themselves started on 8:46 A.M. on the morning of September 11, 2001, and consisted of two hijacked airplanes hitting the WTC towers, which eventually collapsed. Two other airplanes were also hijacked that day with one crashing into the Pentagon and the other into a field in Pennsylvania. During the day of September 11, "fog of war" rumors had many in the NYC metropolitan area afraid for their lives. Early rumors of more planes being hijacked and aimed for other NYC and national targets were rife. As round-the-clock, real-time television coverage of the attacks saturated the airwaves, millions in the area saw images first of people waving for help from the towers of the WTC and then of the towers falling. Meanwhile, countless residents of the tristate area knew someone or were related to someone who was working in the WTC. Disrupted communications systems meant that many were uncertain about the fate of family or friends for most of the day of September 11 and, in many cases, for days after the attacks.

In many respects, the aftermath of the terrorist attacks on New York City represented a model of community mobilization in response to a mass trauma. There was a highly visible and mostly effective mobilization of municipal and national resources to aid those affected by the attacks and a rapid engagement of resources to assist the population of the area both in the short term and in the relative long term. Approximately \$20 billion in federal aid was routed to New York City in the aftermath of the attacks.⁵⁹ For example, Project Liberty was a free service established to provide counseling after the attacks.⁶⁰ It was established soon after the September 11 attacks and was fully functional until 2004, at which point several of the services it provided were reduced. All services were terminated in 2005. During its existence, Project Liberty provided services to approximately 750,000 persons in the NYC metropolitan area.⁶¹ It made as a core part of its mission specific outreach efforts aimed at ensuring that all residents of New York City would avail themselves of services if needed. However, despite the outpouring of national attention after the attacks and the relatively effective functioning of official governmental resources in the aftermath of the attacks (particularly when compared with the response after Hurricane Katrina, as discussed earlier), the health consequences of the September 11, 2001, terrorist attacks clearly reflected underlying vulnerabilities that were largely predicated on socioeconomic circumstance.

Several studies have amply documented that the psychological and behavioral consequences of the September 11, 2001, terrorist attacks extended well beyond those who are typically considered victims of such disasters and into the general population.^{35,62-65} Persons who were more exposed to the disaster (e.g., persons who lived closer to the WTC complex, persons who had a friend or relative killed in the attacks) were more likely to have psychological symptoms and adverse health behavior than were those who were not directly exposed to the disaster. Overall, it has been estimated that persons directly affected by the attacks were 3.5 times more likely to have adverse mental

health symptoms after the attacks than persons who were not directly affected.⁶⁶ However, once direct and immediate exposure to the attacks is taken into consideration, the extension of the consequences of these attacks to the general population provides several examples of the role of social vulnerabilities and capacities in shaping health after this disaster.

One of the more consistent observations that emerged from research carried out after the September 11, 2001 terrorist attack was the differential risk of psychopathology among different ethnic groups. Several studies showed that Hispanics had a higher prevalence of psychopathology than did other racial/ethnic groups^{63,67} and specific analyses showed that Hispanics of Dominican or Puerto Rican origin were more likely than other Hispanics and non-Hispanics to report symptoms consistent with posttraumatic stress disorder (PTSD) after the September 11 terrorist attacks.⁶³ In one study that attempted to understand the reason behind these differences, it was shown that Dominicans and Puerto Ricans were more likely than persons of other races/ethnicities to have lower incomes, to be younger, to have lower social support, to have had greater exposure to the September 11 attacks, and to have experienced an emotional reaction upon hearing of the September 11 attacks. These variables accounted for 60 to 74 percent of the observed higher prevalence of probable PTSD in these groups.⁶³

The role of pre- and postdisaster income as determinants of postdisaster functioning and well-being was reinforced in other analyses after this event. For example, one analysis that focused on the longitudinal risk of PTSD after the September 11, 2001, attacks found that unemployment at any time after the attacks predicted PTSD persistence even when accounting for a range of other potentially confounding covariates. In addition, high levels of perceived work stress predicted PTSD persistence among persons employed after September 11, 2001, and this was associated with poor mental health.⁶⁸ Therefore, in the aftermath of the September 11 attacks, individual socioeconomic position and job status both contributed to differences in postdisaster mental health and may explain many of the other differences observed between racial/ethnic groups after this event.

A further illustration of this point has been recent work that showed empirically that properties of urban neighborhoods of residence were associated with the individual risk of psychopathology after the September 11, 2001 attack, even after accounting for individual vulnerabilities. Specifically, in this postdisaster context, neighborhood-level income inequality has been shown to be associated with depression among persons with lower income.⁶⁹ It has been hypothesized that persons with individual socioeconomic disadvantage may be more socially or economically marginalized and dependent on local resources and hence more vulnerable to the consequences of this particular disaster. Other work has shown that neighborhood poverty was associated with the risk of incident depression in the years after the attacks even when accounting for individual socioeconomic status.⁷⁰ Taken together, data pulled from studies on mental health outcomes following the September 11 attacks amply demonstrate the role of vulnerabilities and capacities and how these play out across individuals, groups,

and communities. In addition, the events of September 11, 2001 illustrate how the uniquely urban characteristics of population density and diversity, complexity, and income inequality, described in Chapter One of this volume, influenced how this disaster affected health.

IMPLICATIONS FOR PREVENTION AND INTERVENTION

Underlying socioeconomic vulnerabilities—both individual and ecological—contributed to shaping health after the September 11, 2001 attack, much as they did after Hurricane Katrina and after the humanitarian crises in Angola and the Balkans. These events are clearly substantially different, and the mobilization of external resources in response to these events is dramatically different both in scope and effectiveness. However, social and ecological factors consistently influence health and well-being after all these events, further reinforcing the premise guiding this chapter that underlying conditions represent a spectrum of vulnerabilities and capacities that shape postdisaster health and functioning. In addition, postdisaster interventions, while potentially helpful as protective factors, cannot obviate the role played by baseline factors in shaping the outcomes of disasters.

Therefore, the conceptual model presented here suggests and the case studies illustrate how the production of population health in the aftermath of disasters reflects a combination of underlying vulnerabilities and capacities interacting with the disaster stressor itself and potentially mitigated by postdisaster protective factors. These case studies also call attention to the interrelations of global-, community-, and individual-level factors in shaping health after disasters. Our understanding of these processes is enhanced by the use of a combination of approaches from anthropology and epidemiology that consider how vulnerabilities and capacities operate in tandem and interact across levels of units of analysis. Thus, although we can understand the causes of morbidity and mortality outcomes in New Orleans from a biomedical or proximate perspective, clearly the ultimate or upstream causes lie in preexisting health and economic inequalities in the United States, in the interactions between the oil industry and the wetlands, and in the mismanaged governmental attempts to protect citizens of the affected areas. Similarly, we can see that appealing to family members living outside the affected area is a critical source of support in some situations, but this capacity is not universally shared and likely varies widely both within and between communities. The discussions of Hurricane Katrina and Angola show that, in some cases, regardless of the existence of individual-level capacities, governmental forces can act as barriers to action and, at worst, contribute to poor outcomes. The studies about the September 11, 2001 attack similarly highlight the interplay among individuals, groups, and communities. These case studies draw attention to the important role of context in shaping postdisaster outcomes.

We suggest that there are several implications of the observations drawn here for those concerned with public health promotion. The model of vulnerabilities and capacities presented here strongly suggests that traditional understandings of "disaster

preparedness” might be substantially broadened to include elements that may have been seen as outside the purview of disaster preparedness and even public health. The model we propose seeks to include social inequalities, aspects of the built environment, and informal social support, for example, as key components that will influence or mitigate the postdisaster environment. It might reasonably be argued that affecting features of the social environment, such as those just mentioned, that influence postdisaster health is a challenge beyond the scope of most public health practitioners and is certainly outside the scope of disaster preparedness. However, we believe that the approach taken in this chapter strengthens arguments that propose structural changes because they will pay off in general public health and in the postdisaster setting. Further proof of this concept comes from Norris et al.²⁸ In their analyses, they report a consistent finding across studies that individuals who were more distressed before a disaster are likely to experience more distress after a disaster. In this chapter and more so elsewhere,²⁹ we have pointed out that disaster outcomes reflect and amplify preexisting vulnerabilities, which strengthens the case that these determinants should not be overlooked in the effort to mitigate disaster consequences.

There are multiple examples throughout history when public health has indeed acted on contextual factors that expand considerably beyond the realm of individual exposure or behavior. For example, it was public health efforts to improve sanitary conditions in cities that led to sentinel improvements in European cities’ infrastructure and attendant reductions in morbidity and mortality throughout the nineteenth century.⁷¹ Effecting structural changes requires sentinel shifts in policies that may influence underlying determinants. The current increased awareness of disasters and their potential consequences creates an opportunity for advocacy and action to improve underlying features of context that may influence the health of populations after disasters. Such advocacy and action constitute a valid task for public health professionals.

If aspects of the social environment indeed influence postdisaster outcomes and are amenable to intervention, then a second implication of this work is that capacities and vulnerabilities are locally and culturally specific and that the relevant tools are needed to identify these. Once identified, these local assets can be leveraged to reduce the impact of disasters through early warning systems, protect vulnerable members of the community, and improve responses in the postdisaster period. Furthermore, uncovering and leveraging local capacities are particularly relevant in resource-poor settings where higher level public health services may be absent or ineffective. Nevertheless, our understanding of these capacities and vulnerabilities is currently biased toward already known capacities and largely based on those spelled out in the nondisaster social epidemiological literature. We suspect that research methods such as ethnographic and community-based participatory research designs may provide vital insights about how individuals and communities function in the face of a disaster and that knowledge of these local resources may be particularly fruitful in mitigating the postdisaster response and explaining population health variation.

A final implication of our ideas here is that the world’s population is now dominated by urban dwellers. Projections estimate that by 2030, 5 billion people will be living in urban areas throughout the world. Although urban living is associated with a

range of beneficial features, there are also large numbers of poor individuals in these settings.⁷² This is increasingly true in those areas that are witnessing the most rapid urban growth: Asia and Africa.⁷² The perspective that we have put forward here (and others have advanced elsewhere¹²) suggests that poorer individuals moving to or growing up in these settings will not only have reduced access to material resources, but their political voices will be silenced, and their living conditions will likely expose them to pollutants and increase vulnerability to hazards. Dense housing and narrow roads coupled with a range of heating and cooking materials and a lack of publicly funded firefighters put urban dwellers at increased risk of hazards and disasters. The peripheral positioning of many slums also makes them likely to experience floods. These same conditions, along with material deprivation and food insecurity, also erode health and well-being in the predisaster setting. Unfortunately, cities do not appear to be proactively preparing for a disaster: Of 109 cities in Africa and Asia, 34 percent lacked building codes, 46 percent lacked hazard mapping, and 54 percent did not have hazard insurance available for public or private buildings.⁷⁷ We suggest that these pre-existing vulnerabilities set the stage for a tremendous burden in the event of disasters in urban areas worldwide.

SUMMARY

In this chapter, we have sought to extend public health perspectives on disasters from the typical approach—which uses a medical model of disaster preparedness—to the broader issue of why some populations appear to suffer greater health consequences of disasters than others. Our objectives were largely theoretical and conceptual. We suggested that greater attention to the socioecological determinants of the postdisaster context may help to reveal insights for prevention and intervention to reduce the disparate impact of disasters. We also suggested that data

collection and analysis methods that combine qualitative and quantitative methods and are informed by different disciplinary perspectives are critical in identifying factors that promote or undermine health in the postdisaster setting. We presented a conceptual model that called attention to the underlying vulnerabilities and capacities that influence health and well-being, which we illustrated by drawing examples from the disaster literature and through three case studies. We concluded by examining the unique impact of disasters on the world's growing urban population.

DISCUSSION QUESTIONS

1. How did the social conditions in New Orleans prior to Hurricane Katrina affect how the storm influenced health?
2. The authors of this chapter argue that structural changes that reduce inequality and increase social support prior to disasters can help to mitigate the adverse impacts. What do they mean and do you agree or disagree?

3. The authors present several case histories of political and natural disasters to illustrate their points. How do these case studies illustrate—or contradict—the framework the authors present in this chapter? What are the strengths and weaknesses of a case study methodology?
4. What are the pathways by which urban disasters can affect mental health?

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